Department of Defense
Fiscal Year (FY) 2020 Budget Estimates

March 2019

Army

Justification Book of

Research, Development, Test & Evaluation, Army

RDT&E − Volume I, Budget Activity 3

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UNCLASSIFIED
RESEARCH, DEVELOPMENT, TEST AND EVALUATION, ARMY
APPROPRIATION LANGUAGE

For expenses necessary for basic and applied scientific research, development, test and evaluation, including maintenance, rehabilitation, lease, and operation of facilities and equipment, $12,396,895,000.00 to remain available for obligation until September 30, 2021.

OCO for Direct War Costs ($182,624,000.00): Direct War costs are those combat or direct combat support costs that will not continue to be expended once combat operations end at major contingency locations.

OCO for Enduring Requirements ($21,500,000.00): OCO for Enduring Requirements are enduring in-theater and in-CONUS costs that will likely remain after combat operations cease, and have previously been funded in OCO.

COST STATEMENT

The following Justification Books were prepared at a cost of $366,803: Aircraft (ACFT), Missiles (MSLS), Weapons & Tracked Combat Vehicles (WTCV), Ammunition (AMMO), Other Procurement Army (OPA) 1 – Tactical & Support Vehicles, Other Procurement Army (OPA) 2 – Communications & Electronics, Other Procurement Army (OPA) 3 & 4 - Other Support Equipment & Spares, Research, Development, Test and Evaluation (RDTE) for: Budget Activity 1, Budget Activity 2, Budget Activity 3, Budget Activity 4, Budget Activity 5A, Budget Activity 5B, Budget Activity 6, and Budget Activity 7.

FY 2020 RDT&E, ARMY PROGRAM ELEMENT DESCRIPTIVE SUMMARIES
Introduction and Explanation of Contents

1. General. The purpose of this document is to provide summary information concerning the Research, Development, Test and Evaluation, Army program. The descriptive summaries are comprised of R-2 (Army RDT&E Budget Item Justification – program element level), R-2A (Army RDT&E Budget Item Justification – project level), R-3 (Army RDT&E Cost Analysis), R-4 (Schedule Profile Detail) and R-5 (Termination Liability Funding for MDAPs) Exhibits, which provide narrative information on all RDT&E program elements and projects through FY 2020.

2. Relationship of the FY 2020 Budget Submitted to Congress to the FY 2019 Budget Submitted to Congress. This paragraph provides a list of program elements/projects that are major new starts, restructures, developmental transitions, and terminated programs. Explanations for these changes can be found in the narrative sections of the Program Element R-2A Exhibits.

New Start Programs:

Budget Activity	***OSDPE / Project***	***Project Title***
02	0602145A / BJ9	Autonomous Mobility Tech
02	0602145A / BK2	Virtual Prototyping Technology
02	0602145A / BK3	Next Gen Intelligent Fire Control (NG-IFC) Tech
02	0602145A / BK5	Adv Direct In-Direct Armament Sys (ADIDAS) Tech
03	0603002A / MM7	Enabling Med Cap to Support Dispersed OPS Adv Tech
04	0603619A / BU5	Standoff Volcano Obstacle (SAVO) Adv Tech
04	0603639A / EU3	.50 Caliber All-Purpose Tactical Cartridge (APTC)
04	0603774A / VT8	SOLDIER PRECISION TARGETING DEVICES - ADV DEV
04	0603827A / CF2	Integrated Soldier Systems Prototyping (SL CFT)
04	0604021A / AW7	Electronic Warfare Technology Maturation (MIP)
04	0604115A / AX8	Adv Leth and Accuracy Sys for Med Calber (ALAS-MC)
04	0604115A / AX9	Adv Mobility Experimental Prototype Adv Tech
04	0604115A / AY1	MUM-T Platform Enabler
04	0604115A / AY2	Army Operational Fires
04	0604115A / AY3	Strategic Long Range Cannon
04	0604182A / HX1	Land-Based Hypersonic Missile

04	0604403A / FM3	Future Interceptor
04	0604541A / BT1	Interoperability
04	0604541A / BT2	Command Post Mobility/Survivability
04	0604541A / BT3	Common Operating Environment (COE)
04	0604541A / BT4	Network Technology Maturation Initiatives (NTMI)
04	0604541A / BT5	Integrated Tactical Network/Enterprise Network
04	0604644A / MR1	Mobile Medium Range Missile
05	0604601A / CF3	Integrated Soldier Systems (SL CFT)
05	0604802A / EP2	Shoulder-Launched Munitions
05	0604827A / FK4	Soldier Borne Sensor (SBS)
05	0604854A / HB6	Mobile Howitzer
05	0605041A / CY5	CYBER Situational Understanding
05	0605625A / CF6	Next Generation Combat Vehicle (NGCV)
07	0205778A / EG2	GMLRS Alternative Warheads
07	0607145A / FD5	Apache Product Improvement
07	1203142A / FI8	Protected Anti-JAM Tactical SATCOM

Program Element/Project Restructures:

Budget Activity	***Old OSDPE / Project: Title***	***New OSDPE / Project***
01	0601101A / 91A: ILIR-AMC	0601102A / AA1
01	0601101A / F16: ILIR-SMDC	0601102A / AA2
01	0601102A / 305: ATR Research	0601102A / AA9
01	0601102A / 31B: Infrared Optics Rsch	0601102A / AA8
01	0601102A / 52C: Mapping & Remote Sens	0601102A / AB2
01	0601102A / 53A: Battlefield Env & Sig	0601102A / AA7
01	0601102A / 74A: Human Engineering	0601102A / AA4
01	0601102A / 74F: Pers Perf & Training	0601102A / AA4

01	0601102A / ET6: BASIC RESCH IN CLINICAL & REHABILITATIVE MED	0601102A / AB1
01	0601102A / F20: Adv Propulsion Rsch	0601102A / AA6
01	0601102A / F22: Rsch In Veh Mobility	0601102A / AA6
01	0601102A / H42: Materials & Mechanics	0601102A / AA7
01	0601102A / H43: Research In Ballistics	0601102A / AA7
01	0601102A / H44: Adv Sensors Research	0601102A / AA5, AA7, & AA8
01	0601102A / H45: Air Mobility	0601102A / AA6
01	0601102A / H47: Applied Physics Rsch	0601102A / AA9
01	0601102A / H48: Battlespace Info & Comm Rsc	0601102A / AA9
01	0601102A / H52: Equip For The Soldier	0601102A / AA8
01	0601102A / H57: Single Investigator Basic Research	0601102A / AA3
01	0601102A / H66: Adv Structures Rsch	0601102A / AA6
01	0601102A / H67: Environmental Research	0601102A / AA7
01	0601102A / S13: Sci BS/Med Rsh Inf Dis	0601102A / AB1
01	0601102A / S14: Sci BS/Cbt Cas Care Rs	0601102A / AB1
01	0601102A / S15: Sci BS/Army Op Med Rsh	0601102A / AB1
01	0601102A / T22: Soil & Rock Mech	0601102A / AB2
01	0601102A / T23: Basic Res Mil Const	0601102A / AB2
01	0601102A / T24: Signature Physics And Terrain State Basic Research	0601102A / AB2
01	0601102A / T25: Environmental Science Basic Research	0601102A / AB2
01	0601102A / T63: Robotics Autonomy, Manipulation, & Portability Rsh	0601102A / AA6
01	0601102A / T64: Sci BS/System Biology And Network Science	0601102A / AB1
01	0601102A / VR9: Surface Science Research	0601102A / AA7
01	0601103A / D55: University Research Initiative	0601103A / AB3
01	0601104A / EA6: Cyber Collaborative Research Alliance	0601104A / AB7
01	0601104A / F17: Neuroergonomics Collaborative Technology Alliance	0601104A / AB7
01	0601104A / FF5: Distributed Collaborative Intelligent Systems CTA	0601104A / AB7
01	0601104A / FF7: Internet of Battlefield Things CTA	0601104A / AB7
01	0601104A / H04: HBCU/MI Programs	0601104A / AB4

01	0601104A / H05: Institute For Collaborative Biotechnologies	0601104A / AB7 & AB4
01	0601104A / H59: International Tech Centers	0601104A / AC6
01	0601104A / H73: Automotive Research Center (ARC)	0601104A / AB4
01	0601104A / J08: Institute For Creative Technologies (ICT)	0601104A / AB4
01	0601104A / J12: Institute For Soldier Nanotechnology (ISN)	0601104A / AB4
01	0601104A / J14: Army Educational Outreach Program	0601104A / AB8
01	0601104A / J15: Network Sciences ITA	0601104A / AB7
01	0601104A / J17: Vertical Lift Research Center Of Excellence	0601104A / AB4
01	0601104A / VS2: Multi-Scale Materials Modeling Centers	0601104A / AB7
01	0601104A / VS3: Center For Quantum Science Research	0601104A / AB7
02	0602105A / H84: Materials	0602141A / AH8, 0602143A / AZ5 & BE6, 0602145A / BI4
02	0602105A / XW4: Manufacturing Science	0602144A / BL1
02	0602120A / H16: S3I Technology	0602145A / BI2, 0602146A / AP5 & AR1, 0602148A / AL8, 0602150A / AD5
02	0602120A / TS1: Tactical Space Research	0602146A / AO5
02	0602120A / TS2: Robotics Technology	0602145A / BF8
02	0602211A / 47A: AERON & ACFT Wpns Tech	0602148A / AJ6, AJ4, AJ8, AM2, AI7, AK2, AL2, AI5, AJ2, AK1
02	0602211A / 47B: Veh Prop & Struct Tech	0602148A / AK9, AL5, AI9, AL4
02	0602270A / 906: Tactical Electronic Warfare Applied Research	0602146A / AN7, AO2, 0602148A / AK2
02	0602270A / CYB: Applied Offensive Cyber	0602146A / AQ3
02	0602303A / 214: Missile Technology	0602147A / AF8, AF3, AG2, AE7, AG1, AG9, AF9, AF5, AH2, AF6, AF7, 0602148A / AK4, 0602150A / AD3, AD7
02	0602307A / 042: High Energy Laser Technology	0602150A / AC9
02	0602308A / C90: Advanced Distributed Simulation	0602143A / BC3, BE8, 0602145A / BF6
02	0602308A / D02: Modeling & Simulation For Training And Design	0602143A / BE8
02	0602601A / C05: Armor Applied Research	0602145A / BG6, BH9
02	0602601A / H77: National Automotive Center	0602145A / BJ3, BI9
02	0602601A / H91: Ground Vehicle Technology	0602145A / BF1, BF3, BF6, BH7, BH5
02	0602618A / H80: Survivability And Lethality Technology	0602141A / AH5, AH6, AH7, 0602143A / AY6, 0602145A / BG6, 0602147A / AH4
02	0602622A / 552: Smoke/Novel Effect Mun	0602144A / BL2, 0602145A / BG8

02	0602623A / H21: Jt Svc Sa Prog (JSSAP)	0602143A / AY6
02	0602624A / H18: Weapons & Munitions Technologies	0602147A / AG6, AG4, BN4, 0602148A / AK6
02	0602624A / H28: Warheads/Energetics Technologies	0602145A / AH9, 0602147A / AG8, AG6, 0602148A / AK2
02	0602705A / EM8: High Power And Energy Component Technology	0602145A / BH7, 0602146A / AP4, AO2, 0602150A / AD2
02	0602705A / H11: Tactical And Component Power Technology	0602143A / BD8, 0602148A / AM4
02	0602705A / H94: Elec & Electronic Dev	0602144A / BL1, 0602146A / AV9, AO4, AV5, 0602148A / AK2
02	0602709A / H95: Night Vision And Electro-Optic Technology	0602143A / BD1, 0602145A / BH2, BF9, BJ2, 0602148A / AK2
02	0602712A / H24: Countermine Tech	0602143A / BD1, 0602144A / BL4, 0602145A / BJ7
02	0602712A / H35: Camouflage & Counter-Recon Tech	0602145A / BI2
02	0602716A / H70: Human Fact Eng Sys Dev	0602143A / AY6, BB7, BC3, BE8, 0602145A / BF6
02	0602720A / 048: Ind Oper Poll Ctrl Tec	0602144A / BK7
02	0602720A / 835: Mil Med Environ Crit	0602146A / AR5
02	0602720A / 896: Base Fac Environ Qual	0602146A / AR5
02	0602782A / 779: Command, Control And Platform Electronics Tech	0602146A / AV6, AW1, AQ9, AW3, AW5
02	0602782A / CY2: Applied Defensive Cyber	0602146A / AP1, AO8
02	0602782A / H92: Communications Technology	0602143A / AN1, 0602146A / AP7, AM6, AN3, AM8, AN5, AO2, AN9
02	0602783A / Y10: Computer/Info Sci Tech	0602146A / AP3
02	0602784A / 855: Topographical, Image Intel & Space	0602146A / AU5, AU3, AT7, AT9
02	0602784A / H71: Meteorological Research For Battle Command	0602146A / AV7
02	0602784A / T40: Mob/Wpns Eff Tech	0602144A / BL7, BL9, 0602145A / BF1, BG2, 0602146A / AR9, AT2, 0602150A / AE2
02	0602784A / T41: Mil Facilities Eng Tec	0602144A / BK7
02	0602784A / T42: Terrestrial Science Applied Research	0602146A / AT7
02	0602784A / T45: Energy Tec Apl Mil Fac	0602144A / BK7
02	0602786A / H98: Clothing & Equipm Tech	0602143A / AZ2, AZ9, BB4, BB5, BB9, BC2, BC6, BD6
02	0602786A / H99: Joint Service Combat Feeding Technology	0602143A / BE3
02	0602786A / XW5: Small Unit Expeditionary Maneuver Technology	0602143A / BE1, BE3, BR9
02	0602787A / 869: Warfighter Health Prot & Perf Stnds	0602787A / MK4
02	0602787A / 870: Dod Med Def Ag Inf Dis	0602787A / MM8
02	0602787A / 874: Cbt Casualty Care Tech	0602787A / MM4

02	0602787A / ET4: Appl Resch in Clinical and Rehabilitative Medicine	0602787A / MN1
02	0602787A / XV5: Medical Capabilities to Support Dispersed Ops	0602787A / MM6
03	0603001A / 242: Airdrop Equipment	0603118A / BE5
03	0603001A / C07: Joint Service Combat Feeding Tech Demo	0603118A / BE2
03	0603001A / FF6: Individual Protection	0603118A / AY9, AZ6, AZ8, BB3
03	0603001A / J50: Future Warrior Technology Integration	0603118A / BB6, BC1, BC4, BD7, BD9, BB8
03	0603001A / XW6: Small Unit Expeditionary Maneuver	0603118A / BE5
03	0603002A / 810: Ind Base Id Vacc&Drug	0603002A / MN8, MM9, MO9
03	0603002A / 840: Combat Injury Mgmt	0603002A / MO4, MN3, MO7, MN5, MM5, MO2
03	0603002A / MM3: Warfighter Medical Protection & Performance	0603002A / MN6, MO8, MN9, MO3, MN7, MG4
03	0603003A / 313: Adv Rotarywing Veh Tech	0603465A / AI4, AI6, AJ3, AJ5, AJ9, AK3, AK8, AL6 AL9, & AM3
03	0603003A / 436: Rotarywing MEP Integ	0603465A / AL1
03	0603003A / 447: ACFT Demo Engines	0603465A / AI8 & AJ1
03	0603004A / 232: Advanced Lethality & Survivability Demo	0603118A / AY7, 0603462A / BF5, BG5, BI1, BK4, BK6, 0603464A / AE6, AG3, AG5, AG7, 0603465A / AK7
03	0603004A / L96: High Energy Laser Technology Demo	0603466A / AD1
03	0603004A / L97: Smoke And Obscurants Advanced Technology	0603119A / BL3, 0603462A / BG7, BG9
03	0603005A / 221: Combat Veh Survivablty	0603462A / BG7, BH1, BI1, BI5
03	0603005A / 441: Combat Vehicle Mobilty	0603119A / BK9, 0603462A / BF7, BG4, BH6, BI8, BJ1, BJ6
03	0603005A / 497: Combat Vehicle Electro	0603462A / BH8
03	0603005A / 515: Robotic Ground Systems	0603462A / BF2, BF4, BK1
03	0603006A / 592: Space Application Tech	0603463A / AO6
03	0603015A / S29: Modeling & Simulation - Adv Tech Dev	0603118A / BC8, BE9
03	0603015A / S31: Modeling And Simulation Infrastructure Technology	0603118A / BC4, BC8, BE9
03	0603125A / DF5: Agile Integration & Demonstration	0602145A / BH5, BI4
03	0603125A / DW4: Energy Technologies (Congressional Adds (CAs))	0602145A / BH5, BI4
03	0603270A / CY3: Offensive Cyber Operations Mirror Adv Tech	0603463A / AQ4
03	0603270A / K15: Advanced Comm Ecm Demo	0603463A / AN8, AO7, AO3, AO1
03	0603270A / K16: Non-Commo Ecm Tech Dem	0603465A / AK3, 0603462A / BG7, 0603463A / AO1
03	0603313A / 206: Missile Simulation	0603464A / AF4

03	0603313A / 263: Future Msl Tech Integr(FMTI)	0603464A / AE8, AE9, AH3, BS3, 0603462A / BG7
03	0603313A / 704: Advanced Missile Demo	0603466A / AC8 & AD4, 0603465A / AK5
03	0603606A / 608: Countermine & Bar Dev	0603118A / BC9, 0603462A / BJ8
03	0603606A / 683: Area Denial Sensors	0603462A / BG1
03	0603607A / 627: Jt Svc Sa Prog (JSSAP)	0603118A / AY5
03	0603710A / K70: Night Vision Adv Tech	0603118A / BC9, 0603462A / BI3, BG1, 0603463A / AQ5
03	0603710A / K86: Night Vision, Abn Sys	0603465A / AK3, AL6, AL7
03	0603728A / 002: Environmental Compliance Technology	0603119A / BK8
03	0603728A / 03E: Environmental Restoration Technology	0603119A / BM1, 0603463A / AR4, AR6
03	0603734A / T08: Combat Eng Systems	0603119A / BL6, BL8, BM1, 0603462A / BG3, 0603463A / AS9, AU6, AU4, AT8, AT3, AU1, 0603466A / AE3
03	0603772A / 101: Tactical Command and Control	0603462A / BH3, 0603463A / AW2, AW4, AR2, AV8
03	0603772A / 243: Sensors And Signals Processing	0603466A / AD6
03	0603794A / EL4: Tactical Comms and Networking Technology Int	0603463A / AP6, AP8, AM7, AP9, AN4, AN6, AO3, AQ1, AO1
03	0603794A / EL5: Secure Tactical Information Integration	0603463A / AP2, AO9
04	0603774A / VT7: Soldier Maneuver Sensors - Adv Dev	0603774A / BQ5
04	0604120A / ED5: Assured Positioning, Navigation and Timing (PNT)	1206120A / FJ8
04	0604120A / EH8: DISMOUNTED	1206120A / FJ9
04	0604120A / EH9: PSEUDOLITES	1206120A / FK1
04	0604120A / EJ2: MOUNTED	1206120A / FK2
04	0604120A / EJ3: ANTI-JAM ANTENNA	1206120A / FK3
04	0604319A / DU3: IFPC2	0605052A / EY7
05	0604710A / L67: Soldier Night Vision Devices	0604710A / BQ6
05	0604798A / FG7: Emerging Technology Initiatives	0605054A / FI3
05	0605013A / 738: AcqBiz	0605013A / FL9
05	0605053A / FB8: Soldier Borne Sensor (SBS)	0604827A / FK4
06	0604256A / 976: Army Threat Sim (ATS)	0604759A / FF1
07	0205402A / EF2: Integrated Base Defense	0604785A / DS4

Program Terminations:

Budget Activity	***OSDPE / Project***	***OSDPE Title / Project Title***
01	0601103A / V72	University Research Initiatives / Minerva
01	0601104A / H09	University and Industry Research Centers / Robotics CTA
01	0601104A / H50	University and Industry Research Centers / Network Sciences Cta
02	0602105A / H7G	Materials Technology / Nanomaterials Applied Research
02	0602120A / SA2	Sensors and Electronic Survivability / Biotechnology Applied Research
02	0602624A / H19	Weapons and Munitions Technology / Asymmetric & Counter Measure Technologies
02	0602705A / H17	Electronics and Electronic Devices / Flexible Display Center
02	0602720A / 895	Environmental Quality Technology / Pollution Prevention
02	0602786A / 283	Warfighter Technology / Airdrop Adv Tech
02	0602786A / VT4	Warfighter Technology / Expeditionary Mobile Base Camp Technology
03	0603001A / 543	Warfighter Advanced Technology / Ammunition Logistics
03	0603001A / VT5	Warfighter Advanced Technology / Expeditionary Mobile Base Camp Demonstration
03	0603002A / ET5	Medical Advanced Technology / Adv Tech Dev in Clinical & Rehabilitative Medicine
03	0603728A / 025	Environmental Quality Technology Demonstrations / Pollution Prevention Technology
04	0603619A / 606	Landmine Warfare and Barrier - Adv Dev / Cntrmn/Barrier Adv Dev
04	0603639A / EL8	Tank and Medium Caliber Ammunition / LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER
04	0603804A / EW8	Logistics and Engineer Equipment - Adv Dev / Armored Engineer Vehicles
04	0603804A / K39	Logistics and Engineer Equipment - Adv Dev / Field Sustainment Support Ad
04	0603804A / K41	Logistics and Engineer Equipment - Adv Dev / Water And Petroleum Distribution - Ad
04	0603804A / VR8	Logistics and Engineer Equipment - Adv Dev / Combat Service Support Systems - Ad
04	0604020A / CF1	Cross Functional Team (CFT) Advanced Development & Prototyping / CFT Advanced Development & Prototyping
04	0604115A / DS3	Technology Maturation Initiatives / Technology Maturation Initiatives
04	1206308A / FE6	Army Space Systems Integration / Army Space System Enhancement/Integration
05	0210609A / ED8	Paladin Integrated Management (PIM) / Paladin Integrated Management (PIM)
05	0604321A / B41	All Source Analysis System / CI/HUMINT Software Products (MIP)
05	0604321A / B51	All Source Analysis System / Machine - Foreign Language Translation System
05	0604601A / S62	Infantry Support Weapons / Counter-Defilade Target Engagement - SDD

05	0604601A / S70	Infantry Support Weapons / Personnel Recovery Support System (PRSS)
05	0604622A / E50	Family of Heavy Tactical Vehicles / TRAILER DEVELOPMENT
05	0604713A / EL2	Combat Feeding, Clothing, and Equipment / Army Field Feeding Equipment
05	0604741A / FG5	Air Defense Command, Control and Intelligence - Eng Dev / Counter Unmanned Aerial Systems (UAS)
05	0604768A / P01	Brilliant Anti-Armor Submunition (BAT) / MULTI - MODE SEEKER DEVELOPMENT AND TEST
05	0604780A / 571	Combined Arms Tactical Trainer (CATT) Core / Close Cbt Tact Trainer
05	0604780A / 577	Combined Arms Tactical Trainer (CATT) Core / Gaming Technology In Support Of Army Training
05	0604780A / 585	Combined Arms Tactical Trainer (CATT) Core / Aviation Combined Arms Tactical Trainer
05	0604804A / EC9	Logistics and Engineer Equipment - Eng Dev / Contingency Basing Infrastructure
05	0604804A / H01	Logistics and Engineer Equipment - Eng Dev / Combat Engineer Eq Ed
05	0604804A / H14	Logistics and Engineer Equipment - Eng Dev / Materials Handling Equipment - Ed
05	0604804A / VR7	Logistics and Engineer Equipment - Eng Dev / Combat Service Support Systems
05	0604818A / 334	Army Tactical Command & Control Hardware & Software / Common Software
05	0604823A / L87	Firefinder / Hypervelocity Armament System (HAS)
05	0604827A / EY3	Soldier Systems - Warrior Dem/Val / Soldier Power Generator
05	0605013A / FE9	Information Technology Development / ALTESS (P&R Forms)
05	0605029A / EQ2	Integrated Ground Security Surveillance Response Capability (IGSSR-C) / IntegGrdSecSurvRespC(IGSSR-C)
05	0605037A / EQ6	Evidence Collection and Detainee Processing / Evidence Collection and Detainee Processing
05	0605380A / EG6	AMF Joint Tactical Radio System (JTRS) / Small Airborne Networking Radio (SANR)
06	0303260A / FA9	Defense Military Deception Initiative / Security Initiatives
06	0604759A / 986	Major T&E Investment / Major Operational Test Instrumentation
06	0604759A / FA4	Major T&E Investment / Warrior Injury Assessment Manikin (WIAMan)
06	0605803A / 720	Technical Information Activities / Tech Info Func Actv
06	0605803A / 730	Technical Information Activities / Pers & Trng Analys Act
06	0605803A / C16	Technical Information Activities / FAST
06	0605803A / C18	Technical Information Activities / BAST
07	0203735A / 431	Combat Vehicle Improvement Programs / M113 IMPROVEMENTS
07	0203735A / FD8	Combat Vehicle Improvement Programs / Light Armored Vehicle Improvement
07	0203740A / 484	Maneuver Control System / Maneuver Control System
07	0203801A / DT5	Missile/Air Defense Product Improvement Program / Stinger Product Improvement

07	0203802A / 788	Other Missile Product Improvement Programs / ATACMS PIP
07	0205410A / EE9	Materials Handling Equipment / Material Handling Equipment - Advance Development
07	0303140A / FF8	Information Systems Security Program / Unit Activity Monitoring (UAM)
07	0303150A / EA5	WWMCCS/Global Command and Control System / Strategic and Joint Mission Command
07	0305219A / MQ1	MQ-1 Gray Eagle UAV / MQ-1 Gray Eagle - Army UAV (MIP)
07	0607135A / ES2	Apache Product Improvement Program / Apache Product Improvement Program
07	0607140A / ES7	Emerging Technologies from NIE / Emerging Technologies from NIE
07	0607665A / DT2	Family of Biometrics / Non-MIP Biometrics

3. Classification: This document contains no classified data Appropriately cleared individuals can obtain further information on Classified/Special Access Programs by contacting the Department of the Army (ASA(ALT)) Special Programs Office.

Department of Defense
FY 2020 President's Budget
Exhibit R-1 FY 2020 President's Budget
Total Obligational Authority
(Dollars in Thousands)

12 Feb 2019

Appropriation	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted
Research, Development, Test & Eval, Army	11,633,461	11,074,556	300,604	11,375,160
Total Research, Development, Test & Evaluation	11,633,461	11,074,556	300,604	11,375,160

Department of Defense
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Appropriation	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)
Research, Development, Test & Eval, Army	12,192,771		204,124	204,124	12,396,895
Total Research, Development, Test & Evaluation	12,192,771		204,124	204,124	12,396,895

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Summary Recap of Budget Activities	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted
Basic Research	464,187	506,444		506,444
Applied Research	1,342,832	1,578,725		1,578,725
Advanced Technology Development	1,503,959	1,585,778		1,585,778
Advanced Component Development & Prototypes	1,563,615	1,264,647	4,000	1,268,647
System Development & Demonstration	3,349,488	2,965,361	236,863	3,202,224
RDT&E Management Support	1,579,102	1,438,536		1,438,536
Operational Systems Development	1,830,278	1,735,065	59,741	1,794,806
Total Research, Development, Test & Evaluation	11,633,461	11,074,556	300,604	11,375,160

Summary Recap of FYDP Programs				
General Purpose Forces	668,082	666,757	10,000	676,757
Intelligence and Communications	401,118	252,771	40,613	293,384
Research and Development	10,369,821	9,830,755	249,991	10,080,746
Central Supply and Maintenance	118,410	108,696		108,696
Administration and Associated Activities	654			
Space	68,222	209,622		209,622
Classified Programs	7,154	5,955		5,955
Total Research, Development, Test & Evaluation	11,633,461	11,074,556	300,604	11,375,160

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Summary Recap of Budget Activities	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)
Basic Research	454,980				454,980
Applied Research	893,990				893,990
Advanced Technology Development	1,099,564				1,099,564
Advanced Component Development & Prototypes	2,929,355		17,114	17,114	2,946,469
System Development & Demonstration	3,549,431		111,917	111,917	3,661,348
RDT&E Management Support	1,286,625		1,875	1,875	1,288,500
Operational Systems Development	1,978,826		73,218	73,218	2,052,044
Total Research, Development, Test & Evaluation	12,192,771		204,124	204,124	12,396,895
Summary Recap of FYDP Programs					
General Purpose Forces	866,366				866,366
Intelligence and Communications	257,681		76,418	76,418	334,099
Research and Development	10,659,601		127,706	127,706	10,787,307
Central Supply and Maintenance	59,848				59,848
Administration and Associated Activities					
Space	342,002				342,002
Classified Programs	7,273				7,273
Total Research, Development, Test & Evaluation	12,192,771		204,124	204,124	12,396,895

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Summary Recap of Budget Activities	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted
Basic Research	464,187	506,444		506,444
Applied Research	1,342,832	1,578,725		1,578,725
Advanced Technology Development	1,503,959	1,585,778		1,585,778
Advanced Component Development & Prototypes	1,563,615	1,264,647	4,000	1,268,647
System Development & Demonstration	3,349,488	2,965,361	236,863	3,202,224
RDT&E Management Support	1,579,102	1,438,536		1,438,536
Operational Systems Development	1,830,278	1,735,065	59,741	1,794,806
Total Research, Development, Test & Evaluation	11,633,461	11,074,556	300,604	11,375,160

Summary Recap of FYDP Programs				
General Purpose Forces	668,082	666,757	10,000	676,757
Intelligence and Communications	401,118	252,771	40,613	293,384
Research and Development	10,369,821	9,830,755	249,991	10,080,746
Central Supply and Maintenance	118,410	108,696		108,696
Administration and Associated Activities	654			
Space	68,222	209,622		209,622
Classified Programs	7,154	5,955		5,955
Total Research, Development, Test & Evaluation	11,633,461	11,074,556	300,604	11,375,160

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Summary Recap of Budget Activities	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)
Basic Research	454,980				454,980
Applied Research	893,990				893,990
Advanced Technology Development	1,099,564				1,099,564
Advanced Component Development & Prototypes	2,929,355		17,114	17,114	2,946,469
System Development & Demonstration	3,549,431		111,917	111,917	3,661,348
RDT&E Management Support	1,286,625		1,875	1,875	1,288,500
Operational Systems Development	1,978,826		73,218	73,218	2,052,044
Total Research, Development, Test & Evaluation	12,192,771		204,124	204,124	12,396,895
Summary Recap of FYDP Programs					
General Purpose Forces	866,366				866,366
Intelligence and Communications	257,681		76,418	76,418	334,099
Research and Development	10,659,601		127,706	127,706	10,787,307
Central Supply and Maintenance	59,848				59,848
Administration and Associated Activities					
Space	342,002				342,002
Classified Programs	7,273				7,273
Total Research, Development, Test & Evaluation	12,192,771		204,124	204,124	12,396,895

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Appropriation: 2040A Research, Development, Test & Eval, Army

Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
1	0601101A	In-House Laboratory Independent Research	01	11,783	11,579		11,579	U
2	0601102A	Defense Research Sciences	01	274,098	315,660		315,660	U
3	0601103A	University Research Initiatives	01	74,349	65,202		65,202	U
4	0601104A	University and Industry Research Centers	01	103,957	114,003		114,003	U
5	0601121A	Cyber Collaborative Research Alliance	01					U
	Basic Research			464,187	506,444		506,444	
6	0602105A	Materials Technology	02	73,136	83,586		83,586	U
7	0602120A	Sensors and Electronic Survivability	02	83,581	80,849		80,849	U
8	0602122A	TRACTOR HIP	02	8,627	8,674		8,674	U
9	0602126A	TRACTOR JACK	02		400		400	U
10	0602141A	Lethality Technology	02					U
11	0602142A	Army Applied Research	02					U
12	0602143A	Soldier Lethality Technology	02					U
13	0602144A	Ground Technology	02					U
14	0602145A	Next Generation Combat Vehicle Technology	02					U
15	0602146A	Network C3I Technology	02					U
16	0602147A	Long Range Precision Fires Technology	02					U
17	0602148A	Future Verticle Lift Technology	02					U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
1	0601101A	In-House Laboratory Independent Research	01						U
2	0601102A	Defense Research Sciences	01	297,976				297,976	U
3	0601103A	University Research Initiatives	01	65,858				65,858	U
4	0601104A	University and Industry Research Centers	01	86,164				86,164	U
5	0601121A	Cyber Collaborative Research Alliance	01	4,982				4,982	U
	Basic Research			454,980				454,980	
6	0602105A	Materials Technology	02						U
7	0602120A	Sensors and Electronic Survivability	02						U
8	0602122A	TRACTOR HIP	02						U
9	0602126A	TRACTOR JACK	02						U
10	0602141A	Lethality Technology	02	26,961				26,961	U
11	0602142A	Army Applied Research	02	25,319				25,319	U
12	0602143A	Soldier Lethality Technology	02	115,274				115,274	U
13	0602144A	Ground Technology	02	35,199				35,199	U
14	0602145A	Next Generation Combat Vehicle Technology	02	219,047				219,047	U
15	0602146A	Network C3I Technology	02	114,516				114,516	U
16	0602147A	Long Range Precision Fires Technology	02	74,327				74,327	U
17	0602148A	Future Verticle Lift Technology	02	93,601				93,601	U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
18	0602150A	Air and Missile Defense Technology	02					U
19	0602211A	Aviation Technology	02	72,170	81,805		81,805	U
20	0602213A	C3I Applied Cyber	02					U
21	0602270A	Electronic Warfare Technology	02	33,683	25,558		25,558	U
22	0602303A	Missile Technology	02	52,858	91,647		91,647	U
23	0602307A	Advanced Weapons Technology	02	36,959	44,468		44,468	U
24	0602308A	Advanced Concepts and Simulation	02	27,662	28,470		28,470	U
25	0602601A	Combat Vehicle and Automotive Technology	02	78,759	104,404		104,404	U
26	0602618A	Ballistics Technology	02	83,299	85,491		85,491	U
27	0602622A	Chemical, Smoke and Equipment Defeating Technology	02	3,895	5,027		5,027	U
28	0602623A	Joint Service Small Arms Program	02	6,473	12,380		12,380	U
29	0602624A	Weapons and Munitions Technology	02	241,344	383,410		383,410	U
30	0602705A	Electronics and Electronic Devices	02	90,613	96,760		96,760	U
31	0602709A	Night Vision Technology	02	38,243	33,573		33,573	U
32	0602712A	Countermine Systems	02	25,329	27,223		27,223	U
33	0602716A	Human Factors Engineering Technology	02	23,813	24,121		24,121	U
34	0602720A	Environmental Quality Technology	02	34,118	19,469		19,469	U
35	0602782A	Command, Control, Communications Technology	02	32,458	54,956		54,956	U
36	0602783A	Computer and Software Technology	02	13,707	14,948		14,948	U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
18	0602150A	Air and Missile Defense Technology	02	50,771				50,771	U
19	0602211A	Aviation Technology	02						U
20	0602213A	C3I Applied Cyber	02	18,947				18,947	U
21	0602270A	Electronic Warfare Technology	02						U
22	0602303A	Missile Technology	02						U
23	0602307A	Advanced Weapons Technology	02						U
24	0602308A	Advanced Concepts and Simulation	02						U
25	0602601A	Combat Vehicle and Automotive Technology	02						U
26	0602618A	Ballistics Technology	02						U
27	0602622A	Chemical, Smoke and Equipment Defeating Technology	02						U
28	0602623A	Joint Service Small Arms Program	02						U
29	0602624A	Weapons and Munitions Technology	02						U
30	0602705A	Electronics and Electronic Devices	02						U
31	0602709A	Night Vision Technology	02						U
32	0602712A	Countermine Systems	02						U
33	0602716A	Human Factors Engineering Technology	02						U
34	0602720A	Environmental Quality Technology	02						U
35	0602782A	Command, Control, Communications Technology	02						U
36	0602783A	Computer and Software Technology	02						U

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37	0602784A	Military Engineering Technology	02	114,947	101,124		101,124	U
38	0602785A	Manpower/Personnel/Training Technology	02	19,791	21,847		21,847	U
39	0602786A	Warfighter Technology	02	58,476	56,532		56,532	U
40	0602787A	Medical Technology	02	88,891	92,003		92,003	U
		Applied Research		1,342,832	1,578,725		1,578,725	
41	0603001A	Warfighter Advanced Technology	03	53,763	41,795		41,795	U
42	0603002A	Medical Advanced Technology	03	103,908	101,442		101,442	U
43	0603003A	Aviation Advanced Technology	03	172,545	169,411		169,411	U
44	0603004A	Weapons and Munitions Advanced Technology	03	195,345	241,581		241,581	U
45	0603005A	Combat Vehicle and Automotive Advanced Technology	03	154,084	176,622		176,622	U
46	0603006A	Space Application Advanced Technology	03	39,277	48,985		48,985	U
47	0603007A	Manpower, Personnel and Training Advanced Technology	03	5,063	8,038		8,038	U
48	0603009A	TRACTOR HIKE	03	39,302	22,631		22,631	U
49	0603015A	Next Generation Training & Simulation Systems	03	15,778	28,650		28,650	U
50	0603117A	Army Advanced Technology Development	03					U
51	0603118A	Soldier Lethality Advanced Technology	03					U
52	0603119A	Ground Advanced Technology	03					U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
37	0602784A	Military Engineering Technology	02						U
38	0602785A	Manpower/Personnel/Training Technology	02	20,873				20,873	U
39	0602786A	Warfighter Technology	02						U
40	0602787A	Medical Technology	02	99,155				99,155	U
		Applied Research		893,990				893,990	
41	0603001A	Warfighter Advanced Technology	03						U
42	0603002A	Medical Advanced Technology	03	42,030				42,030	U
43	0603003A	Aviation Advanced Technology	03						U
44	0603004A	Weapons and Munitions Advanced Technology	03						U
45	0603005A	Combat Vehicle and Automotive Advanced Technology	03						U
46	0603006A	Space Application Advanced Technology	03						U
47	0603007A	Manpower, Personnel and Training Advanced Technology	03	11,038				11,038	U
48	0603009A	TRACTOR HIKE	03						U
49	0603015A	Next Generation Training & Simulation Systems	03						U
50	0603117A	Army Advanced Technology Development	03	63,338				63,338	U
51	0603118A	Soldier Lethality Advanced Technology	03	118,468				118,468	U
52	0603119A	Ground Advanced Technology	03	12,593				12,593	U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
53	0603125A	Combating Terrorism - Technology Development	03	44,088	36,757		36,757	U
54	0603130A	TRACTOR NAIL	03	4,880	4,896		4,896	U
55	0603131A	TRACTOR EGGS	03	4,326	6,041		6,041	U
56	0603270A	Electronic Warfare Technology	03	33,249	41,458		41,458	U
57	0603313A	Missile and Rocket Advanced Technology	03	133,433	94,561		94,561	U
58	0603322A	TRACTOR CAGE	03	12,323	16,845		16,845	U
59	0603457A	C3I Cyber Advanced Development	03					U
60	0603461A	High Performance Computing Modernization Program	03	214,100	218,098		218,098	U
61	0603462A	Next Generation Combat Vehicle Advanced Technology	03					U
62	0603463A	Network C3I Advanced Technology	03					U
63	0603464A	Long Range Precision Fires Advanced Technology	03					U
64	0603465A	Future Vertical Lift Advanced Technology	03					U
65	0603466A	Air and Missile Defense Advanced Technology	03					U
66	0603606A	Landmine Warfare and Barrier Advanced Technology	03	18,473	17,097		17,097	U
67	0603607A	Joint Service Small Arms Program	03	5,628	22,799		22,799	U
68	0603710A	Night Vision Advanced Technology	03	45,617	61,313		61,313	U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
53	0603125A	Combating Terrorism - Technology Development	03						U
54	0603130A	TRACTOR NAIL	03						U
55	0603131A	TRACTOR EGGS	03						U
56	0603270A	Electronic Warfare Technology	03						U
57	0603313A	Missile and Rocket Advanced Technology	03						U
58	0603322A	TRACTOR CAGE	03						U
59	0603457A	C3I Cyber Advanced Development	03	13,769				13,769	U
60	0603461A	High Performance Computing Modernization Program	03	184,755				184,755	U
61	0603462A	Next Generation Combat Vehicle Advanced Technology	03	160,035				160,035	U
62	0603463A	Network C3I Advanced Technology	03	106,899				106,899	U
63	0603464A	Long Range Precision Fires Advanced Technology	03	174,386				174,386	U
64	0603465A	Future Vertical Lift Advanced Technology	03	151,640				151,640	U
65	0603466A	Air and Missile Defense Advanced Technology	03	60,613				60,613	U
66	0603606A	Landmine Warfare and Barrier Advanced Technology	03						U
67	0603607A	Joint Service Small Arms Program	03						U
68	0603710A	Night Vision Advanced Technology	03						U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
69	0603728A	Environmental Quality Technology Demonstrations	03	29,150	29,132		29,132	U
70	0603734A	Military Engineering Advanced Technology	03	96,586	101,438		101,438	U
71	0603772A	Advanced Tactical Computer Science and Sensor Technology	03	50,637	43,856		43,856	U
72	0603794A	C3 Advanced Technology	03	32,404	52,332		52,332	U
		Advanced Technology Development		1,503,959	1,585,778		1,585,778	
73	0603305A	Army Missle Defense Systems Integration	04	23,558	60,472		60,472	U
74	0603327A	Air and Missile Defense Systems Engineering	04	58,812	45,231	1,000	46,231	U
75	0603619A	Landmine Warfare and Barrier - Adv Dev	04	69,237	45,198		45,198	U
76	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04	8,920	20,674		20,674	U
77	0603639A	Tank and Medium Caliber Ammunition	04	45,448	41,921		41,921	U
78	0603645A	Armored System Modernization - Adv Dev	04	41,431	84,297		84,297	U
79	0603747A	Soldier Support and Survivability	04	15,759	8,735	3,000	11,735	U
80	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	27,733	35,667		35,667	U
81	0603774A	Night Vision Systems Advanced Development	04	501,816	7,341		7,341	U
82	0603779A	Environmental Quality Technology - Dem/Val	04	15,039	14,731		14,731	U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
69	0603728A	Environmental Quality Technology Demonstrations	03						U
70	0603734A	Military Engineering Advanced Technology	03						U
71	0603772A	Advanced Tactical Computer Science and Sensor Technology	03						U
72	0603794A	C3 Advanced Technology	03						U
		Advanced Technology Development		1,099,564				1,099,564	
73	0603305A	Army Missle Defense Systems Integration	04	10,987				10,987	U
74	0603327A	Air and Missile Defense Systems Engineering	04	15,148		500	500	15,648	U
75	0603619A	Landmine Warfare and Barrier - Adv Dev	04	92,915				92,915	U
76	0603627A	Smoke, Obscurant and Target Defeating Sys-Adv Dev	04						U
77	0603639A	Tank and Medium Caliber Ammunition	04	82,146				82,146	U
78	0603645A	Armored System Modernization - Adv Dev	04	157,656				157,656	U
79	0603747A	Soldier Support and Survivability	04	6,514		3,000	3,000	9,514	U
80	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	34,890				34,890	U
81	0603774A	Night Vision Systems Advanced Development	04	251,011				251,011	U
82	0603779A	Environmental Quality Technology - Dem/Val	04	15,132				15,132	U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
83	0603790A	NATO Research and Development	04	2,485	3,682		3,682	U
84	0603801A	Aviation - Adv Dev	04	9,653	86,180		86,180	U
85	0603804A	Logistics and Engineer Equipment - Adv Dev	04	29,619	17,230		17,230	U
86	0603807A	Medical Systems - Adv Dev	04	36,279	39,244		39,244	U
87	0603827A	Soldier Systems - Advanced Development	04	60,774	31,022		31,022	U
88	0604017A	Robotics Development	04	38,051	74,368		74,368	U
89	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04		9,488		9,488	U
90	0604021A	Electronic Warfare Technology Maturation (MIP)	04					U
91	0604100A	Analysis Of Alternatives	04	7,307	9,753		9,753	U
92	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04		12,393		12,393	U
93	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	57,437	89,248		89,248	U
94	0604115A	Technology Maturation Initiatives	04	145,618	95,229		95,229	U
95	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04	19,201	79,016		79,016	U
96	0604118A	TRACTOR BEAM	04	10,400	52,894		52,894	U
97	0604119A	Army Advanced Component Development & Prototyping	04					U
98	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	132,810				U

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83	0603790A	NATO Research and Development	04	5,406				5,406	U
84	0603801A	Aviation - Adv Dev	04	459,290				459,290	U
85	0603804A	Logistics and Engineer Equipment - Adv Dev	04	6,254		1,085	1,085	7,339	U
86	0603807A	Medical Systems - Adv Dev	04	31,175				31,175	U
87	0603827A	Soldier Systems - Advanced Development	04	22,113				22,113	U
88	0604017A	Robotics Development	04	115,222				115,222	U
89	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04						U
90	0604021A	Electronic Warfare Technology Maturation (MIP)	04	18,043				18,043	U
91	0604100A	Analysis Of Alternatives	04	10,023				10,023	U
92	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04	40,745				40,745	U
93	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	427,772				427,772	U
94	0604115A	Technology Maturation Initiatives	04	196,676				196,676	U
95	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04	33,100		6,000	6,000	39,100	U
96	0604118A	TRACTOR BEAM	04						U
97	0604119A	Army Advanced Component Development & Prototyping	04	115,116		4,529	4,529	119,645	U
98	0604120A	Assured Positioning, Navigation and Timing (PNT)	04						U

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99	0604121A	Synthetic Training Environment Refinement & Prototyping	04	109,165	39,890		39,890	U
100	0604182A	Hypersonics	04					U
101	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04	10,871	40,979		40,979	U
102	0604403A	Future Interceptor	04					U
103	0604541A	Unified Network Transport	04					U
104	0604644A	Mobile Medium Range Missile	04					U
105	0604785A	Integrated Base Defense (Budget Activity 4)	04					U
106	0305251A	Cyberspace Operations Forces and Force Support	04	56,071	52,817		52,817	U
107	1206120A	Assured Positioning, Navigation and Timing (PNT)	04		128,640		128,640	U
108	1206308A	Army Space Systems Integration	04	30,121	38,307		38,307	U
		Advanced Component Development & Prototypes		1,563,615	1,264,647	4,000	1,268,647	
109	0604201A	Aircraft Avionics	05	30,812	32,253		32,253	U
110	0604270A	Electronic Warfare Development	05	68,935	58,627		58,627	U
111	0604321A	All Source Analysis System	05	4,774				U
112	0604328A	TRACTOR CAGE	05	30,252	17,050	12,000	29,050	U
113	0604601A	Infantry Support Weapons	05	99,145	63,793		63,793	U
114	0604604A	Medium Tactical Vehicles	05	5,798	3,699		3,699	U
115	0604611A	JAVELIN	05	20,252	5,616		5,616	U

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99	0604121A	Synthetic Training Environment Refinement & Prototyping	04	136,761				136,761	U
100	0604182A	Hypersonics	04	228,000				228,000	U
101	0604319A	Indirect Fire Protection Capability Increment 2-Intercept (IFPC2)	04						U
102	0604403A	Future Interceptor	04	8,000				8,000	U
103	0604541A	Unified Network Transport	04	39,600				39,600	U
104	0604644A	Mobile Medium Range Missile	04	20,000				20,000	U
105	0604785A	Integrated Base Defense (Budget Activity 4)	04			2,000	2,000	2,000	U
106	0305251A	Cyberspace Operations Forces and Force Support	04	52,102				52,102	U
107	1206120A	Assured Positioning, Navigation and Timing (PNT)	04	192,562				192,562	U
108	1206308A	Army Space Systems Integration	04	104,996				104,996	U
		Advanced Component Development & Prototypes		2,929,355		17,114	17,114	2,946,469	
109	0604201A	Aircraft Avionics	05	29,164				29,164	U
110	0604270A	Electronic Warfare Development	05	70,539				70,539	U
111	0604321A	All Source Analysis System	05						U
112	0604328A	TRACTOR CAGE	05						U
113	0604601A	Infantry Support Weapons	05	106,121				106,121	U
114	0604604A	Medium Tactical Vehicles	05	2,152				2,152	U
115	0604611A	JAVELIN	05	17,897				17,897	U

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116	0604622A	Family of Heavy Tactical Vehicles	05	10,086	11,935		11,935	U
117	0604633A	Air Traffic Control	05	3,433	12,332		12,332	U
118	0604642A	Light Tactical Wheeled Vehicles	05	3,619	1,276		1,276	U
119	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05	34,794	373,337		373,337	U
120	0604710A	Night Vision Systems - Eng Dev	05	184,389	144,442		144,442	U
121	0604713A	Combat Feeding, Clothing, and Equipment	05	8,561	4,502		4,502	U
122	0604715A	Non-System Training Devices - Eng Dev	05	51,900	44,381		44,381	U
123	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	190,385	93,073	119,300	212,373	U
124	0604742A	Constructive Simulation Systems Development	05	17,921	22,600		22,600	U
125	0604746A	Automatic Test Equipment Development	05	7,054	11,782		11,782	U
126	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	10,890	9,134		9,134	U
127	0604768A	Brilliant Anti-Armor Submunition (BAT)	05	7,886	6,886		6,886	U
128	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	17,855	21,936		21,936	U
129	0604798A	Brigade Analysis, Integration and Evaluation	05	139,386	49,250		49,250	U
130	0604802A	Weapons and Munitions - Eng Dev	05	144,389	172,744		172,744	U

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116	0604622A	Family of Heavy Tactical Vehicles	05	16,745				16,745	U
117	0604633A	Air Traffic Control	05	6,989				6,989	U
118	0604642A	Light Tactical Wheeled Vehicles	05	10,465				10,465	U
119	0604645A	Armored Systems Modernization (ASM) - Eng Dev	05	310,152				310,152	U
120	0604710A	Night Vision Systems - Eng Dev	05	181,732				181,732	U
121	0604713A	Combat Feeding, Clothing, and Equipment	05	2,393				2,393	U
122	0604715A	Non-System Training Devices - Eng Dev	05	27,412				27,412	U
123	0604741A	Air Defense Command, Control and Intelligence - Eng Dev	05	43,502				43,502	U
124	0604742A	Constructive Simulation Systems Development	05	11,636				11,636	U
125	0604746A	Automatic Test Equipment Development	05	10,915				10,915	U
126	0604760A	Distributive Interactive Simulations (DIS) - Eng Dev	05	7,801				7,801	U
127	0604768A	Brilliant Anti-Armor Submunition (BAT)	05	25,000				25,000	U
128	0604780A	Combined Arms Tactical Trainer (CATT) Core	05	9,241				9,241	U
129	0604798A	Brigade Analysis, Integration and Evaluation	05	42,634				42,634	U
130	0604802A	Weapons and Munitions - Eng Dev	05	181,023				181,023	U

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131	0604804A	Logistics and Engineer Equipment - Eng Dev	05	76,030	76,388		76,388	U
132	0604805A	Command, Control, Communications Systems - Eng Dev	05	9,559	15,950		15,950	U
133	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	36,685	44,495		44,495	U
134	0604808A	Landmine Warfare/Barrier - Eng Dev	05	26,188	43,064		43,064	U
135	0604818A	Army Tactical Command & Control Hardware & Software	05	157,852	169,607		169,607	U
136	0604820A	Radar Development	05	31,651	39,289		39,289	U
137	0604822A	General Fund Enterprise Business System (GFEBS)	05	47,575	36,810		36,810	U
138	0604823A	Firefinder	05	43,762	27,439		27,439	U
139	0604827A	Soldier Systems - Warrior Dem/Val	05	15,490	10,382		10,382	U
140	0604852A	Suite of Survivability Enhancement Systems - EMD	05	90,187	52,839		52,839	U
141	0604854A	Artillery Systems - EMD	05	3,892	1,779		1,779	U
142	0605013A	Information Technology Development	05	62,613	77,686		77,686	U
143	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	188,637	164,899		164,899	U
144	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	184,300	111,821		111,821	U
145	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05	4,241	3,207		3,207	U
146	0605030A	Joint Tactical Network Center (JTNC)	05	15,242	15,869		15,869	U

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131	0604804A	Logistics and Engineer Equipment - Eng Dev	05	103,226				103,226	U
132	0604805A	Command, Control, Communications Systems - Eng Dev	05	12,595				12,595	U
133	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	48,264				48,264	U
134	0604808A	Landmine Warfare/Barrier - Eng Dev	05	39,208				39,208	U
135	0604818A	Army Tactical Command & Control Hardware & Software	05	140,637				140,637	U
136	0604820A	Radar Development	05	105,243				105,243	U
137	0604822A	General Fund Enterprise Business System (GFEBS)	05	46,683				46,683	U
138	0604823A	Firefinder	05	17,294				17,294	U
139	0604827A	Soldier Systems - Warrior Dem/Val	05	5,803				5,803	U
140	0604852A	Suite of Survivability Enhancement Systems - EMD	05	98,698				98,698	U
141	0604854A	Artillery Systems - EMD	05	15,832				15,832	U
142	0605013A	Information Technology Development	05	126,537				126,537	U
143	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	142,773				142,773	U
144	0605028A	Armored Multi-Purpose Vehicle (AMPV)	05	96,730				96,730	U
145	0605029A	Integrated Ground Security Surveillance Response Capability (IGSSR-C)	05	6,699				6,699	U
146	0605030A	Joint Tactical Network Center (JTNC)	05	15,882				15,882	U

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147	0605031A	Joint Tactical Network (JTN)	05	46,051	41,920		41,920	U
148	0605032A	TRACTOR TIRE	05	118,570	41,166	66,760	107,926	U
149	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05	20,661	5,169		5,169	U
150	0605034A	Tactical Security System (TSS)	05	3,998	4,490		4,490	U
151	0605035A	Common Infrared Countermeasures (CIRCM)	05	97,746	31,139	2,670	33,809	U
152	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	6,650	11,297		11,297	U
153	0605037A	Evidence Collection and Detainee Processing	05	206				U
154	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05	15,481	15,135		15,135	U
155	0605041A	Defensive CYBER Tool Development	05	41,441	33,796		33,796	U
156	0605042A	Tactical Network Radio Systems (Low-Tier)	05	8,845	3,825		3,825	U
157	0605047A	Contract Writing System	05	19,574	41,876		41,876	U
158	0605049A	Missile Warning System Modernization (MWSM)	05	12,480	8,266		8,266	U
159	0605051A	Aircraft Survivability Development	05	169,752	21,938	34,933	56,871	U
160	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	156,361	132,283		132,283	U
161	0605053A	Ground Robotics	05	60,530	71,435		71,435	U

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147	0605031A	Joint Tactical Network (JTN)	05	40,808				40,808	U
148	0605032A	TRACTOR TIRE	05						U
149	0605033A	Ground-Based Operational Surveillance System - Expeditionary (GBOSS-E)	05	3,847				3,847	U
150	0605034A	Tactical Security System (TSS)	05	6,928				6,928	U
151	0605035A	Common Infrared Countermeasures (CIRCM)	05	34,488		11,770	11,770	46,258	U
152	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	10,000				10,000	U
153	0605037A	Evidence Collection and Detainee Processing	05						U
154	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05	6,054				6,054	U
155	0605041A	Defensive CYBER Tool Development	05	62,262				62,262	U
156	0605042A	Tactical Network Radio Systems (Low-Tier)	05	35,654				35,654	U
157	0605047A	Contract Writing System	05	19,682				19,682	U
158	0605049A	Missile Warning System Modernization (MWSM)	05	1,539				1,539	U
159	0605051A	Aircraft Survivability Development	05	64,557		77,420	77,420	141,977	U
160	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	243,228				243,228	U
161	0605053A	Ground Robotics	05	41,308				41,308	U

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162	0605054A	Emerging Technology Initiatives	05		42,813		42,813	U
163	0605203A	Army System Development & Demonstration	05					U
164	0605380A	AMF Joint Tactical Radio System (JTRS)	05	18,639	15,964		15,964	U
165	0605450A	Joint Air-to-Ground Missile (JAGM)	05	28,539	11,758		11,758	U
166	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	339,051	322,263		322,263	U
167	0605625A	Manned Ground Vehicle	05					U
168	0605766A	National Capabilities Integration (MIP)	05	9,382	12,340		12,340	U
169	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	22,530				U
170	0605830A	Aviation Ground Support Equipment	05	6,653	7,703		7,703	U
171	0210609A	Paladin Integrated Management (PIM)	05	5,868				U
172	0303032A	TROJAN - RH12	05	5,631	4,521	1,200	5,721	U
173	0303267A	Auctioned Spectrum Relocation Fund	05	15,885				U
174	0304270A	Electronic Warfare Development	05	14,616	8,922		8,922	U
175	1205117A	Tractor Bears	05	17,928	23,170		23,170	U
		System Development & Demonstration		3,349,488	2,965,361	236,863	3,202,224	
176	0604256A	Threat Simulator Development	06	31,401	47,322		47,322	U
177	0604258A	Target Systems Development	06	13,467	32,120		32,120	U

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162	0605054A	Emerging Technology Initiatives	05	45,896				45,896	U
163	0605203A	Army System Development & Demonstration	05	164,883		19,527	19,527	184,410	U
164	0605380A	AMF Joint Tactical Radio System (JTRS)	05						U
165	0605450A	Joint Air-to-Ground Missile (JAGM)	05	9,500				9,500	U
166	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	208,938				208,938	U
167	0605625A	Manned Ground Vehicle	05	378,400				378,400	U
168	0605766A	National Capabilities Integration (MIP)	05	7,835				7,835	U
169	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Ph	05	2,732				2,732	U
170	0605830A	Aviation Ground Support Equipment	05	1,664				1,664	U
171	0210609A	Paladin Integrated Management (PIM)	05						U
172	0303032A	TROJAN - RH12	05	3,936				3,936	U
173	0303267A	Auctioned Spectrum Relocation Fund	05						U
174	0304270A	Electronic Warfare Development	05	19,675		3,200	3,200	22,875	U
175	1205117A	Tractor Bears	05						U
		System Development & Demonstration		3,549,431		111,917	111,917	3,661,348	
176	0604256A	Threat Simulator Development	06	14,117				14,117	U
177	0604258A	Target Systems Development	06	8,327				8,327	U

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178	0604759A	Major T&E Investment	06	113,516	82,893		82,893	U
179	0605103A	Rand Arroyo Center	06	19,336	19,796		19,796	U
180	0605301A	Army Kwajalein Atoll	06	234,010	246,275		246,275	U
181	0605326A	Concepts Experimentation Program	06	28,701	30,394		30,394	U
182	0605502A	Small Business Innovative Research	06	284,080				U
183	0605601A	Army Test Ranges and Facilities	06	313,589	315,634		315,634	U
184	0605602A	Army Technical Test Instrumentation and Targets	06	57,395	84,805		84,805	U
185	0605604A	Survivability/Lethality Analysis	06	41,296	40,480		40,480	U
186	0605606A	Aircraft Certification	06	4,612	3,936		3,936	U
187	0605702A	Meteorological Support to RDT&E Activities	06	7,070	9,759		9,759	U
188	0605706A	Materiel Systems Analysis	06	21,694	21,223		21,223	U
189	0605709A	Exploitation of Foreign Items	06	12,684	13,026		13,026	U
190	0605712A	Support of Operational Testing	06	50,723	52,705		52,705	U
191	0605716A	Army Evaluation Center	06	56,003	57,039		57,039	U
192	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	1,756	2,798		2,798	U
193	0605801A	Programwide Activities	06	54,383	60,921		60,921	U
194	0605803A	Technical Information Activities	06	39,613	29,024		29,024	U
195	0605805A	Munitions Standardization, Effectiveness and Safety	06	65,709	72,279		72,279	U

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178	0604759A	Major T&E Investment	06	136,565				136,565	U
179	0605103A	Rand Arroyo Center	06	13,113				13,113	U
180	0605301A	Army Kwajalein Atoll	06	238,691				238,691	U
181	0605326A	Concepts Experimentation Program	06	42,922				42,922	U
182	0605502A	Small Business Innovative Research	06						U
183	0605601A	Army Test Ranges and Facilities	06	334,468				334,468	U
184	0605602A	Army Technical Test Instrumentation and Targets	06	46,974				46,974	U
185	0605604A	Survivability/Lethality Analysis	06	35,075				35,075	U
186	0605606A	Aircraft Certification	06	3,461				3,461	U
187	0605702A	Meteorological Support to RDT&E Activities	06	6,233				6,233	U
188	0605706A	Materiel Systems Analysis	06	21,342				21,342	U
189	0605709A	Exploitation of Foreign Items	06	11,168				11,168	U
190	0605712A	Support of Operational Testing	06	52,723				52,723	U
191	0605716A	Army Evaluation Center	06	60,815				60,815	U
192	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	2,527				2,527	U
193	0605801A	Programwide Activities	06	58,175				58,175	U
194	0605803A	Technical Information Activities	06	25,060				25,060	U
195	0605805A	Munitions Standardization, Effectiveness and Safety	06	44,458				44,458	U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
196	0605857A	Environmental Quality Technology Mgmt Support	06	4,883	3,211		3,211	U
197	0605898A	Army Direct Report Headquarters - R&D - MHA	06	54,177	54,130		54,130	U
198	0606001A	Military Ground-Based CREW Technology	06	7,600	4,890		4,890	U
199	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06	59,042	62,940		62,940	U
200	0606003A	CounterIntel and Human Intel Modernization	06		2,636		2,636	U
201	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06		88,300		88,300	U
202	0303260A	Defense Military Deception Initiative	06	1,708				U
203	0909999A	Financing for Cancelled Account Adjustments	06	654				U
	RDT&E	Management Support		1,579,102	1,438,536		1,438,536	
204	0603778A	MLRS Product Improvement Program	07	10,286	6,877		6,877	U
205	0603813A	TRACTOR PULL	07	4,014	4,067		4,067	U
206	0605024A	Anti-Tamper Technology Support	07	4,009	7,251		7,251	U
207	0607131A	Weapons and Munitions Product Improvement Programs	07	16,302	16,003	2,548	18,551	U
208	0607133A	TRACTOR SMOKE	07	12,143	4,577	7,780	12,357	U
209	0607134A	Long Range Precision Fires (LRPF)	07	80,690	159,278		159,278	U
210	0607135A	Apache Product Improvement Program	07	55,565	24,019		24,019	U

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196	0605857A	Environmental Quality Technology Mgmt Support	06	4,681				4,681	U
197	0605898A	Army Direct Report Headquarters - R&D - MHA	06	53,820				53,820	U
198	0606001A	Military Ground-Based CREW Technology	06	4,291				4,291	U
199	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06	62,069				62,069	U
200	0606003A	CounterIntel and Human Intel Modernization	06	1,050		1,875	1,875	2,925	U
201	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06	4,500				4,500	U
202	0303260A	Defense Military Deception Initiative	06						U
203	0909999A	Financing for Cancelled Account Adjustments	06						U
	RDT&E	Management Support		1,286,625		1,875	1,875	1,288,500	
204	0603778A	MLRS Product Improvement Program	07	22,877				22,877	U
205	0603813A	TRACTOR PULL	07						U
206	0605024A	Anti-Tamper Technology Support	07	8,491				8,491	U
207	0607131A	Weapons and Munitions Product Improvement Programs	07	15,645				15,645	U
208	0607133A	TRACTOR SMOKE	07						U
209	0607134A	Long Range Precision Fires (LRPF)	07	164,182				164,182	U
210	0607135A	Apache Product Improvement Program	07						U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
211	0607136A	Blackhawk Product Improvement Program	07	48,241	35,196		35,196	U
212	0607137A	Chinook Product Improvement Program	07	155,433	144,722		144,722	U
213	0607138A	Fixed Wing Product Improvement Program	07	7,782	2,280		2,280	U
214	0607139A	Improved Turbine Engine Program	07	167,532	188,903		188,903	U
215	0607140A	Emerging Technologies from NIE	07	26,112				U
216	0607142A	Aviation Rocket System Product Improvement and Development	07	9,662	38,452		38,452	U
217	0607143A	Unmanned Aircraft System Universal Products	07	36,926	38,331		38,331	U
218	0607145A	Apache Future Development	07					U
219	0607312A	Army Operational Systems Development	07					U
220	0607665A	Family of Biometrics	07	3,032	2,397		2,397	U
221	0607865A	Patriot Product Improvement	07	77,391	75,288		75,288	U
222	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	32,256	30,915		30,915	U
223	0203735A	Combat Vehicle Improvement Programs	07	293,921	336,063		336,063	U
224	0203740A	Maneuver Control System	07	6,443				U
225	0203743A	155mm Self-Propelled Howitzer Improvements	07	39,154	37,155		37,155	U
226	0203744A	Aircraft Modifications/Product Improvement Programs	07	34,228	17,684		17,684	U

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
211	0607136A	Blackhawk Product Improvement Program	07	13,039				13,039	U
212	0607137A	Chinook Product Improvement Program	07	174,371				174,371	U
213	0607138A	Fixed Wing Product Improvement Program	07	4,545				4,545	U
214	0607139A	Improved Turbine Engine Program	07	206,434				206,434	U
215	0607140A	Emerging Technologies from NIE	07						U
216	0607142A	Aviation Rocket System Product Improvement and Development	07	24,221				24,221	U
217	0607143A	Unmanned Aircraft System Universal Products	07	32,016				32,016	U
218	0607145A	Apache Future Development	07	5,448				5,448	U
219	0607312A	Army Operational Systems Development	07	49,526				49,526	U
220	0607665A	Family of Biometrics	07	1,702				1,702	U
221	0607865A	Patriot Product Improvement	07	96,430				96,430	U
222	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	47,398				47,398	U
223	0203735A	Combat Vehicle Improvement Programs	07	334,463				334,463	U
224	0203740A	Maneuver Control System	07						U
225	0203743A	155mm Self-Propelled Howitzer Improvements	07	214,246				214,246	U
226	0203744A	Aircraft Modifications/Product Improvement Programs	07	16,486				16,486	U

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Line No	Program Element Number	Item	Act	FY 2018 (Base + OCO)	FY 2019 Base Enacted	FY 2019 OCO Enacted	FY 2019 Total Enacted	Sec
227	0203752A	Aircraft Engine Component Improvement Program	07	139	146		146	U
228	0203758A	Digitization	07	4,611	6,308		6,308	U
229	0203801A	Missile/Air Defense Product Improvement Program	07	43,615	1,641	2,000	3,641	U
230	0203802A	Other Missile Product Improvement Programs	07	4,800	4,941		4,941	U
231	0203808A	TRACTOR CARD	07	37,883	34,050		34,050	U
232	0205402A	Integrated Base Defense - Operational System Dev	07			8,000	8,000	U
233	0205410A	Materials Handling Equipment	07	1,519	1,462		1,462	U
234	0205412A	Environmental Quality Technology - Operational System Dev	07	187	249		249	U
235	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	69,558	77,188		77,188	U
236	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	93,900	118,955		118,955	U
238	0303028A	Security and Intelligence Activities	07	35,652	12,277	23,199	35,476	U
239	0303140A	Information Systems Security Program	07	108,755	42,520		42,520	U
240	0303141A	Global Combat Support System	07	45,372	53,855		53,855	U
241	0303150A	WWMCCS/Global Command and Control System	07	10,055	2,031		2,031	U
244	0305172A	Combined Advanced Applications	07	1,100	1,500		1,500	U
245	0305179A	Integrated Broadcast Service (IBS)	07		450		450	U

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227	0203752A	Aircraft Engine Component Improvement Program	07	144				144	U
228	0203758A	Digitization	07	5,270				5,270	U
229	0203801A	Missile/Air Defense Product Improvement Program	07	1,287				1,287	U
230	0203802A	Other Missile Product Improvement Programs	07						U
231	0203808A	TRACTOR CARD	07						U
232	0205402A	Integrated Base Defense - Operational System Dev	07						U
233	0205410A	Materials Handling Equipment	07						U
234	0205412A	Environmental Quality Technology - Operational System Dev	07	732				732	U
235	0205456A	Lower Tier Air and Missile Defense (AMD) System	07	107,746				107,746	U
236	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	138,594				138,594	U
238	0303028A	Security and Intelligence Activities	07	13,845		22,904	22,904	36,749	U
239	0303140A	Information Systems Security Program	07	29,185				29,185	U
240	0303141A	Global Combat Support System	07	68,976				68,976	U
241	0303150A	WWMCCS/Global Command and Control System	07	2,073				2,073	U
244	0305172A	Combined Advanced Applications	07						U
245	0305179A	Integrated Broadcast Service (IBS)	07	459				459	U

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246	0305204A	Tactical Unmanned Aerial Vehicles	07	16,925	6,000		6,000	U
247	0305206A	Airborne Reconnaissance Systems	07	20,080	12,416	14,000	26,416	U
248	0305208A	Distributed Common Ground/Surface Systems	07	24,700	27,109		27,109	U
249	0305219A	MQ-1C Gray Eagle UAS	07	10,531				U
250	0305232A	RQ-11 UAV	07	12,691	6,180		6,180	U
251	0305233A	RQ-7 UAV	07	12,773	17,863		17,863	U
252	0307665A	Biometrics Enabled Intelligence	07	8,573	4,310	2,214	6,524	U
253	0708045A	End Item Industrial Preparedness Activities	07	118,410	108,696		108,696	U
254	1203142A	SATCOM Ground Environment (SPACE)	07	9,945	12,105		12,105	U
255	1208053A	Joint Tactical Ground System	07	10,228	7,400		7,400	U
9999	9999999999	Classified Programs		7,154	5,955		5,955	U
		Operational Systems Development		1,830,278	1,735,065	59,741	1,794,806	
		Total Research, Development, Test & Eval, Army		11,633,461	11,074,556	300,604	11,375,160	

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Line No	Program Element Number	Item	Act	FY 2020 Base	FY 2020 OCO for Base Requirements	FY 2020 OCO for Direct War and Enduring Costs	FY 2020 Total OCO	FY 2020 Total (Base + OCO)	Sec
246	0305204A	Tactical Unmanned Aerial Vehicles	07	5,097		34,100	34,100	39,197	U
247	0305206A	Airborne Reconnaissance Systems	07	11,177		14,000	14,000	25,177	U
248	0305208A	Distributed Common Ground/Surface Systems	07	38,121				38,121	U
249	0305219A	MQ-1C Gray Eagle UAS	07						U
250	0305232A	RQ-11 UAV	07	3,218				3,218	U
251	0305233A	RQ-7 UAV	07	7,817				7,817	U
252	0307665A	Biometrics Enabled Intelligence	07	2,000		2,214	2,214	4,214	U
253	0708045A	End Item Industrial Preparedness Activities	07	59,848				59,848	U
254	1203142A	SATCOM Ground Environment (SPACE)	07	34,169				34,169	U
255	1208053A	Joint Tactical Ground System	07	10,275				10,275	U
9999	9999999999	Classified Programs		7,273				7,273	U
		Operational Systems Development		1,978,826		73,218	73,218	2,052,044	
Total Research, Development, Test & Eval, Army				12,192,771		204,124	204,124	12,396,895	

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45	03	0603005A	Combat Vehicle and Automotive Advanced Technology	115
46	03	0603006A	Space Application Advanced Technology	137
47	03	0603007A	Manpower, Personnel and Training Advanced Technology	143
48	03	0603009A	TRACTOR HIKE	148
49	03	0603015A	Next Generation Training & Simulation Systems	151
50	03	0603117A	Army Advanced Technology Development	162
51	03	0603118A	Soldier Lethality Advanced Technology	163
52	03	0603119A	Ground Advanced Technology	202
53	03	0603125A	Combating Terrorism - Technology Development	216
54	03	0603130A	TRACTOR NAIL	224
55	03	0603131A	TRACTOR EGGS	225
56	03	0603270A	Electronic Warfare Technology	226

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58	03	0603322A	TRACTOR CAGE	253
59	03	0603457A	C3I Cyber Advanced Development	254
60	03	0603461A	High Performance Computing Modernization Program	266
61	03	0603462A	Next Generation Combat Vehicle Advanced Technology	276
62	03	0603463A	Network C3I Advanced Technology	330
63	03	0603464A	Long Range Precision Fires Advanced Technology	389
64	03	0603465A	Future Vertical Lift Advanced Technology	409
65	03	0603466A	Air and Missile Defense Advanced Technology	447
66	03	0603606A	Landmine Warfare and Barrier Advanced Technology	457
67	03	0603607A	Joint Service Small Arms Program	464
68	03	0603710A	Night Vision Advanced Technology	470
69	03	0603728A	Environmental Quality Technology Demonstrations	481
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Aviation Advanced Technology	0603003A	43	03	82
C3 Advanced Technology	0603794A	72	03	518
C3I Cyber Advanced Development	0603457A	59	03	254
Combat Vehicle and Automotive Advanced Technology	0603005A	45	03	115
Combating Terrorism - Technology Development	0603125A	53	03	216
Electronic Warfare Technology	0603270A	56	03	226
Environmental Quality Technology Demonstrations	0603728A	69	03	481
Future Vertical Lift Advanced Technology	0603465A	64	03	409
Ground Advanced Technology	0603119A	52	03	202
High Performance Computing Modernization Program	0603461A	60	03	266
Joint Service Small Arms Program	0603607A	67	03	464
Landmine Warfare and Barrier Advanced Technology	0603606A	66	03	457
Long Range Precision Fires Advanced Technology	0603464A	63	03	389
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Military Engineering Advanced Technology	0603734A	70	03	493
Missile and Rocket Advanced Technology	0603313A	57	03	238
Network C3I Advanced Technology	0603463A	62	03	330
Next Generation Combat Vehicle Advanced Technology	0603462A	61	03	276
Next Generation Training & Simulation Systems	0603015A	49	03	151
Night Vision Advanced Technology	0603710A	68	03	470
Soldier Lethality Advanced Technology	0603118A	51	03	163
Space Application Advanced Technology	0603006A	46	03	137
TRACTOR CAGE	0603322A	58	03	253
TRACTOR EGGS	0603131A	55	03	225
TRACTOR HIKE	0603009A	48	03	148
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Weapons and Munitions Advanced Technology	0603004A	44	03	96

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	53.763	41.795	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	95.558
242: *Airdrop Equipment*	-	5.480	1.629	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.109
543: *Ammunition Logistics*	-	4.248	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.248
C07: *Joint Service Combat Feeding Tech Demo*	-	2.155	1.219	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.374
FF6: *Individual Protection*	-	6.098	11.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.698
J50: *Future Warrior Technology Integration*	-	23.976	22.089	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.065
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	8.500	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.000
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	3.306	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.306
XW6: *Small Unit Expeditionary Maneuver*	-	0.000	2.758	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.758

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PE:
* 0603118A Soldier Lethality Advanced Technology

A. Mission Description and Budget Item Justification

In FY 2020 this PE is being eliminated, with continuity of effort realigned to PE 0603118A (Soldier Lethality Advanced Technology) as part of the United States (U.S.) Army's Science and Technology portfolio financial restructure. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

This PE provides Soldiers and Small Combat Units with the most effective personal clothing, equipment, combat rations, shelters, and logistical support items with the least weight and sustainment burden. This PE supports the maturation and demonstration of technologies associated with aerial delivery of personnel and cargo, rapid ammunition/munitions deployability and resupply, combat rations and combat feeding equipment, combat clothing and personal equipment (including protective equipment such as personal armor, helmets, and eyewear), and expeditionary base camps with an emphasis on emerging operating environments and missions that require expeditionary maneuver. The Projects focus on the challenge of integrating clothing and individual equipment on the Soldier to effectively bridge the gap between humans, technology, and equipment design. The Projects in this PE adhere to Tri-Service Agreements on clothing, textiles, and food with coordination provided

through the Cross-Service Warfighter Equipment Board, the Soldier as a System Integrated Concepts Development Team, and the Department of Defense (DoD) Combat Feeding Research and Engineering Board.

Work in this PE is related to, and fully coordinated with, PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603015A (Next Generation Training and Simulation Systems), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), PE 0603710A (Night Vision Advanced Technology), PE 0602784A (Military Engineering Technology), PE 0603734A (Military Engineering Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	44.863	39.338	38.238	-	38.238
Current President's Budget	53.763	41.795	0.000	-	0.000
Total Adjustments	8.900	2.457	-38.238	-	-38.238
• Congressional General Reductions	-0.033	-0.043			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	8.500	2.500			
• Congressional Directed Transfers	-	-			
• Reprogrammings	2.000	-			
• SBIR/STTR Transfer	-1.567	-			
• Adjustments to Budget Years	-	-	-38.238	-	-38.238

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Maneuver Support*	6.000	-
Congressional Add: *Non-Centroidal Helmets*	2.500	2.500
Congressional Add Subtotals for Project: J52	8.500	2.500
Congressional Add Totals for all Projects	8.500	2.500

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603001A *I Warfighter Advanced Technology*

Change Summary Explanation

In FY18, congressional adds for Maneuver support ($6.000 million) and Non-centroidal helmets for warfighters ($2.500 million).
In FY20, PE is eliminated due to Science and Technology (S&T) portfolio financial restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) 242 / *Airdrop Equipment*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
242: *Airdrop Equipment*	-	5.480	1.629	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.109

Note

In Fiscal Year (FY) 2020 this Project is realigned to:
PE 0603118A Soldier Lethality Advanced Technology, Projects:
* BE5 Personnel & Airdrop Safety Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates equipment and innovative techniques for precision aerial delivery of cargo and personnel. Aerial delivery is a key capability for rapid force projection and global precision delivery. These efforts are designed to advance state of the art precision delivery technologies such as parachutes, guidance, navigation, and control (GNC) components and subsystems, tracking sensors, software algorithms, and safety rigging which integrate with currently equipped aircraft, unmanned aerial systems (UAS), and advanced rotary wing aircraft. These efforts provide the Warfighter with highly accurate, timely cargo/payload delivery and resupply in all terrain and weather conditions. Precision delivery/resupply reduces vulnerability of ground Soldiers, aircraft, and aircrew. Precision aerial delivery supports remote warfare with activities such as placement of battlefield sensors, reduction of Soldier load, and initial delivery of key expeditionary base camp assets. Demonstrated technologies transition to Product Manager (PM) Force Sustainment Systems (PM FSS), PM-Soldier Clothing and Individual Equipment (PM SCIE) as well as other Army PMs.

Work in this Project is fully coordinated with Program Element (PE) 0602786A (Warfighter Technology) and supports Anti-Access/Area Denial (A2/AD) and manned-unmanned teaming (MUM-T) operational concepts by demonstrating precision aerial delivery and airdrop from non-traditional platforms.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Airdrop/Aerial Delivery	5.480	1.597	-
Description: This effort matures and demonstrates parachute materials and designs, precision guidance and navigation software and hardware, and tracking sensors and safety devices to increase the accuracy of delivering cargo to remote locations and/or complex terrains. This effort also provides technologies that increase safety during personnel insertions into theaters of operation. This work further evolves breakthroughs from PE 0602786A (Warfighter Technology) / Project 283 (Airdrop Adv Tech) and is coordinated with PE 0602786A (Warfighter Technology) / Project VT4 (Expeditionary Mobile Base Camp Technology). This effort supports capability demonstrations for the Army Top Challenge of easing overburdened Soldiers in small units through the use of			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 242 / *Airdrop Equipment*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
tactical aerial resupply technologies, and supporting A2/AD and MUM-T operational concepts by demonstrating airdrop from non-traditional platforms. ***FY 2019 Plans:*** Demonstrate precision aerial delivery software and hardware components in a GPS denied/degraded environment as well as in Dense, Urban, Complex Terrain. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort will be funded in PE 0603118 (Soldier Lethality Advanced Technology) / Project BE4 (Personnel & Airdrop Safety Advanced Technology) for FY 2020 as part of the financial restructure.			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.032	-
Accomplishments/Planned Programs Subtotals	5.480	1.629	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) 543 / *Ammunition Logistics*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
543: *Ammunition Logistics*	-	4.248	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.248

Note

This Project was completed in FY 2018.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for rapidly deploying and resupplying munitions while also improving the return of unused ammunition from deployment. This effort contributes to force readiness and reduction in the logistics footprint through improvements in Materials Handling Equipment (MHE), ammunition, and lethality packaging/palletization, explosives safety, weapons re-arm, and asset throughput/management.

Efforts in this Project support the Army Science and Technology Lethality and Ground Maneuver Portfolios. Work in this Project is related to, and fully coordinated with Program Element (PE) 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0602601A (Combat Vehicle and Automotive Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Automated Supply Point-Scalable	4.248	-	-
Description: This effort demonstrates globally responsive supply point operations capable of meeting predictive demand through automated cargo identification, handling, and movement technologies. This effort completes in FY 2018.			
Accomplishments/Planned Programs Subtotals	4.248	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** 543 / *Ammunition Logistics*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) C07 / *Joint Service Combat Feeding Tech Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
C07: *Joint Service Combat Feeding Tech Demo*	-	2.155	1.219	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.374

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603118A Soldier Lethality Advanced Technology, Project:
* BE2 Joint Service Combat Feeding Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for military combat feeding systems and combat rations. Areas of emphasis include: enhanced nutrient composition to maximize cognitive and physical performance on the battlefield; cutting edge food stabilization and preservation techniques that increase the variety and quality of rations used by the Joint Services; novel ration packaging solutions to minimize degradation of combat rations during storage; field portable biosensors for food-borne pathogen detection and identification as well as predictive modeling tools to protect the Warfighter from food-borne illnesses. This Project demonstrates combat feeding equipment with reduced logistics (in component parts, weight, volume, fuel, and water) and labor requirements, while improving the quality of food service. The Project, a Department of Defense (DoD) program for which the Army has Executive Agent responsibility, provides technology development for Joint Service Combat Feeding. The DoD Combat Feeding Research and Engineering Board provides oversight for this project. Demonstrated field feeding equipment is transitioned to Product Manager Force Sustainment Systems (PM FSS), Product Manager Combat Support Equipment (PM CSE), Naval Sea Systems Command (NAVSEA)/Naval Supply Systems Command (NAVSUP), and/or United States Air Force Basic Expeditionary Airfield Resources (BEAR) Program Office. Demonstrated ration technologies are transitioned to the Combat Feeding Directorate for Advanced Component Development & Prototypes under Program Element (PE) 0603747A (Soldier Support and Survivability).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project complements and is fully coordinated with PE 0602787A (Medical Technology) and PE 0602786A (Warfighter Technology).

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Joint Service Combat Feeding Technical Demonstration	2.155	1.219	-
Description: This effort matures and demonstrates novel nutritional biochemistry, food processing, and packaging technologies to enhance nutrition, improve food stabilization, and optimize ration packaging to support Warfighter physical and cognitive performance on the battlefield. This effort will demonstrate technologies in support of the Defense Health Agency Veterinary Services (DHA VS) to improve field detection and identification capabilities of chemical and biological threats in foods. This effort provides new threat detection tools and sensors for food inspectors. This effort also demonstrates equipment and energy			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** C07 / *Joint Service Combat Feeding Tech Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
technologies to expand the capability and reduce the logistics footprint of field feeding systems. This work further evolves breakthroughs from PE 0602786A (Warfighter Technology) / Project H99 (Joint Service Combat Feeding Technology) and is coordinated with PE 0602787A (Medical Technology) / Project 869 (Warfighter Health Prot & Perf Stnds). ***FY 2019 Plans:*** Mature and demonstrate ration components to improve readiness, performance and recovery from strenuous exercise to prevent energy deficits that negatively impact mission outcomes; validate food pathogen enrichment methods to identify food pathogens prior to consumption; demonstrate prototype refrigeration technologies to reduce the use of conventional refrigerants. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort is realigned to PE 0603118A (Soldier Lethality Advanced Technology) / Project BE2 (Joint Service Combat Feeding Advanced Technology)			
Accomplishments/Planned Programs Subtotals	2.155	1.219	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) FF6 / *Individual Protection*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
FF6: *Individual Protection*	-	6.098	11.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.698

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603118A (Soldier Lethality Advanced Technology), Projects:
* AY9 Body Armor & Integrated Headborne Advanced Technology
* AZ6 Soldier Signature Management Advanced Technology
* AZ8 Soldier - Small Unit Detectability Advanced Technology
* BB3 Dismounted Soldier Survivability Equip/Tech Integration

A. Mission Description and Budget Item Justification

This Project matures, demonstrates, and integrates Soldier protective clothing and equipment required to enhance Soldier survivability from multiple battlefield threats, impact unit readiness, and potentially debilitate Soldiers. Threats are characterized as combat threats (e.g. flame and thermal, blast and ballistic, multispectral sensors, and laser threats), environmental threats (e.g. cold, heat, wet, vector, water contamination, concealment, antimicrobial, etc.), and Soldier system components and system limitations (e.g. size, weight, and bulk). This effort includes the demonstration and validation of integrated technologies, novel subsystems/systems, and test methods related to the development of personnel armor, helmets, hearing protection, eyewear, uniforms, hand-wear, footwear, and other clothing and individual equipment items. Efforts apply human systems integration principles and practices to protective equipment designs to advance the understanding of trade-offs between protection, lethality and mobility.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 realignments to this Project are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier/Small Unit Multi-Threat Protection	6.098	3.775	-
Description: This effort focuses on maturing and demonstrating multifunctional protective component materials, sub-systems, protection technologies, and test methodologies that have the potential to significantly increase protection afforded by Soldier clothing and individual protective equipment. This effort also focuses on the maturation and demonstration of ballistic, blast, and integrated protection technologies that support tradeoff optimization in component design. Work includes small arms and fragmentation protection, flame and thermal, environmental, and multispectral concealment capabilities as well as novel hydration and water purification technologies for the individual Soldier. This work is fully coordinated with PE 0602786A (Warfighter Technology) / Project H98 (Clothing & Equipm Tech), PE 0602716A (Human Factors Engineering Technology) / Project H70			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** FF6 / *Individual Protection*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
(Human Fact Eng Sys Dev), and PE 0602705A (Electronics and Electronic Devices) / Project H94 (Elec & Electronic Dev). Demonstrated technologies transition to various Program Executive Office (PEO) Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2019 Plans:*** Demonstrate an optimized material solution specifically designed to maximize Soldier protection in austere and extreme cold environments to enable Soldiers to operate effectively for extended mission durations and reduce traumatic injury induced by extreme cold climates; optimize materiel solutions for thermal signature management that reduces the probability of Soldier detection in response to the increase of sensors and Soldier-borne technologies; optimize and demonstrate performance of advanced textile printing capabilities at the component level that can impart multiple functionalities (signature management, vector protection, flame resistance, etc.) in a single, more cost-effective process and more durable capability; advance insect vector repellent testing capabilities in order to assess vector protection material performance at the system level quantify operational effectiveness to mitigate transmission of infectious diseases; develop novel scientific-based test methods to correlate material, system and Soldier performance to inform future requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, Project FF6 will be funded in PE 0603118A Soldier Lethality Advanced Technology, Projects: * AY9 Body Armor & Integrated Headborne Advanced Tech, * AZ8 (Soldier - Small Unit Detectability Adv Technology) * BB3 (Dismounted Soldier Survivability Equip/Tech Integ)			
Title: Soldier Ballistic and Blast Protection ***Description:*** This effort focuses on maturing and demonstrating ballistic and blast personal protection capabilities worn by the individual Soldier and validating advanced test methods of personal protective equipment against small arms, fragmentation and blast threats. These developmental efforts focus on the objective of significantly increase the survivability afforded by Soldier individual protective equipment by increasing sub-system and system material performance against intended threats, reduce sub-system and system weight and inform future requirements linking threat lethality to Soldier survivability. This work is fully coordinated with PE 0602786A (Warfighter Technology) / Project H98 (Clothing & Equipm Tech), PE 0602716A (Human Factors Engineering Technology) / Project H70 (Human Fact Eng Sys Dev), and PE 0602705A (Electronics and Electronic Devices) / Project H94 (Elec & Electronic Dev). Demonstrated technologies transition to various PEO Soldier Product Managers. This effort supports Force Protection capability demonstrations for Soldiers and Small Units. ***FY 2019 Plans:*** Optimize and mature helmet forming processes, material layups, and architectures to manufacture helmets with state of the art, high performance polyethylene materials to demonstrate ballistic performance improvements in prototype helmets designed for	-	7.400	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** FF6 / *Individual Protection*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
small arms threats; exploit ballistic fiber, tape and sheet goods materials in helmet processing techniques to control material layup to reduce inefficiencies in standard processing and exploit gains in ballistic protection and weight reduction; continue the development of an innovative ballistic helmet test methodology to improve behind-helmet blunt trauma measurement capabilities and correlate data with head/brain injury to inform future survivability requirements for protective helmets; develop helmet and torso non-destructive safety evaluation technology to produce a capability that will assess personal protective equipment efficacy; optimize and mature head-borne shock tube test methodology as a means to improve blast-over pressure profiles that can be correlated to operational blast environment conditions; integrate hearing protection into eyewear platforms to enhance individual Soldier hearing protection and maximize operational situational awareness in head-borne protection platforms; exploit existing and emerging ballistic resistant materials in new system designs and architectures against emerging small arms threats to define near term performance trade space. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, Project FF6 will be funded in PE 0603118A Soldier Lethality Advanced Technology, Projects: * AY9 Body Armor & Integrated Headborne Advanced Tech, * AZ8 (Soldier - Small Unit Detectability Adv Technology) * BB3 (Dismounted Soldier Survivability Equip/Tech Integ)			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.425	-
Accomplishments/Planned Programs Subtotals	6.098	11.600	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*				Project (Number/Name) J50 / *Future Warrior Technology Integration*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
J50: *Future Warrior Technology Integration*	-	23.976	22.089	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.065

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603118A Soldier Lethality Advanced Technology, Projects:
* BB6 Physical Augmentation: Advanced Technology for Field Demo
* BB8 Soldier Centric Advanced Technology
* BC1 Human Performance Advanced Technology for Mobility & Lethality
* BD7 Soldier Sys Interfaces/Integration-Sensor Advanced Technology
* BD9 Soldier & Sm Unit Tactical Energy Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, demonstrates, and integrates lightweight and multifunctional materials and components to provide the Soldier and small units with the most effective protection and mobility systems. This Project also invests in understanding the trade-offs of integrating state-of-the-art technology with Soldiers' personal protection, electronics connectivity, power and energy, user interfaces and display content, and other mission specific equipment that seeks to reduce physical weight, cognitive burden, and sustainment needs of the small unit. This Project develops, matures, and maintains a Soldier Systems Engineering Architecture (SSEA) framework that represents human factors consideration in development of major Army platforms. Efforts in this Project focus on integrating and demonstrating system-level personal protection, durable Soldier protective clothing and individual equipment, environmental threats, and power management solutions. In addition, special focus is on understanding and demonstrating the impacts of physical and cognitive load on Soldier mission performance by implementing strategies to reduce load and/or optimize loads to reduce injuries, and the creation of user interfaces that mitigate the impact of increasing technologies and sensors worn and carried by Soldiers. These efforts integrate geographically dispersed laboratory environments to conduct comprehensive assessments and report the technical viability of Soldier system solutions and conducts field demonstrations to obtain relevant feedback for user acceptance and performance validation. This Project also matures and demonstrates mission command and power and energy technologies for the dismounted Soldier and small unit operating in a networked operating environment.

Efforts in this Project support the Under Secretary of Defense for Research and Engineering Science and Technology (S&T) priorities and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project complements and is fully coordinated with Program Element (PE) 0602786A (Warfighter Technology), PE 0602618A (Ballistics Technology), PE 0602105A (Materials Technology), PE 0602787A (Medical Technology), PE 0602716A (Human Factors Engineering Technology), PE 0602308A (Advanced Concepts and Simulation), PE 0603015A (Next Generation Training and Simulation Systems), PE 0602705A (Electronics and Electronic Devices), PE 0603710A (Night Vision Advanced Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), and PE 0603008A (Command, Control, Communications Adv Technology).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier Systems Engineering Architecture (SSEA)	14.000	-	-
Description: This effort pursues a mature and maintainable architecture for a biological (human) platform that utilizes a common Soldier, Equipment, Task (SET) framework at the system level. The architecture will provide a unifying performance construct that considers human dimension and equipment capability resulting in a desired tactical outcome by applying systems engineering processes, analytical tools, and models to assess the complex Soldier as a System and conduct system level trade-offs. This capability is used to assess new and emerging Soldier clothing and equipment components as well as configurations against established baselines using Human-in-the-Loop principles. This effort also matures and integrates associated foundational efforts including human performance assessment measures and evaluation devices required at various testing locations. This effort develops standardized methodologies required for demonstrations to provide operationally relevant assessments. This effort is coordinated with PE 0602716A (Human Factors Engineering Technology) / Project H70 (Human Fact Eng Sys Dev), PE 0602786A (Warfighter Technology) / Project H98 (Clothing & Equipm Tech), 0603015A (Next Generation Training & Simulation Systems) / Project S28 (Immersive Learning Environments), PE 0603710A (Night Vision Advanced Technology) / Project K70 (Night Vision Adv TecH), PE 0602308A (Advanced Concepts and Simulation) / Project C90 (Advanced Distributed Simulation), PE 0602787A (Medical Technology) / Project 869 (Warfighter Health Prot & Perf Stnds), and PE 0603004A (Weapons and Munitions Advanced Technology) / Project 232 (Advanced Lethality & Survivability Demo). This framework effort will end in FY 2018 and transition to human systems integrators for Soldier system development and design.			
Title: Soldier and Small Unit Mission Command/Situational Awareness (SA) and Power and Energy Integration	5.600	7.478	-
Description: This effort matures and demonstrates mission command and power and energy technologies for the dismounted Soldier and small unit. The goal is to fully support the situational awareness mission information tools and power needs of a dismounted mission in an electronically equipped battlefield. This effort is fully coordinated with PE 0602705A (Electronics and Electronic Devices) / Projects H11 (Tactical And Component Power Technology) and H94 (Elec & Electronic Dev), and PE 0603710A (Night Vision Advanced Technology) / Project K70 (Night Vision Adv Tech). ***FY 2019 Plans:*** Mature Soldier wearable power sources and energy harvesting components to reduce the overall weight of Soldier carried power equipment; characterize the power profile of Soldier-worn electronic component technologies within a Soldier system level configuration and against approved mission scenarios; demonstrate advanced Global Positioning System (GPS) denied navigation and environmental sensing algorithms for Soldier borne sensor platforms; mature and demonstrate highly mobile			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
expeditionary maneuver platform technology that includes signature management/decoy and high mobility mission command applications that enable on-demand resupply capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this Project is realigned to PE 0603118A Soldier Lethality Advanced Technology.			
Title: Soldier Interfaces ***Description:*** This effort matures and demonstrates low-cognitive workload user interfaces for display and control of dismounted Soldier mission command systems to enhance interactions of Soldiers and systems required to react effectively on the battlefield. Applies human systems engineering principles to develop design guidelines and techniques for integrating Soldiers and complex technical systems by assessing Soldier responses and capabilities in operational contexts. Matures and validates human performance metrics to design/assess systems and user interfaces to ensure that interactions between humans and machines provides effective operation and control to aid Soldier decision-making processes. Technologies, metrics, and tools developed in this effort will transition to PEO Product Managers and Training and Doctrine Command (TRADOC) and be integrated into the SSEA and Systems Integration Laboratory environment. In FY 2020 this Project is realigned to PE 0603118A Soldier Lethality Advanced Technology. ***FY 2019 Plans:*** Validate single joint (ankle) exoskeleton for reduced metabolic cost and demonstrate operational efficacy for utilization in loaded walking/running; mature single and/or multi-joint exo systems for enhanced mobility and endurance; mature exoskeleton technologies for Soldier tasks such as Logistics (e.g. low mobility lift assist technology) and Infantry (high mobility tactical maneuvering for dismount application); demonstrate Soldier/squad optimization utilizing novel technologies/platforms with validated measures/metrics of human performance by demonstrating the operational impact of decreasing metabolic cost with a device that assists propulsion during locomotion while carrying an external load; provide knowledge product with findings from study that examined tactical timelines for measures of human and operational performance at the small unit level to inform future system development aimed at optimizing Soldier performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this Project is realigned to PE 0603118A Soldier Lethality Advanced Technology.	4.376	6.680	-
Title: Soldier Sensors and Robotics Architectures ***Description:*** This effort builds and matures architectures that link dismounted Soldiers to air and ground robotics platforms. Enables small Soldiers-borne and operated autonomous systems that function as scouts, load carriers, resupply platforms, and/or communication nodes to enable greater reach and expeditionary dismounted maneuver. Applies complex Human Soldier	-	7.182	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** J50 / *Future Warrior Technology Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Integration principles to air and ground control and teleoperation for emerging robotic vehicles and sensors display content. Integrates reconnaissance and surveillance sensors and robotics with Nett Warrior system. Technologies, metrics, and tools developed in this effort will transition to PEO Product Managers and Training and Doctrine Command (TRADOC) and be integrated into the Soldier Systems architecture and Systems Integration Laboratory environment. ***FY 2019 Plans:*** Mature and demonstrate sensors and robotics architectures that enable dismounted linkages and ease of integration for existing and emerging ground and aerial robots; mature Soldier-organic data management and distribution technologies for integration into Soldier-borne electronic devices, sensors, and robotics; develop an integration architecture of sensors and robotics for the Nett Warrior system to increase situational awareness and stand-off protection; identify common sensors that convey alerts and summary data within a sensor configuration that synthesizes data from multiple sensors; increase image and sensing product quality and timeliness from small unit sensors and robotic platforms; identify commercial virtual environment software to assess Nett Warrior and sensor and robotic interfaces in a dynamic mission context. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this Project is realigned to PE 0603118A Soldier Lethality Advanced Technology.			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.749	-
Accomplishments/Planned Programs Subtotals	23.976	22.089	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) J52 / *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
J52: *WARFIGHTER ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	8.500	2.500	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.000

Note

In Fiscal Year (FY) 2018, congressional increase for program in the amount of $8.500 million
In Fiscal Year (FY) 2019, congressional increase for program in the amount of $2.500 million

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Warfighter Advanced Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Maneuver Support	6.000	-
FY 2018 Accomplishments: Maneuver Support		
Congressional Add: Non-Centroidal Helmets	2.500	2.500
FY 2018 Accomplishments: Non-Centroidal Helmets		
FY 2019 Plans: Non-Centroidal Helmets		
Congressional Adds Subtotals	8.500	2.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) VT5 / *Expeditionary Mobile Base Camp Demonstration*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
VT5: *Expeditionary Mobile Base Camp Demonstration*	-	3.306	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.306

Note

In FY 2019 this project is realigned to PE0603001 project:
* XW6 Small Unit Expeditionary Maneuver

A. Mission Description and Budget Item Justification

This Project matures and demonstrates mission-specific plug and play components, subsystems, and modules designed to optimize manpower requirements, improve situational awareness, increase Soldier readiness and survivability, improve habitation, reduce logistics footprint, enhance supportability, and reduce cost. Expeditionary Base Camp (EBC) systems (or remote command outposts) provide an operational capability for Small Combat Units (battalion and below) and Soldiers, which are rapidly deployable/re-locatable, require no Military Construction, and need limited materiel handing support. The need for this technologically enabled capability has arisen as a result of new tactics, techniques, and procedures used in austere, remote, and challenging environments in which stability operations, counterinsurgency operations, and peace keeping missions are conducted. The Army envisions continuing to conduct this full range of operations worldwide, particularly in the Asia Pacific and Middle East regions. This project integrates mature technologies to create mission specific lab demonstrators and assesses the performance capabilities using metrics and methodologies developed under Program Element (PE) 0602786A / Project VT4. Demonstrated EBC equipment is transitioned to Product Manager (PM) Force Sustainment Systems (PM FSS).

Work in this Project complements and is fully coordinated with PE 0602786A (Warfighter Technology), PE 0602105A (Materials Technology), PE 0602784A (Military Engineering Technology), PE 0603734A (Military Engineering Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology (S&T) priorities and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Expeditionary Base Camp (EBC) Technology Demonstrations	3.306	-	-
Description: This effort matures and demonstrates technologies required to plan, establish, operate, protect, sustain, and redeploy a holistic small unit base camp system and manage its power, waste, and water resources. This effort supports Basing Sustainment and Logistics capability demonstrations. This work further evolves breakthroughs from PE 0602786A/Project VT4,			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** VT5 / *Expeditionary Mobile Base Camp Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
PE 0602786A/Project H99 and is coordinated with PE0603001A / Project C07, PE0602105A / Project H84, PE 0602784A / Project T40, PE 0603734A / Project T08, PE 0603004A / Project L97, PE 0603005A / Project 497, PE 0603125A / Project DF5, and PE 0603772A / Project 101.			
Accomplishments/Planned Programs Subtotals	3.306	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603001A / *Warfighter Advanced Technology*	Project (Number/Name) XW6 / *Small Unit Expeditionary Maneuver*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
XW6: *Small Unit Expeditionary Maneuver*	-	0.000	2.758	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	2.758

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603118A Soldier Lethality Advanced Technology, Projects:
* BE5 Personnel & Airdrop Safety Advanced Technology

A. Mission Description and Budget Item Justification

This Project funds the maturation, validation and demonstration of innovative technologies which provide maneuver capabilities such as precision aerial delivery of cargo and personnel and expeditionary maneuver platforms to enable and enhance mission command and human performance in response to emerging operational environments that require expeditionary logistics for aggregated and disaggregated Soldiers and units. Technologies that allow dismounted units to move to positions of advantage rapidly, and then to operate for hours, days, weeks without resupply while sustaining a high tempo for periods of up to seven days. Efforts funded in this Project support all Military Services, the Special Operations Command, and the Defense Logistics Agency. Demonstrated technologies transition to a variety of partners, including Product Manager Force Sustainment Systems (PdM-FSS), Product Manager Combat Support Equipment (PM CSE), and/or Naval Sea Systems Command (NAVSEA)/Naval Supply Systems Command (NAVSUP).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Small Unit Expeditionary Maneuver	-	2.670	-
Description: This effort optimizes technologies that enable Soldier and Small Unit survivability, mission readiness and effectiveness during highly mobile, dispersed operations that may occur in the absence of conventional logistics support. This effort matures and demonstrates technologies that enhance equipment, materiel, and personnel aerial delivery in an Anti-Access/ Area Denial (A2/AD) environment; stabilization techniques and nutrient compositions to maximize the Warfighter?s physical and cognitive performance; and technologies to enhance field detection and identification capabilities of chemical and biological threats in foods.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603001A / *Warfighter Advanced Technology*	**Project (Number/Name)** XW6 / *Small Unit Expeditionary Maneuver*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Demonstrate and support the transition of advanced personnel airdrop safety technologies and cargo airdrop from non-traditional platforms in support of interoperability with manned-unmanned teaming (MUM-T) assets. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, this Project is being realigned to PE 0603118A Soldier Lethality Advanced Technology, Project BE5 Personnel & Airdrop Safety Advanced Technology			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.088	-
Accomplishments/Planned Programs Subtotals	-	2.758	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603002A *I Medical Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	103.908	101.442	42.030	-	42.030	47.041	50.706	52.191	51.045	0.000	448.363
810: *Ind Base Id Vacc&Drug*	-	17.476	16.774	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	34.250
814: *NEUROFIBROMATOSIS (CA)*	-	15.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.000
840: *Combat Injury Mgmt*	-	17.755	19.770	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	37.525
945: *BREAST CANCER STAMP PROCEEDS*	-	0.554	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.554
97T: *NEUROTOXIN EXPOSURE TREATMENT (CA)*	-	16.000	16.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	32.000
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	9.560	9.004	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.564
MG4: *Tech Base/Enabling Res in Mil Occup Med Adv Tech*	-	0.000	0.000	8.144	-	8.144	7.957	5.502	7.241	6.564	0.000	35.408
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.000
MM3: *Warfighter Medical Protection & Performance*	-	19.563	16.894	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	36.457
MM5: *Tech Base/Enabling Res Combat Cas Care Adv Tech*	-	0.000	0.000	2.408	-	2.408	2.795	3.249	3.651	6.914	0.000	19.017
MM7: *Enabling Med Cap to Support Dispersed OPS Adv Tech*	-	0.000	0.000	1.819	-	1.819	3.851	4.826	4.778	5.000	0.000	20.274
MM9: *Tech Base/Enabling Rsrch for Infect Dis Adv Tech*	-	0.000	0.000	2.976	-	2.976	2.979	4.376	7.607	7.488	0.000	25.426
MN3: *Immediate Cardiopulmonary Stabilization Adv Tech*	-	0.000	0.000	1.903	-	1.903	1.894	1.808	1.895	1.940	0.000	9.440

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*								
MN4: *Advanced Life Support Advanced Technology*	-	0.000	0.000	3.801	-	3.801	3.397	4.531	5.109	5.185	0.000	22.023
MN5: *Next Generation Blood Products Advanced Technology*	-	0.000	0.000	5.964	-	5.964	6.634	6.752	6.972	7.056	0.000	33.378
MN6: *Blast & Head Impact Exposure Monitor Advanced Tech*	-	0.000	0.000	1.412	-	1.412	1.412	1.412	0.000	0.000	0.000	4.236
MN7: *Musculoskeletal Injury Screening Tool Adv Tech*	-	0.000	0.000	0.300	-	0.300	0.300	0.300	0.300	0.297	0.000	1.497
MN8: *Drugs to Prevent and Treat Malaria Advanced Tech*	-	0.000	0.000	2.146	-	2.146	3.015	2.995	0.000	0.000	0.000	8.156
MN9: *Far Forward Behavioral Health Care Advanced Tech*	-	0.000	0.000	0.266	-	0.266	0.272	0.278	0.285	0.000	0.000	1.101
MO2: *Traumatic Brain Injury (TBI) Treatment Adv Tech*	-	0.000	0.000	4.285	-	4.285	4.406	4.387	4.083	0.797	0.000	17.958
MO3: *Military Occupational Fitness Standards Adv Tech*	-	0.000	0.000	0.250	-	0.250	0.300	0.300	0.150	0.000	0.000	1.000
MO4: *Burn Recovery Optimization Advanced Technology*	-	0.000	0.000	2.084	-	2.084	3.297	5.500	5.434	5.099	0.000	21.414
MO7: *Improved Bone Repair Advanced Technology*	-	0.000	0.000	1.539	-	1.539	1.369	1.230	1.303	1.344	0.000	6.785
MO8: *Expeditionary Performance Nutrition Advanced Techn*	-	0.000	0.000	0.200	-	0.200	0.429	0.511	0.520	0.476	0.000	2.136
MO9: *Vaccines to Prevent Dengue Fever Advanced Tech*	-	0.000	0.000	2.533	-	2.533	2.434	2.399	2.713	2.736	0.000	12.815
MP3: *Phys Chem Toxicity Assessment Sys Adv Tech**	-	0.000	0.000	0.000	-	0.000	0.300	0.350	0.150	0.149	0.000	0.949

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A *I Medical Advanced Technology*

Note

Project MM7 (Enabling Med Cap to Support Dispersed OPS Adv Tech) is a new start for Fiscal Year (FY) 2020.

As detailed in each Project-level R-2A exhibit, all other Projects in this Program Element (PE) either re-organize activities that were previously funded within this same PE or transition successful Applied Research from PE 0602787A (Medical Technology).

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates advanced medical technologies including drugs, vaccines, medical diagnostic devises, measures for identification and vector control, and developing medical practices and procedures to effectively protect and improve the survivability of United States Forces across the entire spectrum of military operations. Tri-Service coordination and cooperative efforts are focused in four principal medical areas: Combat Casualty Care, Military Operational Medicine, Militarily Relevant Infectious Diseases, and Clinical and Rehabilitative Medicine.

Promising medical technologies are refined and validated through extensive testing, which is conducted in compliance with Food and Drug Administration (FDA) regulations for human medical products, and EPA regulations for insect-control products that impact humans or the environment (e.g., repellents and insecticides). The FDA requires medical products to undergo extensive preclinical testing in animals and/or other models to obtain preliminary effectiveness and safety information before they can be tested in human clinical trials. Clinical trials are conducted stepwise: first to prove the product is safe in humans, second to demonstrate the desired effectiveness and optimal dosage (amount to be administered) in a small group human study, and third to demonstrate effectiveness in large, diverse human populations. Each successive phase includes larger numbers of human subjects and requires FDA cognizance prior to proceeding. Work conducted in this PE primarily focuses on late stages of technology maturation activities required to conduct safety and effectiveness clinical trials. Some high-risk technologies may require additional maturation with FDA guidance prior to initiating these clinical trials. Such things as proof of product stability and purity are necessary to meet FDA standards before entering later stages of testing and prior to transitioning into a formal acquisition program where large pivotal trials in diverse populations will be conducted for licensure. Activities in this PE may include completion of preclinical animal studies and small safety and effectiveness studies involving humans according to FDA and EPA requirements. Promising medical technologies that are not regulated by the FDA or EPA are modeled, prototyped, and tested in relevant environments.

Blast research and research into maturing field rations in this PE are fully coordinated with the US Army Natick Soldier Research, Development, and Engineering Center. This coordination enables improved body armor design and rations for Soldiers. Additionally, the activities funded in this PE are externally peer reviewed and fully coordinated with all Services as well as other agencies through the Joint Technology Coordinating Groups of the Armed Services Biomedical Research Evaluation and Management (ASBREM) Community of Interest (COI). The ASBREM COI, formed under the authority of the Assistant Secretary of Defense for Research and Engineering, serves to facilitate coordination and prevent unnecessary duplication of effort within the Department of Defense's biomedical research and development community, as well as its associated enabling research areas.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) Science and Technology (S&T) focus areas and the Army Modernization Strategy.

Work in this PE is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603002A *I Medical Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	67.780	62.496	59.386	-	59.386
Current President's Budget	103.908	101.442	42.030	-	42.030
Total Adjustments	36.128	38.946	-17.356	-	-17.356
• Congressional General Reductions	-0.040	-0.054			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	39.000	39.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.859	-			
• SBIR/STTR Transfer	-1.973	-			
• Adjustments to Budget Years	-	-	-17.356	-	-17.356

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 814: *NEUROFIBROMATOSIS (CA)*		
Congressional Add: *Peer-reviewed Neurofibromatosis Research*	15.000	15.000
Congressional Add Subtotals for Project: 814	15.000	15.000
Project: 97T: *NEUROTOXIN EXPOSURE TREATMENT (CA)*		
Congressional Add: *Peer-reviewed Neurotoxin Exposure Treatment Parkinson's Research*	16.000	16.000
Congressional Add Subtotals for Project: 97T	16.000	16.000
Project: MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *Peer-reviewed Military Burn Research Program*	8.000	8.000
Congressional Add Subtotals for Project: MM2	8.000	8.000
Congressional Add Totals for all Projects	39.000	39.000

Change Summary Explanation

FY18 congressional adds for Peer-reviewed neurotoxin exposure treatment Parkinson's research ($16.000 million), Peer-reviewed neurofibromatosis research ($15.000 million), and Peer-reviewed military burn research program ($8.000 million).
FY19 congressional adds for Peer-reviewed neurotoxin exposure treatment Parkinson's research ($16.000 million), Peer-reviewed neurofibromatosis research ($15.000 million), and Peer-reviewed military burn research program ($8.000 million).
FY20 decrease is due to a program reduction in support of Army Modernization Priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) 810 / *Ind Base Id Vacc&Drug*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
810: *Ind Base Id Vacc&Drug*	-	17.476	16.774	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	34.250

Note

In Fiscal Year (FY) 2020 this Project is being realigned to the following Projects within this Program Element (PE):
* MM9 Tech Base/Enabling Research for Infectious Diseases Advanced Technology
* MO1 Vaccines to Prevent Hantavirus Associated Disease Advanced Technology
* MN8 Drugs to Prevent and Treat Malaria Advanced Technology
* MO5 Vaccine to Prevent P. falciparum Malaria Advanced Technology
* MO6 Vaccines to Prevent Bacterial Diarrheal Diseases Advanced Technology
* MO9 Vaccines to Prevent Dengue fever Advanced Technology

A. Mission Description and Budget Item Justification

This Project maturates and demonstrates United States (U.S.) Food and Drug Administration (FDA)-regulated medical countermeasures such as drugs, vaccines, and diagnostic (identification of the nature and cause of a particular disease) systems to naturally occurring infectious diseases that are threats to deployed United States military forces. The focus of the Project is on prevention, diagnosis, and treatment of diseases that can adversely impact military mobilization, deployment, and operational effectiveness. Prior to licensure of a new drug or vaccine to treat or prevent disease, the FDA requires testing in human subjects. Studies are conducted stepwise: first to prove the product is safe in humans, second to demonstrate the desired effectiveness and optimal dosage (amount to be administered) in a small study, and third to demonstrate effectiveness in large, diverse human populations. All test results are submitted to the FDA for evaluation to ultimately obtain approval (licensure) for medical use. This Project supports the studies for safety and effectiveness testing on small study groups after which they transition to the next phase of development for completion of expanded safety and initial studies for effectiveness in larger populations. If success is achieved for a product in this Project, the effort will transition into Advanced Development. The Project also supports testing of personal protective measures that can reduce disease transmission from arthropods to include products such as repellents and insecticides, which are regulated by the Environmental Protection Agency (EPA).

Research conducted in this Project focuses on the following four areas:

(1) Prevention/Treatment of Parasitic (organism living in or on another organism) Diseases
(2) Bacterial Disease Threats (diseases caused by bacteria)
(3) Viral Disease Threats (diseases caused by viruses)
(4) Diagnostic Systems and Vector Identification and Control

Research is conducted in compliance with FDA regulations for medical products for human use and EPA regulations for insect-control products that impact humans or the environment (e.g., repellents and insecticides).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

Work is managed by the U.S. Army Medical Research and Materiel Command (USAMRMC) in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Promising medical countermeasures identified in this Project are further matured under PE 0603807A (Medical Systems - Adv Dev), Project 808 (DoD Drug & Vacc Ad).

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) Science and Technology (S&T) focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by USAMRMC at Fort Detrick, MD.

Efforts in this Project support the Soldier portfolio and the principal area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Technology Research on drugs and vaccines against parasitic diseases	6.813	6.404	-
Description: This effort selects promising anti-parasitic drug candidates for treating malaria and leishmaniasis for testing in humans, and prepares data packages required for FDA approval of testing in humans. Studies have shown that the malaria parasite can become resistant to existing drugs, which makes it necessary to continually develop new and more effective and safe treatments. This effort selects candidate vaccines for various types of malaria, including the severe form of malaria (Plasmodium falciparum) and the less severe but relapsing form (Plasmodium vivax), prepares technical data packages required for FDA approval of testing in humans, and conducts testing of promising malaria vaccine candidates in humans. A malaria vaccine would minimize the progression and impact of drug resistance and eliminate the need to take preventive anti-malarial drugs. ***FY 2019 Plans:*** Initiate safety and analytic studies to assess natural break-down of candidate drugs within the human body to improve drug safety and effectiveness for treatment and prevention of malaria for selected triazine lead compound. Complete laboratory clinical trials to assess performance of lead Plasmodium falciparum malaria vaccine candidates. These activities enable down-selection of a lead vaccine for transition to advanced development. Validate laboratory-based immune measures of protection and correlate with protective effectiveness among candidate vaccines undergoing clinical trials. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned within this PE to Projects MM9, MN8 and MO5			
Title: Bacterial Disease Threats	4.188	3.859	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort selects promising candidate vaccines against each of the three main bacterial causes of diarrhea (E. coli, Campylobacter, and Shigella) that pose significant threat during initial deployments, for testing in human subjects. Data packages are prepared, as required for FDA approval, and testing is conducted in human subjects. ***FY 2019 Plans:*** Continue to develop and advance multiple vaccine candidates for Shigella, ETEC and Campylobacter. Prepare data packages for the FDA to test suitable vaccine candidates in humans for safety and effectiveness. Test the vaccine candidates in human clinical trials for safety and effectiveness for Shigella, ETEC and Campylobacter. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned within this PE to Projects MM9 and MO6			
Title: Viral Disease Threats ***Description:*** This effort progresses the most promising vaccine candidates against dengue fever (a severe debilitating disease caused by a virus and transmitted by a mosquito) and hantavirus (severe viral infection that causes internal bleeding and is contracted from close contact with rodents), conducts FDA-required nonclinical safety and protection testing (laboratory- based) in animals, prepares FDA investigational new drug technical data packages, and conducts clinical testing of candidate vaccines in humans. ***FY 2019 Plans:*** Continue to evaluate safety and initial effectiveness of commercial partner dengue vaccine candidates undergoing testing in South East Asia and Latin America. Complete vaccine immunogenicity (ability to provoke an immune response) testing followed by dengue human infection model challenge and effectiveness testing of human subjects immunized with combination inactivated and weakened forms of virus vaccines. Engage commercial partner to pursue development of purified inactivated dengue virus vaccine alone or in combination with live attenuated product. Pursue an expanded Hemorrhagic Fever with Renal Syndrome DNA vaccine clinical trial in a country that has endemic HFRS cases. Test for safety and effectiveness of the HFRS DNA vaccine. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned within this PE to Projects MM9, MO1, and MO9	4.897	5.493	-
Title: Diagnostics and Disease Transmission Control ***Description:*** This effort conducts human subject testing of FDA-regulated field medical diagnostic devices and EPA-approved measures to control arthropod (i.e., insects, ticks & mites) -borne pathogens (infectious agents) that cause diseases such as Q fever, Sand fly fever, and Japanese encephalitis.	1.578	0.585	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 810 / *Ind Base Id Vacc&Drug*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Continue to improve data collection and characterization of arthropod vectors. Evaluate new dipsticks (pathogen detection lateral flow diagnostic devices). Continue to field test Ovitraps (mosquito detection/monitor device) and other vector control methods including repellants spatial devices. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** These research efforts end in FY 2019			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.433	-
Accomplishments/Planned Programs Subtotals	17.476	16.774	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) 814 / *NEUROFIBROMATOSIS (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
814: *NEUROFIBROMATOSIS (CA)*	-	15.000	15.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.000

Note

Congressional increase for Neurofibromatosis Research Program

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurofibromatosis research.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Peer-reviewed Neurofibromatosis Research	15.000	15.000
FY 2018 Accomplishments: Peer-reviewed Neurofibromatosis Research		
FY 2019 Plans: Peer-reviewed Neurofibromatosis Research		
Congressional Adds Subtotals	15.000	15.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) 840 / *Combat Injury Mgmt*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
840: *Combat Injury Mgmt*	-	17.755	19.770	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	37.525

Note

In Fiscal Year (FY) 2020 this Project is realigned to:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM5 Tech Base/Enabling Research for Combat Casualty Care Advanced Technology
* Project MN3 Immediate Cardiopulmonary Stabilization Advanced Technology
* Project MN4 Advanced Life Support Advanced Technology
* Project MN5 Next Generation Blood Products Advanced Technology
* Project MO2 Traumatic Brain Injury (TBI) Treatment Advanced Technology
* Project MO4 Burn Recovery Optimization Advanced Technology
* Project MO7 Improved Bone Repair Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, demonstrates, and validates promising medical technologies and new clinical practices for control of severe bleeding, treatment for traumatic brain injury (TBI), resuscitation and stabilization of trauma patients, acute treatment of extremity (arms and legs) and facial injuries, treatment of severe burn wounds, treatment of single and multiple organ failures due to trauma, and predictive indicators and decision aids for life support systems. Emphasis is placed on provision of prolonged field care when evacuation to theater hospitals is delayed.

Research conducted in this Project focuses on combat casualty care in the following four areas:

(1) Damage Control Resuscitation
(2) Combat Trauma Therapies
(3) Traumatic Brain Injury
(4) Combat Critical Care Engineering

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project 874, are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Damage Control Resuscitation	4.694	5.588	-
Description: This effort supports work required to validate safety and effectiveness of drugs and medical procedures to control or stop bleeding, maintain metabolism (the chemical processes that are required to maintain life) minimize harmful inflammation after major trauma preserving tissue function, and prevent or minimize secondary organ failure (including brain and spinal cord injury). ***FY 2019 Plans:*** Begin clinical trial to demonstrate safety of cold-stored platelets in human subjects. Evaluate stem cell safety and effectiveness in animal model of severe traumatic injury, bleeding, and inflammation. Assess current bleeding control products under prolonged care scenarios (i.e., when medical evacuation is delayed or prolonged). Perform preclinical studies to determine physiological effects of endovascular (refers to device that is directly introduced into a major blood vessel) bleeding control product use on subsequent fluid resuscitation effectiveness. Evaluate mechanical interventions for bleeding not controlled by application of pressure to determine best products and practices. Assess animal studies to determine effect of prolonged low blood pressure resuscitation on survival following definitive surgical repair and full resuscitation. Evaluate combinations of blood products and drugs to determine which optimally mitigate the effects of inflammation and prolonged ischemia (inadequate or absent blood supply) produced in critical tissues by traumatic bleeding. Continue evaluation of methods to refrigerate whole blood that do not impair platelet function. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned to the newly established 6.3 projects			
Title: Combat Trauma Therapies	5.997	5.116	-
Description: This effort focuses on work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from battlefield injuries. ***FY 2019 Plans:*** Assess path of healing in animal burn wounds and measure time to wound closure for various degrees of burn wounds. Continue retrospective analyses to identify clinical determinants of long-term disability in casualties with musculoskeletal injuries. Continue animal studies to determine optimal concentration of a commonly used antiseptic solution for initial wash-out of dismounted complex battlefield injuries. Continue studies in animals to evaluate effectiveness of products to combat wound infection, inflammation and scarring of delayed wound healing. ***FY 2019 to FY 2020 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
In FY 2020 funds have been realigned to the newly established 6.3 projects			
Title: Traumatic Brain Injury (TBI) ***Description:*** This effort supports work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from TBI. ***FY 2019 Plans:*** Validate novel biomarkers of TBI using human serum samples across the spectrum of TBI severity. Refine drugs and drug treatment protocols to optimize outcome during the subacute (first two to three weeks following injury) and chronic (one to three months following injury) TBI recovery time frames. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned to the newly established 6.3 projects	3.948	3.948	-
Title: Combat Critical Care Engineering ***Description:*** This effort supports development of diagnostic and therapeutic medical devices, algorithms, software, and data-processing systems for resuscitation, stabilization and life support, and development of improved critical care nursing practices. The aim is to improve care of severely injured or ill casualties during transport and in theater hospitals, and to develop and evaluate technologies to treat vital organ failure caused by traumatic injury. ***FY 2019 Plans:*** Conduct safety/effectiveness study of miniaturized extracorporeal life support system in trauma burn patients with lung injury. Conduct large animal studies of an automated type of endovascular balloon occlusion of the aorta (used for control of intra-abdominal bleeding) to determine its safety and ability to prevent organ failure. Create evidence-based competency assessment program for combat casualty care skills for all provider levels. Create centralized support system that includes best practice guidelines for evidence-based trauma management throughout continuum of care and supports telemedicine. Evaluate performance of life-saving intervention prediction algorithm in intensive care environment. Measure the performance of the Burn Resuscitation Decision Support System (a device that guides fluid resuscitation in patients with severe burns) technology in civilian burn centers. Develop a model to predict wound closure rate and time to full closure in burn patients. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned to the newly established 6.3 projects.	3.116	4.648	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:***	-	0.470	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** 840 / *Combat Injury Mgmt*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 SBIR / STTR Transfer			
FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	17.755	19.770	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) 945 / *BREAST CANCER STAMP PROCEEDS*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
945: *BREAST CANCER STAMP PROCEEDS*	-	0.554	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	0.554

A. Mission Description and Budget Item Justification

This Project receives funds as proceeds from the sale of Breast Cancer Stamps.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Breast Cancer Stamp Proceeds	0.554	-	-
Accomplishments/Planned Programs Subtotals	0.554	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) 97T / *NEUROTOXIN EXPOSURE TREATMENT (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
97T: *NEUROTOXIN EXPOSURE TREATMENT (CA)*	-	16.000	16.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	32.000

Note

Congressional increase for Peer-Reviewed Neurotoxin Exposure Treatment Parkinson's Research Program

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Neurotoxin Exposure Treatment.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Peer-reviewed Neurotoxin Exposure Treatment Parkinson's Research	16.000	16.000
FY 2018 Accomplishments: Peer-reviewed Neurotoxin Exposure Treatment Parkinson's Research		
FY 2019 Plans: Peer-reviewed Neurotoxin Exposure Treatment Parkinson's Research		
Congressional Adds Subtotals	16.000	16.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) ET5 / *Adv Tech Dev in Clinical & Rehabilitative Medicine*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
ET5: *Adv Tech Dev in Clinical & Rehabilitative Medicine*	-	9.560	9.004	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	18.564

Note

This Project ends in FY 2019.

A. Mission Description and Budget Item Justification

This Project supports basic research on experimental models that are developed to support in-depth trauma research studies. This Project includes studies to understand the healing of burned or traumatically injured tissues including eye, bone, nerve, skin, muscle, organs and composite tissues. Such efforts will minimize lost duty time and provide military medical capabilities for post-evacuation restorative and rehabilitative care.

Research conducted in this Project focuses on clinical and rehabilitative medicine.

Work in this Project complements and is fully coordinated with Program Element (PE) 0602787A (Medical Technology).

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Clinical and Rehabilitative Medicine	9.560	8.683	-
Description: This effort supports clinical studies to advance treatment and restoration strategies of traumatically-injured tissues, to include skin, nerve, bone and ocular (eye) tissue to ultimately restore function and appearance. Areas of interest for regenerative medicine include healing without scarring, repair of compartment syndrome (muscle and nerve damage following reduced blood flow caused by swelling), replacement skin, facial reconstruction and vision restoration.			
FY 2019 Plans: Conduct advanced pre-clinical trials to ensure the safety and effectiveness of an ocular bandage designed to rescue vision post-injury. Continue pre-clinical investigation of engineered skin substitutes for regeneration of functional skin without scarring. Conduct pre-clinical trials of devices for repairing traumatic injury to craniofacial and extremity tissues. Evaluate candidate biological therapies and drugs for reduced need of immunosuppressive (inhibition of the immune response) therapies following			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** ET5 / *Adv Tech Dev in Clinical & Rehabilitative Medicine*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
hand and face transplants. Down-select identified candidate technologies and biologics that create a wound environment more conducive to bone healing. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 funds have been realigned to the newly established 6.3 projects MN2 and MP4			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.321	-
Accomplishments/Planned Programs Subtotals	9.560	9.004	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MG4 / *Tech Base/Enabling Res in Mil Occup Med Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MG4: *Tech Base/Enabling Res in Mil Occup Med Adv Tech*	-	0.000	0.000	8.144	-	8.144	7.957	5.502	7.241	6.564	0.000	35.408

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

Medical efforts support laboratory studies and field demonstrations of biomedical products designed to counteract diverse environmental, physiological and psychological stressors, as well as reduce the impacts of hazards encountered in training and operational environments. Initiatives will demonstrate and transition medical technologies to support Soldier/squad survivability under demanding operational tempo in order to protect, optimize and enhance Soldier performance & sustain lethality across the diverse range of military operations.

The four main thrust areas are:
(1) Physiological Health,
(2) Environmental Protection,
(3) Injury Prevention and Reduction,
(4) Psychological (mental) Health and Resilience.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Injury Prevention & Reduction	-	-	0.866
Description: This effort supports and validates injury prediction tools and return-to-duty assessments for brain, spine, and chest injury from blast, blunt, and ballistic impact. These are all priorities for Program Executive Office (PEO)-Soldier and support various Maneuver Center of Excellence programs to include: Soldier Protection Systems (e.g. Integrated Head Protection Systems and Vital Toro Protection Systems). This effort also addresses need for validated aeromedical standards and strategies			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MG4 / *Tech Base/Enabling Res in Mil Occup Med Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
to enable aircrew to effectively fight, navigate, and land under a range of degraded visual environments and provide aeromedical return to duty guidelines after neurosensory injury (deficits in the nervous system control of vision, hearing, taste, smell, and touch). This supports Cross Functional Team (CFT): Future Vertical Lift. ***FY 2020 Plans:*** Will continue to validate musculoskeletal injury risk models and return-to-duty criteria from data collected from training and theater. Will continue to validate cervical spine injury risk (Head Supported Mass Criteria) criteria that will inform acquisition of new head mounted technologies the Army CFTs are pursuing. Will validate health hazard and medical requirements that will inform Army Aviation fitness for duty and Future Vertical Lift requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work transferred from other project due to S&T Financial Restructuring. In FY 2020, funding for Injury Prevention and Reduction decreased due to: 1) eliminated funding for Sensory Performance, Injury & Protection in order to accelerate new priority programs within MRMC; and 2) reduced funding for Blunt, Blast & Accelerative Injury.			
Title: Physiological Health & Performance ***Description:*** This effort supports and matures laboratory prototypes, evaluates nutritional formulations and interventions, and validates decision aids for the prediction of Soldier performance in high operational tempo military environments. ***FY 2020 Plans:*** Will evaluate impact of sleep on high operational tempo military performance. Will demonstrate the impact of sleep deprivation and caffeine on operationally relevant complex cognitive processes. Will validate time-restricted spectral analyses of standard polysomnography to predict future behavior and estimate previous sleep quality and quantity. Will evaluate low-current brain stimulation as a cognitive enhancer during periods of sleep loss. Will evaluate psychophysiological indicators of aviator flight performance under workload conditions. Will mature evidence-based algorithmic modelling of aircrew clinical risk. Will evaluate effects of refractive/corrective eye surgery and corneal aberration on contrast sensitivity and flight safety. Will validate dining satisfaction and quality surveys at military dining facilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring. In FY 2020, increased funding for Physiological Health & Performance is due to normal and planned progression of existing efforts in the high priority of program efforts in sleep, nutrition and human performance.	-	-	2.546
Title: Psychological Health & Resilience ***Description:*** This effort supports and validates neurocognitive (relating to or involving the central nervous system and cognitive abilities) assessment and brain injury detection methods, and validates tools and preclinical methods to treat post-traumatic	-	-	2.818

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MG4 / *Tech Base/Enabling Res in Mil Occup Med Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
stress disorder in a military population. This effort also supports validation of interventions in Warfighters for post-traumatic stress disorder (PTSD), validation of biomarkers of individual PTSD symptoms, validation of methods to follow effectiveness of PTSD treatments, validation of neuroprotective (protection of nerves and nervous system) interventions and validation of strategies to prevent neurocognitive deficits (reduced ability to learn and comprehend) and symptomatology associated with brain injury. This effort matures and validates early interventions to prevent and reduce military stressor and combat-related behavioral health problems, including symptoms of post-traumatic stress disorder (PTSD), depression, anger problems, anxiety, substance abuse, suicide, and other health risk behaviors. This effort matures and validates tools and interventions to enhance and sustain psychological resilience throughout Soldiers' careers. ***FY 2020 Plans:*** Will deliver a decision-making support tool to guide management of suicide-related events in garrison. Will conduct suicide prevention studies to evaluate effectiveness of Internet-delivered brief interventions to improve Service member mental health during transition periods. Will conduct studies to validate easy-to-use evidence-based interventions to improve behavioral health in units by leveraging individual, team and leader-specific behaviors at platoon and company levels. Will evaluate optimally tailored resilience training paradigm incorporating different resiliency readiness profiles matched to tailored resilience training. Will conduct studies to validate cognitive bias modification tools to improve behavioral health and performance. Will conduct clinical field trial of a repurposed FDA approved drug for treating sleep problems in a deployed setting. Will deliver biologically based biomarkers for onset of stress disorders and for resilience to stress disorders. Will fund clinical trials evaluating effectiveness of provider tool-kit for behavioral health return to duty (RTD) decision making and clinical trials for brief far-forward interventions for behavioral health problems and accompanying provider training in their use. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring. In FY 2020, reduced funding for Psychological Health and Resilience is due to reduced funding for Psychiatry & Clinical Psychology Disorders due to realignment of funds away from USACEHR Systems Biology for PTSD to new high priority programs within MRMC.			
Title: Environmental Health & Protection ***Description:*** This effort supports and maturates non-invasive technologies, decision-aid tools, and models to enhance Soldier protection and sustainment across the operational spectrum. The aim is to provide the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimized physical and cognitive performance during cold-weather and hot-humid operations. This effort tests a computational algorithm for identifying latent hepatic, renal, and cardiac injury after toxic metal and/or toxic industrial chemical exposure during training and operations. This effort tests models to predict likelihood of neurologic and/or physical injury as a result of hazardous exposure(s) in the operational environment.	-	-	1.914

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MG4 / *Tech Base/Enabling Res in Mil Occup Med Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2020 Plans: Will provide validated tools that sustain lethality and optimize performance to prevent injuries related to multi-environmental stressors. Will provide a capability to improve performance and thermal comfort in hot environments using cooling technology with skin temperature feedback control. Will provide a capability to increase finger and toe temperatures to improve manual dexterity and performance in cold weather operations. Will provide a capability a measure of cognitive fatigue due to sustained, effortful cognitive activity (workload) from exposure to stress and environmental extremes. Will provide accurate signal detection of toxic environmental hazards and physiological algorithms to detect degraded performance post-chemical exposure. Will provide a capability for mission planning and the documenting of toxic chemical or hazardous material exposures. Will provide risk management criteria for Commanders/leaders to make decisions in real-time regarding the severity of the exposure and the likelihood of clinical manifestation of a toxic exposure. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring. In FY 2020 funding decreased due to movement of some of the funds from Operational Exposure Dosimetry for Neurological and Physical Health.			
Accomplishments/Planned Programs Subtotals	-	-	8.144

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MM2 / *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MM2: *MEDICAL ADVANCE TECHNOLOGY INITIATIVES (CA)*	-	8.000	8.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.000

Note

Congressional increase for Peer-reviewed military burn research.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Medical Advanced Technology Initiatives.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Peer-reviewed Military Burn Research Program	8.000	8.000
FY 2018 Accomplishments: Peer-reviewed Military Burn Research Program		
FY 2019 Plans: Peer-reviewed Military Burn Research Program		
Congressional Adds Subtotals	8.000	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MM3 / *Warfighter Medical Protection & Performance*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MM3: *Warfighter Medical Protection & Performance*	-	19.563	16.894	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	36.457

Note

In Fiscal Year (FY) 2020 this Project was realigned to:
Program Element (PE) 0603002A Medical Advanced Technology, Projects:

* MG4 Tech Base/Enabling Research In Military Occupational Medicine Advanced Technology
* MN6 Blast & Head Impact Exposure Monitor Advanced Technology
* MN7 Musculoskeletal Injury Screening Tool Advanced Technology
* MN9 Far Forward Behavioral Health Care Advanced Technology
* MO3 Military Occupational Fitness Standards Advanced Technology
* MO8 Expeditionary Performance Nutrition Advanced Technology

A. Mission Description and Budget Item Justification

This Project supports the medical and survivability technology areas of the future force with laboratory validation studies and field demonstrations of biomedical products designed to protect, sustain, and enhance Soldier performance in the face of myriad environmental and physiological (human physical and biochemical functions) stressors and materiel hazards encountered in training and operational environments. This effort focuses on demonstrating and transitioning technologies as well as validated tools associated with biomechanical-based health risks, injury assessment and prediction, Soldier survivability, and performance during continuous operations.

The four main thrust areas are:
(1) Physiological Health,
(2) Environmental Protection,
(3) Injury Prevention and Reduction
(4) Psychological (mental) Health and Resilience.

This Project contains no duplication with any effort within the Military Departments and includes direct participation by other Services. The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Physiological (human physical and biochemical functions) Health and Environmental Protection (Sleep Research/ Environmental Monitoring) ***Description:*** This effort supports and matures laboratory prototypes, nutritional interventions, and decision aids for the validation of physiological status and prediction of Soldier performance in extreme environments. This effort supports Capability Demonstration 1.b, Force Protection--Warfighter and Small Unit in FY 2014-2016 and also supports capability demonstrations in the area of decreasing Warfighter physical burden in FY 2014-2016. Starting in FY 2019 this effort moves to Physiological Health.	7.083	-	-
Title: Physiological Health ***Description:*** This effort supports and matures laboratory prototypes, nutritional formulations and interventions, and decision aids for the validation of physiological status and prediction of Soldier performance in extreme environments. ***FY 2019 Plans:*** Evaluate interventions to mitigate sleep loss and fatigue and improve individual and team performance in operational settings, including multi-domain battle scenarios. Demonstrate effectiveness of transcranial electrical stimulation of the prefrontal cortex for enhancing learning through the consolidation of emotional memories. Evaluate the utility and effectiveness of transcranial direct current electrical stimulation technologies as neurocognitive interventions for the enhancement of the recuperative sleep and the development of operationally relevant sleep strategies. Validate dietary interventions for promoting satisfaction and healthy eating in dining facilities to ensure optimal health and performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 funds were realigned to new projects MG4, and MO8	-	2.602	-
Title: Environmental Health and Protection - Physiological (human physical and biochemical functions) Awareness Tools and Warrior Sustainment in Extreme Environments. ***Description:*** This effort supports and maturates non-invasive technologies, decision-aid tools, and models to enhance Warfighter protection and sustainment across the operational spectrum. This effort provides the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimize physical and cognitive performance during cold-weather and hot-humid operations. Starting in FY 2019 this effort is combined into Environmental and Protection.	2.822	-	-
Title: Environmental Health & Protection ***Description:*** This effort supports and maturates non-invasive technologies, decision-aid tools, and models to enhance Soldier protection and sustainment across the operational spectrum. The aim is to provide the scientific basis for developing focused heating and cooling solutions to maintain fine motor dexterity, core temperature, and optimized physical and cognitive performance during cold-weather and hot-humid operations. This effort tests a computational algorithm for identifying latent	-	5.588	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
hepatic, renal, and cardiac injury after toxic metal and/or toxic industrial chemical exposure during training and operations. This effort tests models to predict likelihood of neurologic and/or physical injury as a result of hazardous exposure(s) in the operational environment. ***FY 2019 Plans:*** Provide evidence-based practice recommendations for protecting health and performance against combined environmental threats. Develop enhanced next generation of predictive algorithms for incorporation into wearable sensor systems. Transition the Cold Weather Ensemble Decision Aid (CWEDA) to PEO Soldier and US Army Alaska, for assessing and comparing different clothing ensembles for predicting cold weather endurance. Validate prototype focused heating capability to improve manual dexterity for individuals in cold weather operations. Transition prototypes such as the Heat Strain Decision Application (HSDApp) to JPEO-Chemical Biological Defense, PEO Soldier, and Army Public Health Center. Evaluate modeling paradigms which identify population subgroups at increased risk of military operational exposure-related health responses. Develop and enhance a next generation of health, readiness and performance predictive algorithms for incorporation into wearable sensors systems. Validate assessment technologies/tools for physical and/or neurological health outcomes in operational environments. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 funds were realigned to new project MG4			
Title: Injury Prevention and Reduction	5.168	5.058	-
Description: This effort supports and validates injury prediction tools and return-to-duty assessments for brain, spine, and chest injury from blast, blunt, and ballistic impact. This effort also addresses need for validated aeromedical standards and strategies to enable aircrew to effectively fight, navigate, and land under a range of degraded visual environments and provide aeromedical return to duty guidelines after neurosensory injury (deficits in the nervous system control of vision, hearing, taste, smell, and touch). ***FY 2019 Plans:*** Use human head impact/blast and clinical diagnosis of mild traumatic brain injuries (mTBIs) within the training environment (e.g., airborne operations, combatives) to improve and validate mTBI prediction algorithms that can be used for the development of improved head protection systems. Validate musculoskeletal injury risk models with data collected from training and theatre. Determine cervical spine injury risk (Head Supported Mass Criteria) leveraging methods used by personal protective equipment developers to measure impact of clothing and equipment such as the Army's Load Effects Assessment Program (LEAP). Evaluate and extend current auditory injury risk models to include auditory nerve damage and begin to evaluate with advanced animal models. Improve current guidance using results from computational models and animal studies for protective eyewear against			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
blast threats that will inform the Authorized Protective Eyewear List (APEL). Validate medical requirements that will inform Army Aviation fitness for duty requirements ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 funds were realigned to new projects MG4, MN7, MO3, and MN6			
Title: Psychological Health and Resilience ***Description:*** This effort supports and validates neurocognitive (relating to or involving the central nervous system and cognitive abilities) assessment and brain injury detection methods, and validates tools and preclinical methods to treat post-traumatic stress disorder in a military population. This effort also supports validation of interventions in Warfighters for post-traumatic stress disorder (PTSD), validation of biomarkers of individual PTSD symptoms, validation of methods to follow effectiveness of PTSD treatments, validation of neuroprotective (protection of nerves and nervous system) interventions and validation of strategies to prevent neurocognitive deficits (reduced ability to learn and comprehend) and symptomatology associated with brain injury. ***FY 2019 Plans:*** Refine the Unit Behavioral Health Needs Assessment tool with metrics from combat operations, non-combat operations, and garrison. Evaluate an evidence-based, team-level intervention that positively influences Soldier outcomes related to behavioral health, resilience, and unit readiness through the regulation of small-team dynamics (e.g., group effect). Evaluate effectiveness of experimental compounds for PTSD symptom alleviation. Continue characterizations of PTSD subtyping and collection of treatment associated blood specimens for development of precision medicine approaches to PTSD treatment. Transition assessment tools to providers to augment return-to-duty decisions. Transition to behavioral health providers a web-based model for dissemination of research findings addressing evidence-based PTSD treatments. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 funds were realigned to new projects MG4 and MN9	3.536	3.201	-
Title: Health Research ***Description:*** This effort develops and validates novel tools and strategies to advance individualized operational exposure dosimetry (measures of exposure) and establish dose-response links between operational exposures and neurological and physical health. Dosimetry tools may include new technologies, human biomarkers objective physiologic markers, physiological modeling, and validated algorithms to evaluate the health effects of military service, including deployments, and methods to detect a Warfighters exposure to environmental contamination and/or toxic substances, e.g. toxic industrial chemicals. Starting in FY 2019 this effort is combined into Environmental Health & Protection.	0.954	-	-
Title: FY 2019 SBIR / STTR Transfer	-	0.445	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM3 / *Warfighter Medical Protection & Performance*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	19.563	16.894	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MM5 / *Tech Base/Enabling Res Combat Cas Care Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MM5: *Tech Base/Enabling Res Combat Cas Care Adv Tech*	-	0.000	0.000	2.408	-	2.408	2.795	3.249	3.651	6.914	0.000	19.017

Note

In Fiscal Year (FY) 2020, this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt.

A. Mission Description and Budget Item Justification

Preclinical and early clinical development, demonstration, and transition of new combat casualty care technologies that save lives and minimize permanent injury following combat-related traumatic injuries. Focus is identifying more effective critical care technologies and clinical practice guidelines to treat severe bleeding, traumatic brain injury, burns and other combat related traumatic injuries.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through applied research conducted under PE 0602787A, Project 874, are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Combat Trauma Therapies	-	-	1.060
Description: This effort focuses on work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from battlefield injuries.			
FY 2020 Plans: Will continue studies in animals to evaluate effectiveness of products to combat wound infection, inflammation and scarring of delayed wound healing.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM5 / *Tech Base/Enabling Res Combat Cas Care Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Funds for ongoing work were realigned from Project 840 / Combat Trauma Therapies			
Title: Pre-Hospital Tactical Combat Casualty Care ***Description:*** This effort supports demonstration and validation of materiel and knowledge products to advance the level of care that can be provided given the tactical, environmental, and patient factors inherent in the prehospital combat setting. Successful translation of research to the field will augment combat medic capabilities, thereby reducing death and serious injury in the battlefield space where the majority of preventable casualty deaths occur. ***FY 2020 Plans:*** Will begin clinical testing of an automated system for assessing injury severity. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Combat Critical Care Engineering	-	-	0.484
Title: Traumatic Brain Injury ***Description:*** This effort supports work required to validate safety and effectiveness of drugs, biologics, and medical procedures intended to minimize immediate and long-term effects from TBI. ***FY 2020 Plans:*** Will evaluate alternative therapies that promote brain-remodeling and restoration of function following severe TBI. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Traumatic Brain Injury (TBI)	-	-	0.864
Accomplishments/Planned Programs Subtotals	-	-	2.408

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MM7 / *Enabling Med Cap to Support Dispersed OPS Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MM7: *Enabling Med Cap to Support Dispersed OPS Adv Tech*	-	0.000	0.000	1.819	-	1.819	3.851	4.826	4.778	5.000	0.000	20.274

Note

This Project is a new start in Fiscal Year (FY) 2020.

A. Mission Description and Budget Item Justification

This Project is a new start for FY 2020 designed to mature Applied Research first developed in PE 0602787A (Medical Technology) / Project XV5 (Medical Capabilities to Support Dispersed Ops).

The aim of this Project is to develop a data-driven, intelligent and autonomous combat evacuation medical capability by maturing relevant artificial intelligence (AI) and machine learning algorithms and processes. These efforts will support initial and sustained integrated theater health care and trauma care delivery in future dispersed operations characterized by delayed evacuation, prolonged care, and reduced/denied communications. AI and machine learning technologies developed in this Project aim to reduce military combat casualties by enabling autonomous evacuation utilizing future Army Unmanned Aerial System (UAS) and ground platforms. Pursuant to these aims, this Project will research and design a tele-monitored and remote-controlled medical module to support medical resupply and casualty evacuation. The medical module will be developed to be self-contained, providing a "roll-on, roll-off" medical capability to future multi-purpose UAS and ground platforms.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy.

Work in this Project is performed by: the United States (U.S.) Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Combat Evacuation Mission Module	-	-	1.819
Description: Research, design and develop a tele-monitored and remote-controlled Combat Evacuation Mission Module to support medical resupply and casualty evacuation using future multi-purpose vertical takeoff and landing (VTOL) Unmanned Aerial Systems (UAS). Provides a self-contained medical module capability adaptable to various future multi-purpose VTOL UAS.			
FY 2020 Plans: Will complete vehicle flight instrumentation of the first generation Combat Evacuation Mission Module prototype for calibration and check out in preparation for flight testing. Will complete flight test plans, procure test components, and prepare the Medical Module for transport to the flight test facility.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM7 / *Enabling Med Cap to Support Dispersed OPS Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will construct a full-sized mock-up of the second generation Combat Evacuation Mission Module, based on current Objective vehicle UAS design, using rapid-prototyping capabilities to begin the determination of equipment configurations, placements, implementations, and interface requirements. Will medically-equip the mock-up second generation Mission Module using conceptual representations/ prototypes of emerging systems for remotely operated, or semi-autonomous/closed-loop patient monitoring, diagnostic, and intervention that would either support an attending medic during en route care or provide a remote en route care capability if there is no medic available to attend during transport. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** New start for FY 2020 to mature 0602787A / XV5 efforts developed in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	1.819

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MM9 / *Tech Base/Enabling Rsrch for Infect Dis Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MM9: *Tech Base/Enabling Rsrch for Infect Dis Adv Tech*	-	0.000	0.000	2.976	-	2.976	2.979	4.376	7.607	7.488	0.000	25.426

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 810 Ind Base Id Vacc & Drug

A. Mission Description and Budget Item Justification

Technology development, demonstration, and transition of FDA-regulated medical countermeasures such as drugs and vaccines to naturally-occurring infectious diseases of military importance, as identified by worldwide medical surveillance and capability needs assessments.

Research is conducted in compliance with FDA regulations for medical products for human use.

Work is managed by the United States Army Medical Research and Materiel Command (USAMRMC) in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Promising medical countermeasures identified in this Project are further matured under Program Element 0603807A, Project 808.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

Efforts in this Project support the Soldier portfolio and the principal area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Technology Research on drugs and vaccines against parasitic diseases	-	-	1.408
Description: Test lead drug candidates in healthy volunteers to determine drug pharmacology, safety, and effectiveness against malaria. Transition the lead anti-malarial drug with improved safety, effectiveness and less frequent dosing to advanced			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM9 / *Tech Base/Enabling Rsrch for Infect Dis Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
development. Perform small studies in healthy volunteers to test vaccine safety, effectiveness and immunogenicity against malaria with down-selection and transition of the vaccines to advanced development. ***FY 2020 Plans:*** Will initiate safety and analytic studies to assess natural break-down of candidate drugs within the human body to improve drug safety and effectiveness for treatment and prevention of malaria for selected triazine lead compound. Will complete clinical trials to assess performance of lead Plasmodium falciparum malaria vaccine candidates. These activities enable down- selection of a lead vaccine for transition to advanced development. Will validate laboratory-based immune measures of protection and correlate with protective effectiveness among candidate vaccines undergoing clinical trials. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work transferred from other project due to S&T Financial Restructuring.			
Title: Viral Disease Threats ***Description:*** Perform small studies in healthy volunteers to test vaccine safety, effectiveness, and immunogenicity against Dengue and Hantaviruses infections so as to down-select and transition lead vaccine candidates to advanced development. ***FY 2020 Plans:*** Will continue to evaluate safety and initial effectiveness of commercial partner dengue vaccine candidates undergoing testing in Southeast Asia and Latin America. Will continue to complete vaccine immunogenicity (ability to provoke an immune response) testing followed by dengue human infection model challenge and effectiveness testing of human subjects immunized with combination inactivated and weakened forms of virus vaccines. Will continue to engage commercial partner to pursue development of purified inactivated dengue virus in combination with live attenuated product. Will continue to pursue an expanded Hemorrhagic Fever with Renal Syndrome (HFRS) DNA vaccine clinical trial in a country/region that has endemic HFRS cases. Will continue to test for safety and effectiveness of the HFRS DNA vaccine. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work transferred from other project due to S&T Financial Restructuring.	-	-	1.568
Accomplishments/Planned Programs Subtotals	-	-	2.976

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MM9 / *Tech Base/Enabling Rsrch for Infect Dis Adv Tech*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MN3 / *Immediate Cardiopulmonary Stabilization Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MN3: *Immediate Cardiopulmonary Stabilization Adv Tech*	-	0.000	0.000	1.903	-	1.903	1.894	1.808	1.895	1.940	0.000	9.440

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers development, pre-clinical and early-clinical demonstration, and transition of technologies for hemorrhage control and airway management. These technologies facilitate autonomous intubation and airway management in combat casualties with obstructed airways. This Project also covers advanced technologies for use in forward areas to control non-compressible torso hemorrhage, and demonstration of pain-relieving drugs that are safe for use during bleeding.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Device Product Candidates for Immediate Cardiopulmonary Stabilization	-	-	1.903
Description: Development, preclinical and early-clinical demonstration, and transition of technologies that facilitate autonomous intubation and airway management in combat casualties with obstructed airways, as well as advanced hemostatic bandage candidates that augment the patient's blood clotting system and new tourniquet technologies suitable for prolonged use.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN3 / *Immediate Cardiopulmonary Stabilization Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will conduct preclinical and early clinical evaluation of devices indicated for use to facilitate autonomous intubation and airway management in combat casualties with obstructed airways, advanced hemostatic dressings that are effective independent of the patient's blood clotting system, as well as new tourniquet technologies having prolonged effectiveness. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Combat Trauma Therapies			
Accomplishments/Planned Programs Subtotals	-	-	1.903

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MN4 / *Advanced Life Support Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MN4: *Advanced Life Support Advanced Technology*	-	0.000	0.000	3.801	-	3.801	3.397	4.531	5.109	5.185	0.000	22.023

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers development, demonstration, and transition of technologies that enable advanced life support under prolonged field care scenarios, including: life-support devices that provide lung and kidney functions in casualties with severe injuries; and devices and clinical guidelines for the prevention of irreversible organ damage resulting from prolonged lack of blood circulation.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Technology Product Demonstration for Advanced Life Support	-	-	3.801
Description: Development, demonstration, and transition of technologies that enable advanced life support under prolonged field care scenarios: life-support devices that provide lung and kidney functions in casualties with severe injuries; devices and clinical guidelines for the prevention of irreversible organ damage resulting from prolonged lack of blood circulation.			
FY 2020 Plans: Will demonstrate devices indicated for use to control oxygen and carbon dioxide exchange in casualties with acute lung injury, and/or to deliver blood purification in critically injured/ill casualties with acute kidney injury. Will demonstrate improved means to control bleeding within the chest and abdomen through use of a specialized catheter that maintains normal blood pressure			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN4 / *Advanced Life Support Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
within the brain, heart and lungs and minimizes lack of blood flow to other organs and lower body until definitive surgical care is available. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from PE 0603002A Project 840 (Combat Injury Mgt) - Task #4/Prolonged Field Care			
Accomplishments/Planned Programs Subtotals	-	-	3.801

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MN5 / *Next Generation Blood Products Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MN5: *Next Generation Blood Products Advanced Technology*	-	0.000	0.000	5.964	-	5.964	6.634	6.752	6.972	7.056	0.000	33.378

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers technology development, pre-clinical and early-clinical demonstration, and transition of new blood products with increased shelf life and functionality. Cold-stored platelets, fibrinogen replacement technologies, and pharmaceuticals that protect and metabolically stabilize blood-deprived tissues will improve prompt hemorrhage control, mitigate effects of shock, and minimize sustainment requirements.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation Biopharmaceutical Product Candidates for Hemostasis	-	-	5.964
Description: Technology development, pre-clinical and early-clinical demonstration, and transition of new blood products with increased shelf life and functionality. Cold-stored platelets and fibrinogen replacement technologies will improve prompt hemorrhage control and minimize sustainment requirements.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN5 / *Next Generation Blood Products Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate preclinical and early clinical technologies to optimize shelf life and functionality of cold stored platelets, and pharmacologic replacement of fibrinogen to assist early hemorrhage control. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Damage Control Resuscitation			
Accomplishments/Planned Programs Subtotals	-	-	5.964

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MN6 / *Blast & Head Impact Exposure Monitor Advanced Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MN6: *Blast & Head Impact Exposure Monitor Advanced Tech*	-	0.000	0.000	1.412	-	1.412	1.412	1.412	0.000	0.000	0.000	4.236

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

This effort will develop a prototype predictive tool that can provide the unit leader an indication of whether a potential mild traumatic brain injury event has occurred. This capability will provide the unit leader an additional objective tool to determine whether a Soldier can be safely be exposed to more impacts without increased risk of injury.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Blast & Head Impact Exposure Monitor	-	-	1.412
Description: This effort will develop a prototype predictive tool that can provide the unit leader an indication of whether a potential mild traumatic brain injury event has occurred. This capability will provide the unit leader an additional objective tool to determine whether a Soldier can be safely exposed to more impacts without increased risk of injury.			
FY 2020 Plans: Will support the Environmental Sensors in Training (ESiT) program. Will support additional sites for data collection in high risk exposure communities: blast (heavy weapons training, breaching) and head impact (airborne).			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN6 / *Blast & Head Impact Exposure Monitor Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Ongoing work realigned from other project due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	1.412

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MN7 / *Musculoskeletal Injury Screening Tool Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MN7: *Musculoskeletal Injury Screening Tool Adv Tech*	-	0.000	0.000	0.300	-	0.300	0.300	0.300	0.300	0.297	0.000	1.497

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

This capability will deliver a prototype unit leader tool that can assess the integrity of musculoskeletal tissue and provide an objective risk assessment for fitness for return to duty.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Musculoskeletal Injury Screening Tool	-	-	0.300
Description: This capability will deliver a prototype unit leader tool that can provide an objective assessment of musculoskeletal tissue integrity and provide fitness or return-to-duty recommendations. ***FY 2020 Plans:*** Will develop objective medical assessments of Return-to-Duty. Will support data collection in support of Training and Doctrine Command ? Center for Initial Military Training (TRADOC-CIMT)-led effort. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	0.300

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN7 / *Musculoskeletal Injury Screening Tool Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MN8 / *Drugs to Prevent and Treat Malaria Advanced Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MN8: *Drugs to Prevent and Treat Malaria Advanced Tech*	-	0.000	0.000	2.146	-	2.146	3.015	2.995	0.000	0.000	0.000	8.156

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 810 Ind Base Id Vacc & Drug

A. Mission Description and Budget Item Justification

This Project covers technology development, demonstration, and transition of a candidate malaria prevention drug with weekly or less frequent dosing. The candidate drug may also be effective for the treatment of P. falciparum and P. vivax malaria. Infectious disease prevention sustains individual and unit readiness and reduces health services requirements and cost. Research is conducted in compliance with FDA regulations for medical products for human use.

Work is managed by the United States (U.S.) Army Medical Research and Materiel Command (USAMRMC) in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Promising medical countermeasures identified in this Project are further matured under PE 0603807A, Project 808.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

Efforts in this Project support the Soldier portfolio and the principal area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Drugs to Prevent and Treat Malaria Advanced Technology	-	-	2.146
Description: Test drugs in healthy volunteers to determine drug pharmacology, safety, and effectiveness against malaria. Transition current lead anti-malarial prophylactic drug (triazine) with improved safety, effectiveness, and requiring less frequent dosing to PM Pharm in support of future FDA licensure.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN8 / *Drugs to Prevent and Treat Malaria Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will complete clinical trial study data analysis then identify a single lead for use in humans. Will optimize lead formulation and test safety and toxicity in animals. Will initiate activities to perform a clinical trial in a small number of healthy human volunteers to test drug safety and effectiveness against P. falciparum malaria using controlled human malaria infection. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned to this project from Advanced Technology Research on drugs and vaccines against parasitic diseases			
Accomplishments/Planned Programs Subtotals	-	-	2.146

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MN9 / *Far Forward Behavioral Health Care Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MN9: *Far Forward Behavioral Health Care Advanced Tech*	-	0.000	0.000	0.266	-	0.266	0.272	0.278	0.285	0.000	0.000	1.101

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

This Project will deliver improved psychological treatment interventions to keep Soldiers in the fight under high intensity operational stressors.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Optimal Delivery of Far Forward Behavioral Health Care	-	-	0.266
Description: The effort will deliver improved psychological treatment interventions to keep Soldiers in the fight under high intensity operational stressors. ***FY 2020 Plans:*** The most promising brief psychotherapy interventions, self-administered computer apps, and treatment protocols for use with Service members deployed far forward will be identified and adapted and ready for initial clinical trials. An FDA-approved drug will also be under clinical trial evaluation for use to address Service member?s sleep problems in a far-forward setting for improved physical and psychological readiness and performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	0.266

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MN9 / *Far Forward Behavioral Health Care Advanced Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MO2 / *Traumatic Brain Injury (TBI) Treatment Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MO2: *Traumatic Brain Injury (TBI) Treatment Adv Tech*	-	0.000	0.000	4.285	-	4.285	4.406	4.387	4.083	0.797	0.000	17.958

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers development, demonstration, and transition of technologies for acute battlefield management of Traumatic Brain Injury (TBI). Efforts include pre-clinical demonstration of drug therapy and resuscitation strategies for treatment of acute TBI in the pre-hospital setting, biomarkers, diagnostics, and devices, as well as novel drug delivery technologies to facilitate administration of pharmaceuticals at or near the point of injury to protect the injured brain from further damage.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Selective Brain Cooling and Stem Cell Therapeutic Product Candidates for TBI	-	-	4.285
Description: Development, demonstration, and transition of technologies to treat TBI. Preclinical demonstration of stem cell transplantation to repair and regenerate the injured brain. Preclinical demonstration of a candidate selective brain-cooling device that protects the brain and reduces death from severe TBI but without adverse effects from whole-body cooling.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO2 / *Traumatic Brain Injury (TBI) Treatment Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate stem cell transplantation as a strategy to repair and regenerate the injured brain. Will have preclinical demonstration of a device that provides selective cooling of the brain, to protect the brain and reduce mortality in severe TBI while preventing the secondary adverse effects associated with whole body cooling. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Traumatic Brain Injury (TBI)			
Accomplishments/Planned Programs Subtotals	-	-	4.285

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MO3 / *Military Occupational Fitness Standards Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MO3: *Military Occupational Fitness Standards Adv Tech*	-	0.000	0.000	0.250	-	0.250	0.300	0.300	0.150	0.000	0.000	1.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

This capability will provide the unit leader a validated toolkit of operationally relevant physical fitness assessments that can supplement clinical criteria to determine whether a Soldier can return to duty after musculoskeletal injury without the risk of re-injury.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY20 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Military Occupational Fitness Standards	-	-	0.250
Description: This capability will provide the unit leader a validated toolkit of operationally relevant physical fitness assessments that can supplement clinical criteria to determine whether a Soldier can return to duty after musculoskeletal injury without the risk of re-injury. ***FY 2020 Plans:*** Will validate physical fitness standards and Return-to-Duty strategies, including the validation of Return-to-Duty during basic combat training. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work realigned from other project due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	0.250

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO3 / *Military Occupational Fitness Standards Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MO4 / *Burn Recovery Optimization Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MO4: *Burn Recovery Optimization Advanced Technology*	-	0.000	0.000	2.084	-	2.084	3.297	5.500	5.434	5.099	0.000	21.414

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers technology development, demonstration, and transition of burn recovery optimization technologies, including: diagnostic technology to predict skin graft success or failure and identify patients at heightened risk for scarring; and adult stem cell therapy candidate to decrease inflammation and limit organ injury following severe burns.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Theranostic Product Candidates to Optimize Burn Recovery	-	-	2.084
Description: Technology development, demonstration, and transition of burn recovery optimization technologies: diagnostic technology to predict skin graft success or failure and identify patients at heightened risk for scarring; adult stem cell therapy candidate to decrease inflammation and limit organ injury following severe burns.			
FY 2020 Plans: Will demonstrate biomarkers to identify skin graft success or failure, and to identify which patients are at heightened risk for scarring. Will develop and demonstrate treatments using mesenchymal stem cells (these are human cells that can, under the			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO4 / *Burn Recovery Optimization Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
right conditions, transform into multiple cell types having ability to repair damaged tissue) to decrease inflammation and limit systemic organ injury following severe burn injury. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned from Project 840 / Combat Trauma Therapies			
Accomplishments/Planned Programs Subtotals	-	-	2.084

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MO7 / *Improved Bone Repair Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MO7: *Improved Bone Repair Advanced Technology*	-	0.000	0.000	1.539	-	1.539	1.369	1.230	1.303	1.344	0.000	6.785

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 840 Combat Injury Mgmt

A. Mission Description and Budget Item Justification

This Project covers development, demonstration, and transition of technologies that improve outcomes following severe limb injuries to include open bone fractures and all related acute and prolonged field care complications of severe limb trauma.

All research is conducted in compliance with Food and Drug Administration (FDA) requirements for licensure of medical products for human use.

Promising efforts identified through Applied Research conducted under PE 0602787A, Project MM4 are further matured under this Project. Promising results identified under this Project are further matured under PE 0603807A, Project 836.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Technology Candidates for Stabilization and Treatment of Extremity Trauma	-	-	1.539
Description: Development, demonstration, and transition of technologies that improve bone repair outcomes in severe limb injuries where the two ends of a broken bone cannot be rejoined (for example, because part of the bone is missing, or the fracture is contaminated with bacteria, which inhibits normal healing).			
FY 2020 Plans: Will develop technologies to repair deleterious complications that prevent bone union and healing in severe extremity fractures.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO7 / *Improved Bone Repair Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Funds for ongoing work were realigned from Project 840 / Combat Trauma Therapies			
Accomplishments/Planned Programs Subtotals	-	-	1.539

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*				Project (Number/Name) MO8 / *Expeditionary Performance Nutrition Advanced Techn*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
MO8: *Expeditionary Performance Nutrition Advanced Techn*	-	0.000	0.000	0.200	-	0.200	0.429	0.511	0.520	0.476	0.000	2.136

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project MM3 Warfighter Medical Protection & Performance

A. Mission Description and Budget Item Justification

This Project covers development of nutritionally-optimized food products that will be matured to allow a soldier to eat-on-the-go while ensuring maximal physiological and cognitive performance with minimal logistical footprint.

The cited work is fully coordinated with Natick Soldier Research Development (NSRDEC), Natick, MA and with other Services in order to avoid duplication of effort.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by: the U.S. Army Medical Research Materiel Command (USAMRMC), Fort Detrick, MD..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Performance Nutrition for an Expeditionary Force	-	-	0.200
Description: Development of nutritionally-optimized food products prototypes that will allow Soldiers to eat-on-the-go with minimal logistical footprint while ensuring maximal physiological and cognitive performance. ***FY 2020 Plans:*** Will evaluate and provide components of food prototypes that are nutritionally optimized for cognitive and physical performance, configured for eating-on-the-go and compatible with multiple ration platforms (e.g., Meal-Ready-to-Eat [MRE], First Strike Ration [FSR]), tailorable for mission requirements, e.g., high/low physical or cognitive demand, formulated to enhance immune function and promote readiness and lighter weight with reduced logistical footprint. ***FY 2019 to FY 2020 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO8 / *Expeditionary Performance Nutrition Advanced Techn*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Ongoing work realigned from other project due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	0.200

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603002A / *Medical Advanced Technology*	Project (Number/Name) MO9 / *Vaccines to Prevent Dengue Fever Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
MO9: *Vaccines to Prevent Dengue Fever Advanced Tech*	-	0.000	0.000	2.533	-	2.533	2.434	2.399	2.713	2.736	0.000	12.815

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603002A Medical Advanced Technology
* Project 810 Ind Base Id Vacc & Drug

A. Mission Description and Budget Item Justification

This Project covers technology development, demonstration, and transition of a candidate vaccine for the prevention of dengue hemorrhagic fever or dengue shock syndrome caused by any of the 4 dengue virus types. The vaccine will be effective in people with and without a prior history of dengue infection. Infectious disease prevention sustains individual and unit readiness and reduces health services requirements and cost.

Work in this Project is managed by the United States (U.S.) Army Medical Research and Materiel Command (USAMRMC) in coordination with the Naval Medical Research Center (NMRC). The Army is responsible for programming and funding all Department of Defense (DoD) naturally occurring infectious disease research requirements, thereby precluding duplication of effort within the Military Departments.

Promising medical countermeasures identified in this Project are further matured under PE 0603807A, Project 808.

The cited work is consistent with the Under Secretary of Defense (Research and Engineering) science and technology focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program resources to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by USAMRMC at Fort Detrick, MD.

Efforts in this Project support the Soldier portfolio and the principal area of Military Relevant Infectious Diseases.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Vaccines to Prevent Dengue Fever Advanced Technology	-	-	2.533
Description: Perform small studies in healthy volunteers to test vaccine safety, effectiveness, and immunogenicity against Dengue Fever. Transition vaccine with high effectiveness and safety against all four serotypes of Dengue to PM Pharm in support of future FDA licensure.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603002A / *Medical Advanced Technology*	**Project (Number/Name)** MO9 / *Vaccines to Prevent Dengue Fever Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will perform clinical trial where optimized vaccine regimen is tested for safety and immunogenicity in humans. Will perform clinical trial to test for additional safety, immunogenicity and effectiveness against a Dengue challenge model against Dengue serotypes. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Funds for ongoing work were realigned to this project from Viral Disease Threats			
Accomplishments/Planned Programs Subtotals	-	-	2.533

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603003A *I Aviation Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	172.545	169.411	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	341.956
313: *Adv Rotarywing Veh Tech*	-	142.093	113.678	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	255.771
436: *Rotarywing MEP Integ*	-	6.554	7.417	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.971
447: *ACFT Demo Engines*	-	5.898	3.716	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.614
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	18.000	44.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	62.600

Note

In FY 2020 this Program Element (PE) is being realigned, with continuity of effort realigned to PE 0603465A Future Vertical Lift Advanced Technology.

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates manned and unmanned air vehicle technologies to enable Army aviation modernization. Within this PE, aviation technologies are advanced and integrated into realistic and robust demonstrations. Project 313 matures, demonstrates and integrates enabling component, subsystems and systems in the following areas: rotors and, structures. Project 436 matures, integrates and demonstrates air launched weapons systems, mission equipment packages to enable control of unmanned systems and advanced teaming capabilities. Project 447 matures and demonstrates affordable and efficient engines and drive trains.

Work in this PE contributes to the Army Science and Technology (S&T) Air Systems portfolio and is related to and fully coordinated with PE 0602211A (Aviation Technology), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603710A (Night Vision Advanced technology), and PE 0603270A (Electronic Warfare Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy. Work in this PE is performed by the U.S. Army Futures Command (AFC).

FY 2020 realignments are due to financial restructuring in support of the Army Modernization Priorities.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603003A *I Aviation Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	160.746	124.958	111.607	-	111.607
Current President's Budget	172.545	169.411	0.000	-	0.000
Total Adjustments	11.799	44.453	-111.607	-	-111.607
• Congressional General Reductions	-0.127	-0.147			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	18.000	44.600			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-6.074	-			
• Adjustments to Budget Years	-	-	-111.607	-	-111.607

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*		
Congressional Add: *JTARV*	3.000	-
Congressional Add: *FVL Research*	10.000	-
Congressional Add: *Rotary Wing Development*	5.000	-
Congressional Add: *Stretch Broken Composite Material Forms*	-	4.000
Congressional Add: *Advanced Helicopter Seating System*	-	5.000
Congressional Add: *Data Refinement and Optimization for Aviation Sustainment*	-	1.600
Congressional Add: *Surface Tolerant Adhesive for Bonded Airframe Structure*	-	5.000
Congressional Add: *Joint Tactical Aerial Supply Vehicle*	-	3.000
Congressional Add: *Rotorcraft Automated Compenent Tracking*	-	6.000
Congressional Add: *Future Vertical Lift (FVL) Research*	-	20.000
Congressional Add Subtotals for Project: BA7	18.000	44.600
Congressional Add Totals for all Projects	18.000	44.600

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603003A *I Aviation Advanced Technology*

Change Summary Explanation

FY 2019, $44.6 million in congressional adds were applied to Project BA7 (AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)) for rotorcraft automated component tracking, future vertical lift capability set 3, advanced helicopter seating system, surface tolerant adhesive for bonded airframe structure, joint tactical aerial resupply vehicle, data refinement and optimization for aviation sustainment, and stretch broken composite material forms.

FY 2020, PE eliminated due to Science and Technology financial restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603003A / *Aviation Advanced Technology*	Project (Number/Name) 313 / *Adv Rotarywing Veh Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
313: *Adv Rotarywing Veh Tech*	-	142.093	113.678	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	255.771

Note

In Fiscal Year (FY) 2020, this Project is being realigned to Program Element (PE) 0603003A Future Vertical Lift Advanced Technology, Projects:
* AI4 Joint Multi-Role (JMR) Demonstration
* AI6 Next Gen Tactical UAS TD
* AJ3 Next Gen Rotorcraft Transmission
* AJ5 Digital Vehicle Management and Control
* AJ7 Advanced Rotors Advanced Technology
* AJ9 Integ Mission Equipment for Vertical Lift Systems
* AK3 Aviation Survivability Advanced Technology
* AK8 Air Launched Effects Advanced Technology
* AL6 Degraded Visual Environment Mitigation (DVE-M)
* AM3 Aircraft and Aircrew Protection

A. Mission Description and Budget Item Justification

This Project matures, demonstrates and integrates components, subsystems and systems for vertical lift and unmanned air systems that provide improved aircraft and occupant survivability, reduced maintenance and sustainment costs, and greater performance through improved rotors, drives, vehicle management systems and platform design and structures. Systems demonstrated include rotors and robust airframe structures. A major effort in this Project is the Joint Multi-Role (JMR) Technology Demonstrator (TD) in support of the Future Vertical Lift (FVL) family of aircraft.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy.

Work in this project is coordinated with Program Executive Office Aviation (PEO Aviation) and PEO Intelligence, Electronic Warfare, and Sensors (PEO IEW&S).

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Platform Design & Structures Systems	115.866	80.484	-
Description: Provide demonstration of Future Vertical Lift (FVL) platform configurations that address multi domain battle capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed,			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
range, payload, and reduced operating costs, to inform and reduce future aviation materiel acquisitions. Flight demonstrate operational capabilities of technology demonstrators. ***FY 2019 Plans:*** Mature and demonstrate integrated, fastenerless advanced structural assemblies that enable future vertical lift platforms with crashworthy, damage tolerant, lightweight and sustainable solutions. Continue flight demonstrations of two Joint Multi-Role (JMR) Technology Demonstrator (TD) aircraft to collect data and assess the capabilities of advanced rotary-wing configurations (an advanced tilt rotor and lift-offset, co-axial helicopter with a pusher prop) and enabling component technologies. Demonstrate advanced flight control technologies. Demonstrate on a ground test stand a Single Rotor Tiedown (SRT) test of the two-speed gearbox, Independent Blade Control (IBC) and rotors critical to realizing the performance capabilities of an Optimum Speed Tilt Rotor (OSTR). Finalize development a mission systems architecture from a representative architecture specification using JCA, model-based engineering tools, virtual integration methods and open systems architecture in a Mission Systems Architecture Capstone Demonstration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Projects AI4 and AJ9.			
Title: Rotors & Vehicle Management Systems ***Description:*** This effort demonstrates the performance benefits of advanced rotors through the assessment of alternative designs aimed to satisfy future force capability needs for increased system durability, speed, range and payload. This effort also integrates advanced flight controls with real-time aircraft state information into vehicle management systems to enable safe, low-effort maneuvering and real-time adaptation to aircraft state changes (degradation, damage, mission, etc.) ***FY 2019 Plans:*** Conduct trade studies to identify reliable technologies that enable highly efficient aircraft performance throughout the flight envelope. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Projects AJ5 and AJ7.	3.072	1.292	-
Title: Rotorcraft Drive Systems ***Description:*** This effort demonstrates advanced rotorcraft drive technologies with the potential to: increase the horsepower-to-weight ratio; reduce drive system noise; reduce production, operating and support costs; and provide automatic component impending failure detection. The drive system demonstrators for this effort will be applicable to Future Vertical Lift (FVL) platforms. ***FY 2019 Plans:***	2.062	1.037	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Continue fabrication of advanced multi-speed drive train hardware and initiate development testing of demonstrator hardware under the Next Generation Rotorcraft Transmission program to enable greater aircraft speed/range in support of Future Vertical Lift. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Project AJ3.			
Title: Survivability for Degraded Visual Environment (DVE) Operations ***Description:*** Develop and mature advanced sensor cueing and flight controls to provide ability to maintain terrain and obstacle situational awareness during all DVEs both aircraft induced (brown-out & white-out) and environmentally induced (fog, rain, snow etc.) Flight testing on fleet aircraft is an integral component of the demonstration. Work in this area is being done in coordination with efforts at United States (U.S.) Army Communications-Electronics Research, Development, and Engineering Center (CERDEC), Program Element (PE) 0603710A, Night Vision Advanced Technology. The program presents an opportunity to North Atlantic Treaty Organization (NATO) nations, global industry, and academia to participate with their own assets in order to foster information exchange and collaboration. ***FY 2019 Plans:*** Conduct multiple research focused trials and demonstrations while seeking opportunities to spin off and transition research to programs that will provide capability to the warfighter. Physically integrate sensor fusion engine onto test aircraft and conduct engineering flight test of integrated system. Implement approaches for multi ship networking and operations in DVE. Conduct capstone demonstration in government SIL that validates optimal cueing symbology, sensor driven guidance, flight control configuration, and optimum presentation of sensor data through augmented and virtual reality. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Project AL6.	8.500	16.377	-
Title: Aircraft & Occupant Survivability Systems ***Description:*** This effort increases rotorcraft survivability by reducing platform signatures, providing the means to more efficiently counter enemy detection and tracking systems, and also increases protection to the aircraft and aircrew against ballistic munitions, crash landings, and post-crash fire events. This effort enhances air crew situational awareness, allowing manned/ unmanned aircraft to avoid enemy air threats. ***FY 2019 Plans:*** Develop aircraft survivability correlator algorithms that take into account aircraft signatures, vulnerable areas, maneuverability, terrain, threat understanding, and available countermeasures to provide an appropriate response for an increased level of threat	9.196	7.532	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
aircraft protection. Develop ownship and team based survivability behaviors and continue integration of rotorcraft threat protection technologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Project AM3.			
Title: Next Generation Tactical UAS Technology Demonstration (NGTUAS) ***Description:*** Develop and demonstrate transformational air vehicle technologies that overcome key barriers to meet the Army?s future Unmanned Aircraft System (UAS) performance, survivability, and reliability requirements and operational capabilities. Work in this area is being done in coordination with efforts at AMRDEC Program Element (PE) 0602211A, Platform Design & Structures Technologies. ***FY 2019 Plans:*** Refine air vehicle technologies maturation, integration and system level test and demonstration strategies. Validate new design and assessment methodologies relevant to UAS-scaled platforms through demonstration. Develop an informed Model Performance Specifications (MPS) and provide quantifiable metrics and key attributes for the NGTUAS. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465A/ Project AI6.	-	2.888	-
Title: Maintainability & Sustainability Systems ***Description:*** Enables highly reliable, low maintenance platforms that can survive un-sustained in the multi-domain battle space for extended periods. Integrates and demonstrates technology solutions comprising aircraft health state awareness, data driven sustainment approaches, and operationally durable designs with minimal operating and sustainment costs.	3.397	-	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	4.068	-
Accomplishments/Planned Programs Subtotals	142.093	113.678	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 313 / *Adv Rotarywing Veh Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603003A / *Aviation Advanced Technology*	Project (Number/Name) 436 / *Rotarywing MEP Integ*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
436: *Rotarywing MEP Integ*	-	6.554	7.417	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.971

Note

In Fiscal Year (FY) 2020 this Project is being realigned to Program Element (PE) 0603465 Future Vertical Lift Advanced Technology, Projects:
* AL1 Advanced Teaming for Tactical Aviation Oper

A. Mission Description and Budget Item Justification

This Project matures and validates man-machine integration and mission equipment software and hardware technologies for unmanned and optionally manned aircraft systems and integrated threat protection systems. Efforts focus on artificial intelligence, intelligent agents, cognitive decision aiding, sensors, avionics, communications, and pilot vehicle interfaces. This Project improves the overall mission execution by demonstrating manned and unmanned system teaming, enhanced aircraft pilotage capability, improved crew workload distribution, and new capabilities for both manned and unmanned aircraft. This Project supports Army transformation by providing mature technology to greatly expand the capabilities of unmanned aircraft, in current operating roles and future unmanned wingman roles.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Unmanned and Optionally Manned Systems	6.554	5.674	-
Description: Mature and apply tactical behavior algorithms and safe-flight technologies to enable unmanned and optionally manned aircraft to maintain safe, responsive, flexible, and tactical formation flight with manned helicopters for unmanned wingman applications in re-supply, reconnaissance, surveillance and attack missions. Develop, mature, apply, and integrate advanced decision aiding, autonomy, and human-machine interface technologies to enable the helicopter flight crew to make full use of the capabilities of an unmanned aircraft system (UAS) without requiring continuous attention. Efforts include development of intelligent algorithms that aid decisions and actions in order to increase situation awareness, maximize use of on-board and off-board sensors, efficiently manage a team of manned and unmanned vehicles and their mission systems, and develop and execute effective and appropriate offensive and defensive responses.			
FY 2019 Plans: Continue the development, integration and demonstration of third party vendor software and advanced human machine interface technologies in simulations to enable increased manned and unmanned teaming capabilities and to inform crew station			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 436 / *Rotarywing MEP Integ*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
development programs for both legacy fleet aircraft upgrades and future aircraft procurements. Continue to demonstrate software and hardware integration within an open systems, modular architecture based system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work transferred to PE 0603465 due to S&T Financial Restructuring.			
Title: Advanced Teaming ***Description:*** Develop and demonstrate teaming behaviors and autonomous decision making for mixed platform formations in combined arms operations. Focus areas include: resilient autonomous algorithms; self-organizing unmanned formations; distributed command and control; and navigation. ***FY 2019 Plans:*** Develop and mature teaming algorithms focused on resupply, reconnaissance and surveillance mission areas. Integrate and demonstrate sensor and processing technology to support teaming behavior for heterogeneous platform formations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603465/ Project AL1	-	1.518	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.225	-
Accomplishments/Planned Programs Subtotals	6.554	7.417	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603003A / *Aviation Advanced Technology*	Project (Number/Name) 447 / *ACFT Demo Engines*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
447: *ACFT Demo Engines*	-	5.898	3.716	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.614

Note

In Fiscal Year (FY) 2020, this Project is being realigned to Program Element (PE) 06033465 Future Vertical Lift Advanced Technology, Projects:
* AI8 Alternative Concept Engine
* AJ1 Future UAS Engine

A. Mission Description and Budget Item Justification

This Project matures and demonstrates power system technologies through design, fabrication, and evaluation of advanced engine components in order to improve the performance of turbine engines and drive systems for vertical lift aircraft and Unmanned Aerial Systems (UAS) vehicles This Project supports Army modernization by demonstrating mature technologies for lighter turbine engines and drives that provide increased power, increased fuel efficiency, improved sustainability and reduced maintenance. These advanced engine designs and drives will significantly improve the overall aircraft performance characteristics and reduce the logistical footprint of Army Aircraft.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Alternative Concept Engine (ACE)	5.898	3.633	-
Description: This effort demonstrates alternative, adaptive, and intelligent engine technologies to provide improved / mission-optimized performance, readiness, and affordability across an expanding engine envelope for increased operational capability for Army Aviation manned and unmanned platforms. The alternative concept engine technology demonstrations planned for this effort are applicable to current and future platforms. Work in this project is coordinated with efforts in PE 0602211A, Project 47A.			
FY 2019 Plans: Continue fabrication and initiate component test of innovative/adaptive engine component technologies such as variable speed power turbine. Continue component design integration efforts and perform fabrication of hardware for full system demonstration to enable greater aircraft performance and engine durability in support of Future Vertical Lift.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** 447 / *ACFT Demo Engines*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort is realigned to PE 06033465/ projects AI8 and AJ1.			
Title: FY 2019 SBIR / STTR Transfer	-	0.083	-
FY 2019 Plans: FY 2019 SBIR / STTR Transfer			
FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	5.898	3.716	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603003A / *Aviation Advanced Technology*				Project (Number/Name) BA7 / *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BA7: *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*	-	18.000	44.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	62.600

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Aviation advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: JTARV	3.000	-
FY 2018 Accomplishments: JTARV		
Congressional Add: FVL Research	10.000	-
FY 2018 Accomplishments: FVL Research		
Congressional Add: Rotary Wing Development	5.000	-
FY 2018 Accomplishments: Rotary Wing Development		
Congressional Add: Stretch Broken Composite Material Forms	-	4.000
FY 2019 Plans: Stretch Broken Composite Material Forms		
Congressional Add: Advanced Helicopter Seating System	-	5.000
FY 2019 Plans: Advanced Helicopter Seating System		
Congressional Add: Data Refinement and Optimization for Aviation Sustainment	-	1.600
FY 2019 Plans: Data Refinement and Optimization for Aviation Sustainment		
Congressional Add: Surface Tolerant Adhesive for Bonded Airframe Structure	-	5.000
FY 2019 Plans: Surface Tolerant Adhesive for Bonded Airframe Structure		
Congressional Add: Joint Tactical Aerial Supply Vehicle	-	3.000
FY 2019 Plans: Joint Tactical Aerial Supply Vehicle		
Congressional Add: Rotorcraft Automated Compenent Tracking	-	6.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603003A / *Aviation Advanced Technology*	**Project (Number/Name)** BA7 / *AVIATION ADVANCED TECHNOLOGY INITIATIVES (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
FY 2019 Plans: Rotorcraft Automated Compenent Tracking		
Congressional Add: Future Vertical Lift (FVL) Research	-	20.000
FY 2019 Plans: Future Vertical Lift (FVL) Research		
Congressional Adds Subtotals	18.000	44.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603004A *I Weapons and Munitions Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	195.345	241.581	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	436.926
232: *Advanced Lethality & Survivability Demo*	-	99.265	70.340	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	169.605
43A: *ADV WEAPONRY TECH DEMO (CA)*	-	68.000	139.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	207.000
L96: *High Energy Laser Technology Demo*	-	23.274	26.225	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	49.499
L97: *Smoke And Obscurants Advanced Technology*	-	4.806	6.016	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.822

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
? 0603118A Soldier Lethality Advanced Technology
? 0603119A Ground Advanced Technology
? 0603462A Next Generation Combat Vehicle Advanced Technology
? 0603464A Long Range Precision Fires Advanced Technology
? 0603465A Future Vertical Lift Advanced Technology
? 0603466A High Energy Laser Tactical Vehicle Demonstrator Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures weapons and munitions components/subsystems and demonstrates lethal weapons systems with potential to increase force application and force protection capabilities across the spectrum of operations. Project 232 focuses on affordable delivery of scalable effects for kinetic weapons and munitions including: artillery, mortars, medium caliber, tank fired, Soldier weapons and shoulder fired weapons. Project L96 matures and integrates critical high energy laser subsystems into mobile demonstrators to explore and validate system performance in relevant environments. Project L97 demonstrates performance of advanced obscurants and delivery of mechanisms and conducts forensic analysis of explosives and hazardous materials to enable detection.

In FY 2018/FY 2019 work in this PE is related to, and fully coordinated with, PE 0602120A (Sensors and Electronic Survivability), PE 0602307A (Advanced Weapons Technology), PE 0602618A (Ballistics Technology), PE 0602622A (Chemical, Smoke, and Equipment Defeating Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602772A (Advanced Tactical Computer Science and Sensor Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603313A (Missile and Rocket Advanced Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603004A *I Weapons and Munitions Advanced Technology*

Beginning in FY 2020, work in this PE is related to and fully coordinated with PE 0603118 (Soldier Lethality Advanced Technology), 0603462A (Next Generation Combat Vehicle Advanced Technology), 0603464A (Long Range Precision Fires Advanced Technology), 0603465A (Future Vertical Lift Advanced Technology), PE 0603466A (High Energy Laser Tactical Vehicle Demonstrator Advanced Technology), and PE 0603119A (Ground Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The work in this PE is performed by the U.S. Army Futures Command (AFC) and the United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	84.079	102.686	112.213	-	112.213
Current President's Budget	195.345	241.581	0.000	-	0.000
Total Adjustments	111.266	138.895	-112.213	-	-112.213
• Congressional General Reductions	-0.056	-0.105			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	68.000	139.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	46.000	-			
• SBIR/STTR Transfer	-2.678	-			
• Adjustments to Budget Years	-	-	-112.213	-	-112.213

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 43A: *ADV WEAPONRY TECH DEMO (CA)*		
Congressional Add: *Program Increase*	42.000	-
Congressional Add: *Gun-launched unmanned aerial system*	3.000	-
Congressional Add: *High energy laser research*	15.000	-
Congressional Add: *High energy rotorcraft integration*	8.000	-
Congressional Add: *Program Increase FY19 Appropriations Act*	-	42.000
Congressional Add: *Program increase - advanced development of asset protection technologies*	-	5.000
Congressional Add: *Program increase - accelerate ERCA gun*	-	12.000
Congressional Add: *Program increase - high energy laser*	-	20.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603004A *I Weapons and Munitions Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Congressional Add: *Program increase - long range precision fires*	-	35.000
Congressional Add: *hypersonic capability - transfer from line 71*	-	25.000
Congressional Add Subtotals for Project: 43A	68.000	139.000
Congressional Add Totals for all Projects	68.000	139.000

Change Summary Explanation

FY18 congressional adds for Program increase ($42.000 million), Gun-launched unmanned aerial system ($3.000 million), High energy laser research ($15.000 million), and High energy laser rotorcraft integration ($8.000 million).

FY19 congressional adds for Program increase ($42.000 million), advanced development of asset protection technologies ($5.000 million), accelerate ERCA gun ($12.000 million), high energy laser ($20.000 million), long range precision fires ($35.000 million), and hypersonic capability ($25.000 million).

This Program Element (PE) is eliminated in FY20 as part of the Science and Technology (S&T) financial restructure initiative; however, continuity of effort is preserved through transition to new Program Elements (PE) / Projects.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / *Weapons and Munitions Advanced Technology*	Project (Number/Name) 232 / *Advanced Lethality & Survivability Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
232: *Advanced Lethality & Survivability Demo*	-	99.265	70.340	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	169.605

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603118A Soldier Lethality Advanced Technology, Projects:
* AY7 Small Arms Fire Control Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BF5 Adv Lethality & Accuracy Sys for Med Cal Adv Tech
* BG5 Extended Line of Sight (ELOS) Advanced Technology
* BI1 Protection for Autonomous Systems Adv Tech
* BK4 Next Gen Intelligent Fire Control(NG-IFC) Adv Tech
* BK6 Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech
PE 0603464A Long Range Precision Fires Advanced Technology, Projects:
* AE6 Strategic Long Range Cannon Advanced Technology
* AG3 Extended Range Cannon Artillery (ERCA) Adv Tech
* AG5 Extended Range Artillery Munition Suite Adv Tech
* AG7 Energetic Materials and Adv Processing Adv Tech
* BS3 Strategic Missile Advanced Technology
PE 0603465A Future Vertical Lift Advanced Technology, Projects:
* AK7 Adv Rotorcraft Armaments Protection Sys Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for affordable precision munitions including advanced energetic materials and munitions, novel fuze designs, penetrators, and scalable effects.

Efforts in this Project support the Lethality and Ground Maneuver portfolios.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Cluster Munitions Replacement Acceleration	7.657	7.748	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates ultra-high reliability fuzing, advanced kill mechanisms, and alternative dispensing technologies for 155mm artillery to provide increased battlefield lethality with reduced unexploded ordnance (UXO) compliant with the Department of Defense (DoD) cluster munitions policy. ***FY 2019 Plans:*** Continue to conduct ballistic testing with the objective of a TRL6 demonstration at the end of FY 2019 to validate performance of critical components such as fuzing and warheads; will optimize tests to capture as much pertinent data as possible to inform requirements generation; will mature and demonstrate the performance of integrated components through ballistic testing to show improvements over legacy systems and serve as a down-select to a tactical design; will generate documentation capturing the cluster munition effort relevant data to facilitate transition to PEO/PM in support of the Cannon-Delivered Area Effects Munitions (C-DAEM) Program of Record. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort ends in FY19.			
Title: Medium Caliber Weapon Systems ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603462A/Project BF5 (Next Generation Combat Vehicle Advanced Technology) as part of the financial restructure and the Army Modernization Strategy. This effort matures and demonstrates advanced medium caliber ammunition, weapon, fire control, and Ammunition Handling Systems (AHS) optimized for remote operation. This effort demonstrates cannon-super high elevation engagement, high performance stabilization, remote ammunition loading, weapon safety and reliability, improved lethality, accuracy, ability to fire a suite of ammunition from non-lethal to lethal, and escalation of force capability in one system. ***FY 2019 Plans:*** Will mature fire control software to support 50mm weapon system integration; will integrate complete weapon system into a test bed turret to mature and demonstrate test bed turret control systems and fire control ballistic solutions for optimized lethal performance; will validate simulated system analysis data against various target sets and provide feedback into fire control solutions for integrated system optimization; will complete an integrated (TRL 6) 50mm demonstration to validate the integrated system accuracy and lethal performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	18.000	9.700	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Beginning in FY 2020, this effort realigns to PE 0603462A/Project BF5 as part of the financial restructure and the Army Modernization Strategy.			
Title: Scale-up of Energetic Materials ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG7 (Long Range Precision Fires Advanced Technology) as part of the financial restructure and the Army Modernization Strategy. This effort matures and demonstrates the performance and insensitivity of energetic materials ranging from 25mm medium caliber (direct fire) through 155mm large caliber (indirect fire) weapons. ***FY 2019 Plans:*** Continue to qualify energetic materials for complete material characterization; will demonstrate high-energy, reduced sensitivity melt-pour formulations for enhanced fragmentation representative munitions. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG7 as part of the financial restructure and the Army Modernization Strategy.	1.400	1.937	-
Title: Active Protection Armament Technologies ***Description:*** This effort supports the Army's Active Protection System (APS) program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. This effort is done in coordination with efforts in Program Element (PE) 0602601A, PE 0602618A, PE 0603004A, PE 0603005A, PE 0603270A, and PE 0603313A. ***FY 2019 Plans:*** Conduct demonstrations of mature Modular APS Framework (MAF)-compliant HKCM subsystems to validate modularity and performance optimization; provide mature technologies for integration in a MAF-compliant HKCM subsystem for a layered demonstration of combined Soft Kill and Hard Kill component technologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort ends in FY 2019	6.811	4.358	-
Title: Long Range Gun Technology ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG3 (Long Range Precision Fires Advanced Technology) as part of the financial restructure and the Army Modernization Strategy.	1.700	4.628	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort matures and demonstrates extended range artillery weapon system and projectile technologies that increase the range by 25% without an increase in platform weight. ***FY 2019 Plans:*** Optimize the design of secondary weapon subsystems such as scavenge systems, elevation, equilibration, automated breech operation, and thermal warning technologies; will demonstrate compact automatic ammunition handling and loading systems with armaments using emerging charge and projectile technologies for improved range and rate of fire performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG3 as part of the financial restructure and the Army Modernization Strategy.			
Title: Affordable Precision Technologies ***Description:*** This effort integrates complementing navigation sensors, actuators and subsystems in order to demonstrate precision delivery capability on an indirect fire munition system in a global positioning system (GPS) denied environment.	3.000	-	-
Title: Counter-Unmanned Aviation System (C-UAS) Technology ***Description:*** This effort matures and demonstrates C-UAS technologies designed to encompass the entire kill chain including detection, tracking, classification, and kinetic defeat of UAS for point defense and mobile applications. ***FY 2019 Plans:*** Demonstrate integrated small (0.50) caliber counter UAS technologies at a live fire event; will demonstrate the ability to track outgoing rounds and incorporate data into fire control solution; will mature and demonstrate guided medium caliber armament system initially created through DARPA effort to search, identify, track and intercept maneuvering threats; will improve fire control and guidance algorithms for C-UAS/Air Defense scenarios; will optimize kinetic armament system components design for integration on a ground vehicle platform. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort completes in FY 2019	1.700	3.622	-
Title: Accelerated Extended Range Munition Suite ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG5 (Long Range Precision Fires Advanced Technology) as part of the financial restructure and the Army Modernization Strategy.	3.000	22.152	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort matures and demonstrates extended range artillery technologies including rocket and base bleed propulsion, hybrid lifting surfaces and guidance technologies which increase range and accuracy. ***FY 2019 Plans:*** Mature and evaluate long range unitary artillery projectile components in the areas of precision, counter-measure, and payload technologies; will conduct system modeling and simulation to assess improved projectile performance by these technologies when fired from Extended Range Cannon Artillery (ERCA) cannon tube; will develop and test integration concepts and algorithms and refine guidance and navigation system design concepts at extended ranges in GPS-denied environments; will mature component development for cargo and effects munition compatible with legacy and ERCA in the following areas: 1) dispensing techniques and sensor for area effects to service precisely located targets ; 2) optimal formulations and characteristics for smoke and illumination payloads that maximize effectiveness ; and 3) survivability of cannon-launched terrain shaping munition for maximum area denial effects; will conduct critical design review of component technologies; will perform test and evaluation of key enabling component technologies; refine concepts for system integration; and will mature modeling and simulation concepts for subsequent validation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG5 as part of the financial restructure and the Army Modernization Strategy.			
Title: Fuze and Power Technology for Munitions ***Description:*** This effort matures and demonstrates innovative fuze and power technologies for enhanced environment and target sensing/classification, warhead initiation schemes, and advanced fuze setting. These technologies will provide enhanced lethality combined effects on targets and advanced initiation schemes for the next generation munitions. ***FY 2019 Plans:*** Conduct live fire (Mann Barrel) demonstration of several 30x173mm or Light Weight 50mm airburst rounds that demonstrate an increase in range accuracy when rounds are corrected; will conduct live fire demonstration of a 40mm round using a pre-timed airburst function and low cost Electronic Safe and Arming (ESAD); will conduct demo of the Precision Guided Kit in a 155mm projectile using the Next Gen Large Cal Setter; and will conduct demo of the extended run time thermal battery. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Efforts completes in FY 2019.	2.860	2.360	-
Title: Enhanced Tactical Multi-Purpose (ETMP) Hand Grenade	1.000	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort develops a multi-purpose selectable lethal hand grenade that produces either fragmentation or blast overpressure effects.			
Title: Extended Range Armament and Fire Control Integration ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG3 (Long Range Precision Fires Advanced Technology) as part of the financial restructure and the Army Modernization Strategy. This effort matures and demonstrates extended range Armament technologies including light weight Cannon and Mount structures, high efficiency recoil cylinders, common lower power fire control hardware, improved fire control software, and improved sensor to shooter communications which will increase range and accuracy. ***FY 2019 Plans:*** Optimize enhanced light weight structures for cannon and mount components, will integrated controls and ammunition handling system; will exploit projectile tracking and guidance technologies to provide accuracy at extended ranges in global positioning system (GPS)-denied environments; will continue to mature and demonstrate advanced and common fire control hardware and software to increase accuracy and reduce logistic burden. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603464A/Project AG3 as part of the financial restructure and the Army Modernization Strategy.	3.000	3.447	-
Title: Aviation Armament System Technologies ***Description:*** This effort matures and demonstrates armament solutions adaptable to current aviation and future vertical lift applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems. ***FY 2019 Plans:*** Will mature and demonstrate a Technology Readiness Level (TRL) 6 airburst munition with a selectable proximity airburst - point detonation fuze for the Apache AH-64E; will optimize critical ammunition technologies in areas of power generation, proximity sensor, and smart multi-mode fuzing to support the Apache AH-64E. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort completes in FY 2019.	1.237	2.433	-
Title: Leader-Soldier Effects Tool Suite	0.700	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates fires and effects planning, coordination and execution tool suite for sensor to shooter and tactical application. Provides enhanced collaborative engagement capability of fielded and emerging battle command systems supporting PM Soldier Warrior and PM Mission Command Program of Record (POR) architectures.			
Title: Advanced Small Arms Fire Control ***Description:*** This effort will mature and demonstrate advanced small arms ballistic calculations from advanced sensor input and optimized architecture for the precision-optical wind system.	1.200	-	-
Title: Extended Line of Site Munition (ELOS) ***Description:*** Beginning in FY 2020, this effort realigns to PE 0603462A/Project BG5 (Next Generation Combat Vehicle Advanced Technology) as part of the financial restructure and the Army Modernization Strategy. This effort demonstrates a 120mm Tank fired ELOS Munition that counters the growing Anti-Tank Guided Missile (ATGM) threat at extended line of sight ranges beyond current capability. ***FY 2019 Plans:*** Will optimize an ELOS Munition Air Frame (projectile) design to include fin stabilization element, Seeker Unit, Guidance Electronics Unit (GEU), Canard Actuation System (CAS), Warhead, GNC (Guidance, Navigation, and Control) Software, Target Acquisition and Tracking Software, and Propulsion system; will integrate these components to validate their performance through a preprogram maneuver cannon fired experiment. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603462A/Project BG5 (Next Generation Combat Vehicle Advanced Technology) as part of the financial restructure and the Army Modernization Strategy.	-	5.811	-
Title: Strategic Long Range Cannon (SLRC)	46.000	-	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	2.144	-
Accomplishments/Planned Programs Subtotals	99.265	70.340	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 232 / *Advanced Lethality & Survivability Demo*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army				Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / *Weapons and Munitions Advanced Technology*	Project (Number/Name) 43A / *ADV WEAPONRY TECH DEMO (CA)*		

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
43A: *ADV WEAPONRY TECH DEMO (CA)*	-	68.000	139.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	207.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Advanced Weaponry Technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Program Increase	42.000	-
FY 2018 Accomplishments: Program Increase		
Congressional Add: Gun-launched unmanned aerial system	3.000	-
FY 2018 Accomplishments: Gun-launched unmanned aerial system		
Congressional Add: High energy laser research	15.000	-
FY 2018 Accomplishments: High energy laser research		
Congressional Add: High energy rotorcraft integration	8.000	-
FY 2018 Accomplishments: High energy rotorcraft integration		
Congressional Add: Program Increase FY19 Appropriations Act	-	42.000
FY 2019 Plans: Program Increase FY19 Appropriations Act		
Congressional Add: Program increase - advanced development of asset protection technologies	-	5.000
FY 2019 Plans: Program increase - advanced development of asset protection technologies		
Congressional Add: Program increase - accelerate ERCA gun	-	12.000
FY 2019 Plans: Program increase - accelerate ERCA gun		
Congressional Add: Program increase - high energy laser	-	20.000
FY 2019 Plans: Program increase - high energy laser		
Congressional Add: Program increase - long range precision fires	-	35.000
FY 2019 Plans: Program increase - long range precision fires		
Congressional Add: hypersonic capability - transfer from line 71	-	25.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** 43A / *ADV WEAPONRY TECH DEMO (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
FY 2019 Plans: hypersonic capability - transfer from line 71		
Congressional Adds Subtotals	68.000	139.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / *Weapons and Munitions Advanced Technology*	Project (Number/Name) L96 / *High Energy Laser Technology Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
L96: *High Energy Laser Technology Demo*	-	23.274	26.225	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	49.499

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603466A Air and Missile Defense Advanced Technology, Projects:
* AD1 High Energy Laser Tactical Vehicle Demonstrator Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced technologies for future High Energy Laser (HEL) weapons technology. The major effort under this Project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations that are traceable to the form, fit, and function requirements for a HEL weapon. SSL technology has demonstrated the potential to engage and defeat rockets, artillery and mortars (RAM), UAVs, cruise missiles, sensors, and optics at tactically relevant ranges. HELs are expected to complement conventional offensive and defensive weapons at a lower cost-per-shot than current systems and without the need to strategically, operationally, or tactically stockpile ordnance. This effort utilizes a modular building block approach with open systems architecture to ensure growth, interoperability, and opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power and thermal management subsystems, as well as Battle Management Command, Control, and Computers (BMC3).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work is performed by the United States Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Laser System Ruggedization	12.550	18.494	-
Description: This effort ruggedizes laser systems for integration on Army platforms. Ruggedization includes modifications of the laser system to withstand vibration, temperature, and contamination environments expected on various Army platforms, while ensuring platform volume, weight, and interface specifications are met. The laser system consists of laser devices, such as the laboratory laser devices developed under Program Element (PE) 0602307A, Project 042, and the prime power (PE 0603005A, Project 441), command and control and thermal management subsystems required for the laser device operation.			
FY 2019 Plans: Complete Critical Design Review (CDR) for the High Energy Laser Tactical Vehicle Demonstrator (HEL TVD). This review will complete the design of the system and includes details of the laser subsystems interfaces with the platform, a Family of Medium			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L96 / *High Energy Laser Technology Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Tactical Vehicles (FMTV). Will begin ruggedizing and assembling thermal management, electrical power, and battle management subsystems for the HEL TVD based on designs of the laser and beam control system designs developed under PE 0602307A, Project 042. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this work is being realigned to PE 0603466A/Project AD1 as part of the financial restructure and the Army Modernization Strategy.			
Title: High Energy Laser Systems Integration and Mobile Demonstrations ***Description:*** This effort integrates a 50 kW-class laser from Project 042 into the existing mobile laser demonstrator platform that includes the ruggedized Beam Control System (BCS) built under the HEL Technical Demonstration effort and other required subsystems to demonstrate weapon system performance. The goal is to demonstrate and evaluate performance of a complete mobile high energy laser system in a relevant environment. ***FY 2019 Plans:*** Complete analysis of the FY18 HELMTT 50 kW-class system risk reduction demonstration; consolidate lessons learned from HELMTT demonstration to apply to High Energy Laser Tactical Vehicle Demonstrator (HEL TVD); begin preliminary planning for HEL TVD demonstration and define target requirements for FY22 demonstration; initiate system demonstration performance prediction analysis based on HEL TVD predicted performance parameters. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this work is being realigned to PE 0603466A/Project AD1 as part of the financial restructure and the Army Modernization Strategy.	10.724	6.876	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.855	-
Accomplishments/Planned Programs Subtotals	23.274	26.225	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L96 / *High Energy Laser Technology Demo*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603004A / *Weapons and Munitions Advanced Technology*	Project (Number/Name) L97 / *Smoke And Obscurants Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
L97: *Smoke And Obscurants Advanced Technology*	-	4.806	6.016	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.822

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603119A Ground Advanced Technology, Projects:
* BL3 Explosives Forensics Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BG7 Ground Systems Active Defense (GSAD) Advanced Tech
* BG9 Obscuration Advanced Technology

A. Mission Description and Budget Item Justification

The Project matures and demonstrates obscurant technologies with potential to enhance personnel/platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces. This Project also matures and demonstrates improved detection of explosives and hazardous materials by Soldiers and Small Units.

Work in this Project is related to, and fully coordinated with, PE 0602622A (Chemical, Smoke and Equipment Defeating Technology) and PE 0603606A, Project 608 (Countermine & Barrier Development).

This Project sustains Army Science and Technology efforts supporting the Ground Maneuver portfolio.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Obscurant Enabling Technologies	0.866	1.802	-
Description: This effort demonstrates the dissemination of new and advanced obscurants. This effort will support Modular Active Protection System (MAPS) in 0603005/221.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L97 / *Smoke And Obscurants Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Assess existing and emerging obscurants and their dissemination in vehicle protection grenades; initiate design efforts to integrate with MAPS system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20 funding is realigned to PE 0603462A/Projects BG7 and BG9 as part of the financial restructure and the Army Modernization Strategy.			
Title: Forensic Analysis of Explosives ***Description:*** This effort demonstrates improved point and stand-off detection of explosives and homemade explosive (HME) precursors. ***FY 2019 Plans:*** Revise and develop 2nd Generation Chemical Fingerprint Imaging System (CFIS) prototype showing optimized detection performance including improved detection of trace explosive residues and other molecules on curved surfaces and detection algorithm for discrimination of target materials on complex backgrounds. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, funding is realigned to PE63270A/Project BG9 (Obscuration Advanced Technology) as part of the financial restructure and the Army Modernization Strategy.	2.034	2.071	-
Title: Detection Mechanisms for Contaminants ***Description:*** This effort demonstrates improved point and standoff detection of a wide range of hazardous materials. ***FY 2019 Plans:*** Investigate UV laser alternatives and spectrometer for trace explosives standoff detection system; conduct technology assessment of trace explosives sensors through a field trial to evaluate sensor sensitivity and technical performance analysis. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, funding is realigned to PE 0603119A/Project BL3 as part of the financial restructure and the Army Modernization Strategy.	1.906	1.923	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:***	-	0.220	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603004A / *Weapons and Munitions Advanced Technology*	**Project (Number/Name)** L97 / *Smoke And Obscurants Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	4.806	6.016	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603005A *I Combat Vehicle and Automotive Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	154.084	176.622	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	330.706
221: *Combat Veh Survivablty*	-	58.077	60.029	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	118.106
441: *Combat Vehicle Mobilty*	-	32.413	26.485	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	58.898
497: *Combat Vehicle Electro*	-	6.934	7.208	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.142
515: *Robotic Ground Systems*	-	21.160	25.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	47.060
533: *Ground Vehicle Demonstrations (CA)*	-	35.500	57.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	92.500

Note

In FY 2020 this PE is being eliminated, with continuity of effort realigned to the following PEs:
? 0603119A (Ground Advanced Technology)
? 0603462A (Next Generation Combat Vehicle Advanced Technology)

A. Mission Description and Budget Item Justification

This PE matures, integrates and demonstrates combat and tactical vehicle automotive technologies that enable a lighter, more mobile and more survivable force. This PE executes the Army's Combat Vehicle Prototyping program to mature, integrate and demonstrate ground vehicle leap ahead technologies in support of future combat vehicles. Project 221 (Combat Vehicle Survivability) matures, integrates and demonstrates protection and survivability technologies such as active protection systems, advanced vehicle armors, blast mitigation and occupant safety devices to address both current and emerging advanced threats to ground vehicles. Project 441 (Combat Vehicle Mobility) matures and demonstrates advanced ground vehicle power and mobility technologies such as powertrains, power generation and storage, water and fuel logistics, and running gear subsystems for military ground vehicles to enable a more efficient, mobile and deployable force. Project 497 (Combat Vehicle Electro) matures, integrates, and demonstrates vehicle electronics hardware (computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms) and software that result in increased crew efficiencies, vehicle performance, reduced size, weight, and power (SWaP) burdens and vehicle maintenance costs. Project 515 (Robotic Ground Systems) matures and demonstrates unmanned ground vehicle (UGV) technologies with a focus on sensors, perception hardware and software, and robotic control algorithms that enable UGV systems to maneuver on and off road at speeds which meet mission requirements with minimal human intervention.

In FY 2018/FY 2019, work in this PE is coordinated with, PE 0602105A (Materials), 0602120A (Sensors and Electronic Survivability, Robotics Technology), 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology), 0602624A (Weapons and Munitions Technology), 0602705A (Electronics and Electronic Devices), 0602784 (Military Engineering Technology), 0603001A (Warfighter Advanced Technology), 0603004A (Weapons and Munitions Advanced Technology), 0603005 (Combat Vehicle and Automotive Advanced Technology), 0603125A (Combating Terrorism Technology Development), 0603270A (Electronic Warfare Technology), 0603313A (Missile and Rocket Advanced Technology), 0603734 (Military Engineering Advanced Technology), 0604115A (Technology Maturation Initiatives), and 0708045A (Manufacturing Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603005A *I Combat Vehicle and Automotive Advanced Technology*

Beginning in FY 2020, work in this PE is related to, and fully coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), and 0603119A (Ground Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this PE is performed by the U.S. Army Futures Command.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	125.537	119.739	118.783	-	118.783
Current President's Budget	154.084	176.622	0.000	-	0.000
Total Adjustments	28.547	56.883	-118.783	-	-118.783
• Congressional General Reductions	-0.083	-0.117			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	35.500	57.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.942	-			
• SBIR/STTR Transfer	-3.928	-			
• Adjustments to Budget Years	-	-	-118.783	-	-118.783

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 533: *Ground Vehicle Demonstrations (CA)*		
Congressional Add: *Congressional add for Ground Vehicle Demonstrations - Advanced Materials Development, Combat Vehicle Weight Reduction, and HMMWV Power Management.*	35.500	-
Congressional Add: *Program increase - lightweight technology for ground combat and tactical vehicles*	-	10.000
Congressional Add: *Program increase - advanced water harvesting technology*	-	5.000
Congressional Add: *Program increase - fuel cell research*	-	5.000
Congressional Add: *Program increase - airless tire technology demonstration*	-	4.000
Congressional Add: *Program increase - HMMWV automotive enhancements*	-	10.000
Congressional Add: *Program increase - HMMWV autonomy*	-	3.000
Congressional Add: *Program increase - HMMWV power system*	-	2.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603005A *I Combat Vehicle and Automotive Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Congressional Add: *Program increase - HMMWV torque monitoring*	-	3.000
Congressional Add: *Program increase - multi-sensor augmented reality system*	-	5.000
Congressional Add: *Program increase - combat vehicle weight reduction initiative*	-	10.000
Congressional Add Subtotals for Project: 533	35.500	57.000
Congressional Add Totals for all Projects	35.500	57.000

Change Summary Explanation

FY18 congressional adds for Program increase ($6.500 million), Advanced materials development ($10.000 million), Combat vehicle weight reduction initiative ($10.000 million), and HMMWV power management ($3.000 million).

FY19 congressional adds for lightweight technology for ground combat and tactical vehicles ($10.000 million), advanced water harvesting technology ($5.000 million), fuel cell research ($5.000 million), airless tire technology demonstration ($4.000 million), HMMWV automotive enhancements ($10.000 million), HMMWV autonomy ($3.000 million), HMMWV power system ($2.000 million), HMMWV torque monitoring ($3.000 million), multi-sensor augmented reality system for tactical land vehicles ($5.000 million), and combat vehicle weight reduction initiative ($10.000 million).

FY20 decrease - Ongoing work transferred to other PEs due to science and technology (S&T) financial restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	Project (Number/Name) 221 / *Combat Veh Survivablty*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
221: *Combat Veh Survivablty*	-	58.077	60.029	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	118.106

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BG7 Ground Systems Active Defense (GSAD) Advanced Technology
* BH1 Survivability Systems Controls Advanced Technology
* BH4 Ground Vehicle Holistic Defense Advanced Technology
* BI5 Materials Application & Integration Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates protection and survivability technologies such as active protection systems (APS), advanced vehicle armors, blast mitigation and occupant safety devices to address both current and emerging advanced threats to ground vehicles. This Project integrates complimentary survivability technologies to enable advanced protection suites, providing greater survivability and protection against emerging threats. This Project executes the Army's APS program to mature and demonstrate APS technologies in order to increase protection against current and emerging advanced threats while maintaining or reducing vehicle weight by reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection and active countermeasures. This Project develops an APS Common Architecture that defines the component interface standards and component specifications enabling adaptable APS solutions that can be integrated across Army vehicle platforms as required.

Work in this Project supports the Army Science and Technology Ground Maneuver Portfolio.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Vision Protection:	4.708	-	-
Description: This effort matures and integrates devices to protect occupant's eyes, vehicle cameras, and electro optic fire control systems against anti sensor laser devices as well as reduces the sensor's optical signature. Anti-sensor laser devices can deny vision either temporarily by flooding the sensor with too much light (jamming) or permanently by damaging the sensor. These jamming or damaging effects can slow our battle tempo, disrupt fire control solutions, or prevent vehicles from completing their mission. This effort focuses on demonstrating the effectiveness of optical systems that protect sensors and Warfighter vision from pulsed, continuous wave and future laser threats to maintain fire control capability and situational awareness. Coordinated work			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
is also being performed in Program Elements (PEs) 0602120A (Sensors and Electronic Survivability), 0602705A (Electronics and Electronic Devices), 0602712A (Countermine Systems), and 0602786A (Warfighter Technology).			
Title: Advanced Armor Technologies: ***Description:*** This effort matures, fabricates, integrates, and evaluates advanced ground vehicle armor systems such as advanced passive kinetic energy armor, explosive reactive armor, electromagnetic armor, and adaptive armor. The goal is to optimize armor system technologies and integration methodologies to reduce overall armor system weight; create and mature scalable / modular / common armor system integration standards for the advanced armor technologies; create armor system test & evaluation standards for advanced armor technologies and leverages the standards for armor component and armor system maturation; refine armor modeling and simulation system engineering process to incorporate advances in armor technologies. This effort is done in coordination with efforts in PEs 0602105A (Materials Technology), 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology) , and 0708045A (Manufacturing Technology). ***FY 2019 Plans:*** Validate integrated subsystem performance for passive (B-kit) and reactive armor (C-kit) against weight and cost objectives; will complete ballistic performance testing of the B-kit and C-kit armor subsystems; will mature adaptive armor solution and optimize for integration with Modular Active Protection System (MAPS) surrogate subsystems into subsystem demonstrator to maximize performance; will verify refined subsystem design through modeling and simulation. Will conduct a demonstration of adaptive armor solutions to verify ballistic performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort will transition to PE 0603462A NGCV Advanced Technology) / Project BG7 (Ground Systems Active Defense Advanced Technology) as part of the financial restructure to continue advanced armor development.	12.647	15.364	-
Title: Occupant Centric Protection (OCP) Technologies: ***Description:*** This effort matures and validates design philosophies, guidelines, military standards, handbooks, etc. that embody a focused, systems engineering approach to occupant centric protection in vehicle design. This is accomplished using tools such as modeling and simulation, full vehicle and subsystem demonstrators, evaluations and component optimizations. This effort addresses and validates the products from requirements generation through design and build to incorporate occupant centric philosophies. This effort is done in coordination with efforts in PEs 0602601A (Combat Vehicle and Automotive Technology)and 0602618A (Ballistics Technology).	3.944	-	-
Title: Blast Mitigation:	10.274	7.574	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort fabricates and matures advanced survivability and protection components, tools, and subsystems for enhanced protection against vehicle mines, improvised explosive devices (IEDs) and other underbody blast threats, and vehicle collision and rollover events that result from blast events. This effort also integrates and improves occupant protection technologies such as seats and restraints. This effort creates the laboratory capability needed to enable expeditious performance evaluation through modeling & simulation (M&S), experimentation, and instrumented test of blast mitigating technologies in such areas as active and passive exterior/hull/cab/kits, interior energy absorbing capabilities for seats, floors, restraints, and sensors for active blast mitigating technologies. This effort is done in coordination with efforts in PE 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Conduct component design improvements for seats, restraints, flooring, structures and active blast technologies based on component level test results. Will assess blast technology form, fit and function in an integrated blast mitigation system prior to system level integration. Will fabricate seats, restraints, flooring, structures and active blast components to be integrated into a system demonstrator for vehicle section durability and blast testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort will transition to PE 0603462A (NGCV Advanced Technology) / Project BG7 (Ground Systems Active Defense Advanced Technology) as part of the financial restructure to continue development of active blast technology.			
Title: Vehicle Fire Protection: ***Description:*** This effort matures, integrates, and demonstrates technologies to minimize vehicle and crew vulnerabilities to fires in current and future military ground vehicles. Supporting technologies include modeling & simulation, sensor systems, software, chemical agents, fire-resistant materials, and hardware components. This effort is done in coordination with efforts in PE 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Continue to evaluate no/low global warming potential (GWP) agents through full scale testing. Will mature vehicle fire protection concepts for the next generation of combat vehicles to improve integration feasibility and effectiveness. Will develop concepts and technologies to conduct fuel containment and fire prevention. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This program ends in FY 2019 to adjust for higher priority efforts.	2.547	2.628	-
Title: Hit Avoidance Technologies:	22.467	28.895	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures, integrates, and demonstrates hard-kill (physical countermeasure) and soft-kill (non-kinetic countermeasure such as electronic jamming or spoofing) Active Protection System (APS) components and integrated systems to verify the APS Common Architecture and reduce integrating risk on current systems. In demonstrating hard-kill and soft kill-active protection technologies, requirements, and specifications will be matured for future integration onto tactical and combat vehicle platforms. This effort is coordinated with efforts in PEs 0602601A, 0602618A, 0603004A, 0603270A, 0603313A, and 0604115A ***FY 2019 Plans:*** Complete MAC software updates based on improvements required from previous demonstrations and testing. Will integrate updated software into the MAC. Will complete a virtual demonstration of hard-kill systems integrated on current vehicle platforms. Will complete the integration of the MAC to demonstrate and validate a soft-kill and hard-kill APS configuration on a demonstrator platform against various threats in various environmental conditions; will complete fabrication and integration of soft-kill and hard-kill system with the MAC on a platform demonstrator. Will complete demonstration and testing of a layered soft-kill and hard-kill active protection system integrated on a platform demonstrator to validate MAC modularity and system performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort is transitioning to PE 0603642A (NGCV Advanced Technology) / Project BH1 (Survivability Systems Controls Advanced Technology) as part of the financial restructure to continue MAC development incorporating additional survivability subsystems.			
Title: System Design Optimization for Lightweighting: ***Description:*** This effort will focus on optimization of platform design to reduce weight in both traditional and novel methods. This effort will demonstrate best practices in cost-conscious, multi-material design for components to reduce ground vehicle weight, as well as demonstrate holistic weight reduction with informed system and component-level design decisions. This will be accomplished by using and evaluating design tools, advanced materials, manufacturing processes and assembly technologies to design lightweight systems, develop lightweight components and enhance the ability to use novel approaches for lightweighting. This effort leverages lessons learned from prior and ongoing individual component efforts within industry, academia and Department of Defense (DoD). This effort is done in coordination with efforts in PEs 0602601A (Combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology), 0603005A (Combat Vehicle and Automotive Advanced Technology), and 0708045A (Manufacturing Technology). ***FY 2019 Plans:*** Assess the modeling and simulation data to provide metrics validating the value of Light Weighting to improve transportability, increase fuel economy and increase SWaP-C. Will continue to evaluate advanced materials and their ability to optimize weight	1.490	3.865	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 221 / *Combat Veh Survivablty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
while maintaining or improving performance. Will conduct Modeling & Simulation to evaluate the impact of lightweight materials on vehicle subsystem loading. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603462A (NGCV Advanced Technology) / Project BI5 (Materials Application and Integration Advanced Technology) as part of the financial restructure.			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	1.703	-
Accomplishments/Planned Programs Subtotals	58.077	60.029	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	Project (Number/Name) 441 / *Combat Vehicle Mobilty*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
441: *Combat Vehicle Mobilty*	-	32.413	26.485	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	58.898

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603119A Ground Advanced Technology, Projects:
* BK9 Ground System Fluids and Fuels Adv Tech
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BF7 Crew Augmentation and Optimization Adv Tech
* BG4 Adv Mobility Experimental Prototype Adv Tech Demo
* BH6 Platform Electrification and Mobility Adv Tech
* BI8 All-Electric Combat Powertrain Advanced Technology
* BJ1 Vehicle System Security Advanced Technology
* BJ6 Hydrogen Based Combat System Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced mobility and onboard electrical power technologies for combat and tactical vehicles to enable lightweight, agile, deployable, fuel efficient and survivable ground vehicles. Technologies include advanced propulsion, engines, transmissions, power, and electrical components and subsystems. This Project will also mature and demonstrate advanced mechanical and electrical power generation systems to increase available onboard electrical power to enable future capabilities such as next generation communications and networking, improvised explosive device jamming systems and next generation sensor devices can be supported on combat and tactical vehicles. This Project also matures and demonstrates water and fuel logistics technologies.

Work in this Project supports the Army Science and Technology Ground Maneuver portfolio.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Onboard Vehicle Electric Power Component Development:	3.992	2.838	-
Description: This effort focuses on meeting the Army's demand for more onboard vehicle electric power (OBVP) to enable technologies such as advanced survivability systems, situational awareness systems and the Army network. This effort matures, integrates, and demonstrates onboard vehicle power components to include electrical power generation machines and associated power converters such as high temperature inverters and converters, advanced control algorithms, and high efficiency power conversion (mechanical to electrical) components. Additionally, it matures and integrates advanced electric machines such			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
as Integrated Starter Generator and their controls for mild hybrid (System that integrated electric machines to assist internal combustion engines for propulsion) electric propulsion and high power electric generation. Coordinated work is also being conducted under Program Element (PE) 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Continue to exploit SIL system optimization, performance, and reliability pushing components to higher powertrain operating temperatures and finalizing OBVP system communication/ network architecture; integrate and optimize advanced OBVP system with an advanced powertrain to include thermal management and define interface with vehicle power management controls; optimize control algorithms for intelligent engine start/stop for the minimization of idle fuel usage. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This project ends in FY 2019.			
Title: Advanced Running Gear: ***Description:*** This effort matures and demonstrates running gear components and advanced suspension technologies to increase vehicle mobility and durability in response to increased ground vehicle platform weights. Components and subsystems include new elastomer compounds, lightweight, survivable track systems and road wheels, advanced compensating track tensioners, advanced damping suspension technologies, Electronic Stability Control (ESC) systems, and preview sensing technologies linked to advanced suspension designs. Coordinated work is also being conducted under PE 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Continue to mature and demonstrate an integrated advanced track and suspension solution for a medium combat vehicle; optimize the advanced track and suspension solution to provide increased mobility at a reduced weight; demonstrate and improve durability and exploit new design to reduce maintenance tasks as compared to currently fielded track solutions; fabricate components to demonstrate an integrated system for design optimization of an advanced medium combat vehicle running gear system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort is transitioning to PE 0603462A (NGCV Advanced Technology) / Project BG4 (Advanced Mobility Experimental Prototype Adv Tech Demo) as part of the financial restructure to continue integrating the advanced running gear into a vehicle system.	3.452	2.140	-
Title: Combat Vehicle Subsystem Demonstrations ***Description:*** This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, and vehicle architecture and systems integration. The primary focus	12.313	8.112	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
of this activity is to mature and demonstrate a series of subsystem demonstrators building off of previous investment in ground combat acquisition and technology programs with the purpose of maturing key technologies to refine and inform future platform requirements and reduce risks in critical ground combat vehicle technology areas. Specifically, this effort focuses on maturing and demonstrating ground combat vehicle mobility technologies such as powertrain subsystems and systems integration technologies such as vehicle structures and concept demonstrators. This effort seeks to optimize platform efficiency and growth potential to ensure the combat fleet is able to accept new technologies as they are developed to bring advanced capability for the Warfighter. This effort is executed in coordination with PEs 0602601A (combat Vehicle and Automotive Technology), 0602618A (Ballistics Technology), 0603004A (Weapons and Munitions Advanced Technology), and 0603125A (Combating Terrorism Technology Development). ***FY 2019 Plans:*** Fabricate advanced propulsion components such as advanced engine, advanced transmission, and advanced thermal management system; continue to optimize next generation combat vehicle with advanced technologies and lessons learned to allow for flexible, scalable and modular technologies; integrate and optimize components from powertrain to demonstrate advanced technologies, capabilities, and improved performance; validate mobility and occupant protection analyses, trade studies, and concepts to inform the advanced combat vehicle survivability demonstrator; continue to evaluate and optimize concept platform configurations to reduce gaps in operational capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort will transition to PE 0603462A (NGCV Advanced Technology) / Project BG4 (Advanced Mobility Experimental Prototype) as part of the financial restructure to continue maturation of the advanced powertrain.			
Title: Energy Storage Systems Development: ***Description:*** The goal of this work is to mature energy storage systems to both enable silent watch capability and increased survivability through power brick energy storage components for pulse power electromagnetic armor. This is accomplished through the maturation and demonstration of advanced ground vehicle energy storage devices such as advanced chemistry batteries, high energy density capacitors, and power brick batteries for pulse power. This effort leverages commercial industry battery development efforts to reduce battery volume and weight while improving their energy and power densities. This effort also matures and optimizes a common specification for battery management systems to improve the battery state of charge indicator accuracy and battery state of health information to reduce the frequency of battery replacement and optimize starting, lighting, and ignition functions. Coordinated work is also being conducted under PEs 0602601A (Combat Vehicle and Automotive Technology) and 0602705A (Electronics and Electronic Devices). ***FY 2019 Plans:***	2.945	3.137	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Continue to optimize advanced form factor (6T) Lithium-ion battery pack system level performance and durability to decrease recharge time, weight, and volume; improve the integrated battery management system and demonstrate optimized combat vehicle power management synchronization and safety; continue to demonstrate safe logistical transportation of Lithium-ion battery packs with the Navy, improve the Li-ion specification, and inform combat vehicle standardized interfaces to reduce logistics costs. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This project ends in FY 2019.			
Title: Propulsion and Thermal Technologies: ***Description:*** This effort matures high power density engines and transmission systems needed to offset increasing combat vehicle weights (armor), increased electrical power generation needs (onboard communications, surveillance and exportable power), improved fuel economy (fuel cost and range), enhanced mobility (survivability), and reduced cooling system burden (size and heat dissipation). This effort also matures thermal management including heat energy recovery, propulsion and cabin thermal management sub-systems to utilize waste heat energy and meet objective power and mobility requirements on combat and tactical vehicles. Lastly, this effort maximizes efficiencies within propulsion and thermal systems to reduce thermal burden on the vehicle while providing the same or greater performance capability. This effort is executed in coordination with PE 0604115A (Technology Maturation Initiatives). ***FY 2019 Plans:*** Complete interface and software maturation of opposed piston engine, advanced thermal management, advanced combat transmission for integration into advanced combat propulsion system; optimize the control strategy for each component and develop supervisory controls for integration of the advanced propulsion system; complete design of components needed to integrate the advanced combat propulsion system into hull for demonstration; demonstrate and validate advanced propulsion system controls calibration and efficient operation to meet combat vehicle electrical power and mobility requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This project ends in FY 2019.	4.831	4.793	-
Title: Force Projection: ***Description:*** This effort focuses on reducing the logistics footprint, improving fuel efficiency, and ensuring mobility by maturing and demonstrating technologies in areas such as water purification, generation, quality monitoring, storage and distribution and wastewater treatment and reuse; petroleum quality monitoring, filtration, storage and distribution, hydraulic fluids; alternative fuels and fuel additives; lubricants, oil, powertrain fluids and coolants. This effort is done in coordination with efforts in PE 0602601A (Combat Vehicle and Automotive Technology).	4.880	2.206	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Continue to demonstrate energy efficient waste water treatment and recycling technologies to support sustainability logistics basing; continue to optimize performance of synthetic fuel blends made from non-petroleum sources to determine suitability for military ground systems that will allow for an increase in energy security; validate that the fuel efficient gear oils maintain and improve vehicle axle durability and provide extended performance time over current gear oil, as well as limited slip performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603119A (Ground Advanced Technology) / Project BK9 (Ground System Fluids and Fuels Advanced Technology) as part of the financial restructure.			
Title: Crew Augmentation ***Description:*** This effort focuses on optimizing crew station technologies while reducing crew sizes that will provide the same overall performance by exploiting human interaction technologies, automations, machine intelligence and customization to permit soldiers to achieve performance beyond today?s constrained ground vehicle environment. ***FY 2019 Plans:*** Mature software and demonstrate simulations to provide workload, span of control and mission performance data to show improved soldier performance through customization, machine augmented, information sorting, and weapon engagement software and algorithms; continue demonstrating that crew size reduction can provide the same overall performance by validating technical assessments that will provide a strong knowledgebase to support future crew stations efforts. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603462A (NGCV Advanced Technology) / Project BF7 (Crew Augmentation and Optimization Advanced Technology) as part of the financial restructure.	-	2.547	-
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.712	-
Accomplishments/Planned Programs Subtotals	32.413	26.485	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 441 / *Combat Vehicle Mobilty*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	Project (Number/Name) 497 / *Combat Vehicle Electro*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
497: *Combat Vehicle Electro*	-	6.934	7.208	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	14.142

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BH8 Enhanced VETRONICS Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates vehicle electronics hardware such as computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms as well as vehicle software to enhance crew performance, increase vehicle fuel efficiency, reduced Size, Weight, and Power (SWaP) burdens and reduce vehicle maintenance costs. This Project also advances open system architectures (power and data) for military ground vehicles to enable common interfaces, standards and hardware implementations. The overall vehicle system architecture is known as the Vehicle Integration for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance / Electronic Warfare (C4ISR/EW) Interoperability (VICTORY), which is a long term technology effort that provides an open architecture that will allow platforms to accept future technologies without the need for significant re design as new technologies are developed and integrated. Additionally this Project matures autonomy architectures that enable the ease of integration of autonomous subsystem technologies into future and existing tactical and combat vehicle architectures. Technical challenges include: software and algorithm development for increased levels of automation for both manned and unmanned systems, secure vehicle data networks, interoperability of intra vehicle systems, and implementation of advanced user interfaces. Overcoming these technical challenges enables improved and increased span of collaborative vehicle operations, efficient workload management, commander's decision aids, embedded simulation for battlefield visualization and fully integrated virtual test/evaluation.

Work in this Project supports the Army Science and Technology Ground Maneuver portfolio.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Vehicle Electronics Integration Technologies:	2.832	2.803	-
Description: This effort matures, demonstrates and implements next generation military ground vehicle electronics and electrical power open architectures for future ground combat and tactical vehicle systems. Mature and demonstrate technologies to include: next generation video/data networking and computing equipment, Silicon Carbide high voltage power electronics and low voltage smart power distribution. Technologies will reduce currently fielded vehicle overall size, weight and power concerns for vehicle electronics. This effort is coordinated with efforts in PE 0602601A (Combat Vehicle and Automotive Technology).			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 497 / *Combat Vehicle Electro*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Will validate the matured technology demonstration designs and technologies from the VEA Research SIL in a current combat vehicle platform to validate enhanced performance specifications for open power, data, network interface requirements, standards and architectural design patterns. Will validate integrated Silicon Carbide (SiC) power system functionality. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort transitions to PE 0603462A (NGCV Advanced Technology) / Project BH8 (Enhanced VETRONICS Advanced Technology) as part of the financial restructure.			
Title: Vehicle Electronics Architecture and Standards: ***Description:*** This effort matures technologies and standards for existing and future combat and tactical ground vehicles. Open commercial standards will be evaluated and modified for use in military ground vehicles and possible inclusion in the Army's open, non-proprietary intra-vehicle data network e.g., VICTORY. This effort will also evaluate standards and components for suitability of integration into vehicle platforms. This effort also supplements the design of electronic architectures to support the efficient integration of electronic components into vehicle systems through the use of open standards. Additionally, this effort matures and expands the VICTORY effort to interface with the Modular Active Protection System (MAPS) Architecture. This effort is coordinated with PEs 0602601A (Combat Vehicle and Automotive Technology) and 0603005A (Combat Vehicle and Automotive Advanced Technology). ***FY 2019 Plans:*** Validate the open data and power architecture capabilities as the VMD is prepared for demonstration. Will validate the MAPS standard interface definitions to mature compliant systems that support the efficient integration of electronics components into vehicle systems through the use of open standards. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort will transition to PE 0603462A (NGCV Advanced Technology) / Project BH8 (Enhanced VETRONICS Advanced Technology) as part of the financial restructure.	2.765	3.015	-
Title: Autonomous Vehicle Architecture: ***Description:*** This project matures, integrates, and demonstrates an improved, optimized autonomy-enabled distribution architecture that eases integration of new and emerging technologies across the full spectrum of operational and tactical supply movement operations. This project addresses systems integration challenges by providing the appropriate fault tolerant architecture design artifacts that will allow ease of integration for autonomy enablement kits, autonomy enablement software, and end-to-end sustainment and tactical ground resupply capability through use of open systems interfaces. This effort is	1.337	1.175	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 497 / *Combat Vehicle Electro*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
coordinated with efforts in PEs 0602120A (Sensors and Electronic Survivability), and 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Continue to mature and validate the common system architecture for autonomous vehicles by demonstrating autonomous vehicle architecture, algorithm software modules, a common interface and hardware and software integration across the full spectrum of operational and tactical supply movement operations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this effort realigns to PE 0603462A (NGCV Advanced Technology) / Project BH8 (Enhanced VETRONICS Advanced Technology) as part of the financial restructure.			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.215	-
Accomplishments/Planned Programs Subtotals	6.934	7.208	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	Project (Number/Name) 515 / *Robotic Ground Systems*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
515: *Robotic Ground Systems*	-	21.160	25.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	47.060

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BF4 Combat Vehicle Robotics Adv Tech
* BK1 Autonomous Mobility Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies to enable Unmanned Ground Vehicles (UGV) including sensor technologies, perception hardware and software, and control technologies that allow the Soldier to perform mission tasks more efficiently. Challenges addressed include: obstacle avoidance, overcoming perception limitations, intelligent situational behaviors, command and control by Soldier operators, frequency of human intervention, operations in adverse weather, and autonomy enabled vehicles protecting themselves and their surroundings from intruders. Mature technologies are incorporated onto existing, Army owned UGV technology demonstrators so that performance of the enabling technologies can be evaluated.

The approach builds upon, complements, and does not duplicate previous and ongoing investments conducted under the Joint Robotics Program Office. Work in this Project supports the Army Science and Technology Ground Maneuver Portfolio. Ground Maneuver Portfolio investments are greatly improving logistics throughput and surge capability supporting maneuver forces (Leader Follower technology) and allow experimentation with manned and unmanned teams to develop the advantages that inform/protect the maneuver force (Robotic Wingman JCTD).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Unmanned Ground Systems Technology:	13.388	8.955	-
Description: This program matures, integrates, and demonstrates advanced robotic and autonomous technologies for the tactical and combat vehicle fleets. Unmanned ground systems technologies can be employed to overcome critical Army challenges to include automated resupply and sustainment, and reduced physical and cognitive burden. Challenges can be met by utilizing relevant technologies such as behavior algorithms, autonomy kits, sensor integration, advanced navigation and planning, object and local environment manipulation, local situational awareness, advanced perception, vehicle and pedestrian safety, and robotic command and control. This effort is coordinated with efforts in Program Elements (PEs) 0602120A (Sensors Electronic			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 515 / *Robotic Ground Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Survivability), 0602601A (Combat Vehicle and Automotive Technology), 0602784A (Military Engineering Technology), 0603001A (Warfighter Advanced technology), and 0603734A (Military Engineering Advanced Technology). ***FY 2019 Plans:*** Mature and develop an improved and optimized distribution system that integrates new and emerging technologies across the full spectrum of operational and tactical supply movement operations. Will continue to optimize common interfaces and open architecture. Will mature hardware-in-the-loop simulators to optimize cargo & vehicle configurations and implementations of autonomous ground resupply on realistic routes. Will continue to improve test & evaluation procedures for robotic systems utilizing modeling and simulation tools that will increase vehicle and pedestrian safety along with robotic control and command. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, funding realigns to PE 0603462A (NGCV Advanced Technology) / Project BF4 (Combat Vehicle Robotics Advanced Technology) as part of the financial restructure.			
Title: Autonomous Ground Vehicle Architecture Integration and Demonstration	7.772	16.001	-
Description: This project matures, integrates, and demonstrates advanced robotic and autonomous foundational architecture and the technologies to enable tactically relevant unmanned ground systems. Technologies focused on creating an open Autonomous Ground Vehicle Reference Architecture for all future unmanned platforms, improved tactical and maneuver intelligence and behavior algorithms based off the architecture, sensor integration and advanced perception for off road, manned and unmanned teaming for the tactical environment, and enabling the integration of weapons and vehicle self-protection capabilities. This effort is coordinated with efforts in PEs 0602120A (Sensors and Electronic Survivability), 0602601A (Combat Vehicle and Automotive Technology), 0602784A (Military Engineering Technology), 0603001A (Warfighter Advanced Technology), and 0603734A (Military Engineering Advanced Technology). ***FY 2019 Plans:*** Mature and develop an improved and optimized distribution system that integrates new and emerging technologies across the full spectrum of operational and tactical supply movement operations. Will continue to optimize common interfaces and architecture for all future autonomous ground vehicle development. Will mature and define open architecture design, data buses and messages. Will exploit automation software and algorithms to increase platform autonomy in increasing complex environments and mission applications. Will mature & demonstrate scalable autonomy in a single material solution agnostic of platform. ***FY 2019 to FY 2020 Increase/Decrease Statement:***			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 515 / *Robotic Ground Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Beginning in FY 2020, this funding realigns to PE 0603642A (NGCV Advanced Technology) / Project BF2 (Autonomous Ground Resupply Advanced Technology) as part of the financial restructure.			
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.944	-
Accomplishments/Planned Programs Subtotals	21.160	25.900	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3				R-1 Program Element (Number/Name) PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*				Project (Number/Name) 533 / *Ground Vehicle Demonstrations (CA)*				
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
533: *Ground Vehicle Demonstrations (CA)*	-	35.500	57.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	92.500

A. Mission Description and Budget Item Justification

These are Congressional Interest Items

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Congressional add for Ground Vehicle Demonstrations - Advanced Materials Development, Combat Vehicle Weight Reduction, and HMMWV Power Management. ***FY 2018 Accomplishments:*** Congressional add for Ground Vehicle Demonstrations - Advanced Materials Development, Combat Vehicle Weight Reduction, and HMMWV Power Management.	35.500	-
Congressional Add: Program increase - lightweight technology for ground combat and tactical vehicles ***FY 2019 Plans:*** Program increase - lightweight technology for ground combat and tactical vehicles	-	10.000
Congressional Add: Program increase - advanced water harvesting technology ***FY 2019 Plans:*** Program increase - advanced water harvesting technology	-	5.000
Congressional Add: Program increase - fuel cell research ***FY 2019 Plans:*** Program increase - fuel cell research	-	5.000
Congressional Add: Program increase - airless tire technology demonstration ***FY 2019 Plans:*** Program increase - airless tire technology demonstration	-	4.000
Congressional Add: Program increase - HMMWV automotive enhancements ***FY 2019 Plans:*** Program increase - HMMWV automotive enhancements	-	10.000
Congressional Add: Program increase - HMMWV autonomy ***FY 2019 Plans:*** Program increase - HMMWV autonomy	-	3.000
Congressional Add: Program increase - HMMWV power system ***FY 2019 Plans:*** Program increase - HMMWV power system	-	2.000
Congressional Add: Program increase - HMMWV torque monitoring	-	3.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603005A / *Combat Vehicle and Automotive Advanced Technology*	**Project (Number/Name)** 533 / *Ground Vehicle Demonstrations (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
FY 2019 Plans: Program increase - HMMWV torque monitoring		
Congressional Add: Program increase - multi-sensor augmented reality system	-	5.000
FY 2019 Plans: Program increase - multi-sensor augmented reality system		
Congressional Add: Program increase - combat vehicle weight reduction initiative	-	10.000
FY 2019 Plans: Program increase - combat vehicle weight reduction initiative		
Congressional Adds Subtotals	35.500	57.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603006A *I Space Application Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	39.277	48.985	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	88.262
257: *DIGITAL BATTLEFLD COMM (CA)*	-	27.500	36.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.500
592: *Space Application Tech*	-	11.777	12.985	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.762

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being realigned to the following PE:
* 0603463A Network C3I Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates advanced space technologies that support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, Department of Defense (DoD), and Army space policies. This PE provides applications for enhanced intelligence, reconnaissance, surveillance, target acquisition, position/navigation/timing, missile warning, ground-to-space surveillance, and command and control capabilities. Project 592 matures and demonstrates networked and integrated surveillance, communications, and command and control capabilities for high altitude and tactically responsive space payloads to enable information superiority, enhanced situational awareness, and support global assured access enabling distributed tactical operations.

Work in this PE complements the work in PE 0602120A (Sensors and Electronic Survivability), PE 0603008A (Electronic Warfare Advanced Technology), and PE 0603794A (Command, Control, and Communications Advanced Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering Science and Technology (S&T) priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	12.231	13.000	13.986	-	13.986
Current President's Budget	39.277	48.985	0.000	-	0.000
Total Adjustments	27.046	35.985	-13.986	-	-13.986
• Congressional General Reductions	-0.009	-0.015			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	27.500	36.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.445	-			
• Adjustments to Budget Years	-	-	-13.986	-	-13.986

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 257: *DIGITAL BATTLEFLD COMM (CA)*		
Congressional Add: *Tactical Small Launch*	20.000	20.000
Congressional Add: *Global Communications Research*	7.500	10.000
Congressional Add: *Assured Positioning, Navigation and Timing for Space and Missile Defense Assets*	-	6.000
Congressional Add Subtotals for Project: 257	27.500	36.000
Congressional Add Totals for all Projects	27.500	36.000

Change Summary Explanation

FY18 congressional adds for Tactical small launch ($20.000 million) and Global communications research ($7.500 million).
FY19 congressional adds for: assured positioning, navigation, and timing for space and missile defense assets ($6.000 million); global communications research ($10.000 million); and tactical small launch ($20.000 million).
FY20 decrease - PE eliminated due to science and technology (S&T) Financial Restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603006A / *Space Application Advanced Technology*	Project (Number/Name) 257 / *DIGITAL BATTLEFLD COMM (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
257: *DIGITAL BATTLEFLD COMM (CA)*	-	27.500	36.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	63.500

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Space Application Advanced Technology as specified in Appropriations Act Conference Reports.

Congressional adds fund efforts to: adapt and mature Conventional Prompt Strike technologies in both the payload delivery vehicle and the payload to meet the Army's emerging long range fires requirements; mature design of glide body, optimize flight-proven navigation, guidance, and control system, and exploit internal layout and design of current vehicle to meet required range, payload, and lethality capabilities; mature and demonstrate Space and High Altitude based global communications technologies and multi-payload/platform communication and prioritization protocols in order to demonstrate commanders guaranteed access to critical communications and position and timing to ensure mission command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Tactical Small Launch ***FY 2018 Accomplishments:*** Tactical Small Launch ***FY 2019 Plans:*** Tactical Small Launch	20.000	20.000
Congressional Add: Global Communications Research ***FY 2018 Accomplishments:*** Global Communications Research ***FY 2019 Plans:*** Global Communications Research	7.500	10.000
Congressional Add: Assured Positioning, Navigation and Timing for Space and Missile Defense Assets ***FY 2019 Plans:*** Assured Positioning, Navigation and Timing for Space and Missile Defense Assets	-	6.000
Congressional Adds Subtotals	27.500	36.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*	**Project (Number/Name)** 257 / *DIGITAL BATTLEFLD COMM (CA)*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603006A / *Space Application Advanced Technology*	Project (Number/Name) 592 / *Space Application Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
592: *Space Application Tech*	-	11.777	12.985	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.762

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* A06 Tag, Track and Locate Small Satellites Advanced Technology
* AV2 LEO Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates payloads, sensors, and data down link systems for tactically responsive space and high altitude platforms supporting Army ground forces. This Project matures, demonstrates, and integrates lightweight materials, hardware components with reduced power consumption, and advanced data collection, processing, and dissemination capabilities. This Project also develops algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems. These efforts support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the National, Department of Defense (DoD), and Army space policies.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Payload Technology Development	11.777	12.542	-
Description: This effort matures technologies for smaller, Warfighter-responsive sensor and communication small satellite constellations. Work related to standard Army networks is done in coordination with the Communications-Electronics Research Development and Engineering Center (CERDEC) and the Army Cyber Center of Excellence.			
FY 2019 Plans: Mature and demonstrate technologies to address Army gaps in tracking and locating capabilities for ground objects of interest; advance space-based data exploitation technologies and components, space-based signal detection/processing/dissemination technologies, and software algorithms; and demonstrate and exploit incremental advances made in tag, track, and location technologies and capabilities.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603006A / *Space Application Advanced Technology*	**Project (Number/Name)** 592 / *Space Application Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Program Element (PE) realigns to PE 0603463A/Project A06 (Tag, Track and Locate Small Satellites Advanced Technology and new effort Low Earth Orbit (LEO) Advanced Technology as part of the financial restructure and supports the Army?s Modernization Priorities.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.443	-
Accomplishments/Planned Programs Subtotals	11.777	12.985	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603007A *I Manpower, Personnel and Training Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	5.063	8.038	11.038	-	11.038	11.189	14.758	16.054	16.360	0.000	82.500
792: *Personnel Performance & Training*	-	5.063	8.038	11.038	-	11.038	11.189	14.758	16.054	16.360	0.000	82.500

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and validates applied behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g. unit cohesion). These technologies provide advanced personnel measures that more fully assess potential and predict performance, behavior, attitudes, and resilience. These technologies also provide innovative and effective Talent Management methods to optimize individual and team performance to ensure the Army can meet mission requirements in uncertain and complex environments. This PE evaluates new selection measures, assignment methods, and performance metrics for individuals and units, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Work in this PE will result in effective non-materiel solutions to help the Army adjust to changes in force size and structure, a variety of mission demands and contexts, challenges in human relations, and budgetary constraints.

Work in this PE complements and is fully coordinated with PE 0602785A (Manpower/Personnel/Training Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Vision, the Army's Talent Management Strategy, and the Army Modernization Strategy

Work in this PE is performed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	6.466	8.044	12.632	-	12.632
Current President's Budget	5.063	8.038	11.038	-	11.038
Total Adjustments	-1.403	-0.006	-1.594	-	-1.594
• Congressional General Reductions	-0.003	-0.006			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-1.260	-			
• SBIR/STTR Transfer	-0.140	-			
• Adjustments to Budget Years	-	-	-1.594	-	-1.594

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603007A *I Manpower, Personnel and Training Advanced Technology*

Change Summary Explanation

In FY 2020, funding reduction aligns program requirements to Army Modernization priorities in support of the National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	Project (Number/Name) 792 / *Personnel Performance & Training*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
792: *Personnel Performance & Training*	-	5.063	8.038	11.038	-	11.038	11.189	14.758	16.054	16.360	0.000	82.500

A. Mission Description and Budget Item Justification

This Project matures and validates applied behavioral and social science technologies that enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., unit cohesion). These technologies provide advanced personnel measures that more fully assess potential and predict performance, behavior, attitudes, and resilience. These technologies also provide innovative and effective Talent Management methods to optimize individual and team performance to ensure the Army can meet mission requirements in uncertain and complex environments. This Project evaluates new selection measures, assignment methods, and performance metrics for individuals and units, assesses innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Work in this Project will result in effective non-materiel solutions to help the Army adjust to changes in force size and structure, a variety of mission demands and contexts, challenges in human relations, and budgetary constraints.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Vision, the Army's Talent Management Strategy, and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences in Ft. Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Talent Assessment and Development	3.040	7.452	11.038
Description: Previously titled ?Talent Management",? this effort refines and assesses innovative talent management approaches to provide the Army the flexibility to adapt to changes in force structure and recruiting environments. This effort validates Soldier selection measures, techniques, and tools to more fully assess Soldier potential and better predict behavior, attrition, and performance. This effort also matures and validates methods to develop and model Soldier talents/competencies longitudinally across a career.			
FY 2019 Plans: Demonstrate differential prediction of cognitive and non-cognitive abilities among Military Occupational Specialty clusters for incorporation into the assignment process to support forecasting of future talent management and human performance needs in near-peer operational environments; provide research to assess the validity of integrated personnel assessments augmented with archival human capital data; provide research to empirically validate instructional approaches to prepare instructors/trainers			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	**Project (Number/Name)** 792 / *Personnel Performance & Training*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
to train complex skills required for emerging high-tempo operational environments that necessitate decisive and timely decision making (e.g., dense urban and distributed units). ***FY 2020 Plans:*** Will validate expanded screening tools to more comprehensively identify high-potential and high-risk individuals; will validate Leader and advisor competency-assessment methods; will mature assessment models augmented with archival human capital data. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Research into Talent Assessment and Development is being accelerated in support of the National Defense Strategy.			
Title: Unit Performance and Cohesion ***Description:*** Previously titled ?Personnel Readiness, Performance, and Conduct,? this effort will mature and refine measures and methods to ensure cohesive, high performing teams for future operational environments. This effort will mature and assess methods to optimize team composition to enhance unit performance, methods to rapidly build and sustain team cohesion, and metrics and assessments of unit performance, command climate, unit resilience, and cohesion. ***FY 2019 Plans:*** Refine measures of collective performance in combat training exercises. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work in this effort ends in FY19.	2.023	0.385	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.201	-
Accomplishments/Planned Programs Subtotals	5.063	8.038	11.038

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603007A / *Manpower, Personnel and Training Advanced Technology*	**Project (Number/Name)** 792 / *Personnel Performance & Training*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	39.302	22.631	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	61.933
B18: *DB18*	-	15.392	8.704	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.096
FH1: *Tractor Hike*	-	23.910	13.927	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	37.837

Note

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	40.552	22.631	23.041	-	23.041
Current President's Budget	39.302	22.631	0.000	-	0.000
Total Adjustments	-1.250	0.000	-23.041	-	-23.041
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-1.250	-	-23.041	-	-23.041

Change Summary Explanation

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) B18 / *DB18*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
B18: *DB18*	-	15.392	8.704	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	24.096

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603009A / *TRACTOR HIKE*				Project (Number/Name) FH1 / *Tractor Hike*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
FH1: *Tractor Hike*	-	23.910	13.927	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	37.837

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603015A *I Next Generation Training & Simulation Systems*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	15.778	28.650	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.428
S28: *Immersive Learning Environments*	-	0.464	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.464
S29: *Modeling & Simulation - Adv Tech Dev*	-	6.023	17.122	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	23.145
S31: *Modeling And Simulation Infrastructure Technology*	-	9.291	8.528	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.819

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PE:
? 0603118A Soldier Lethality Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates tools to enable effective training capability for the Warfighter. Project S28 matures and demonstrates simulation technologies developed by the Institute for Creative Technologies (ICT) at the University of Southern California. Project S29 incorporates advanced modeling and simulation (M&S), training, and leader development technology into immersive training demonstrations as well as demonstrates a framework for future embedded training and simulation systems for future force combat and tactical vehicles, and dismounted Soldier systems. Project S31 develops, integrates and demonstrates an overarching M&S architecture that incorporates multi-resolution, entity-based models, simulations, and tools to enable Network-Centric Warfare M&S capability.

Work in this PE complements and is fully coordinated with efforts in PE 0602308A (Advanced Concepts and Simulation), PE 0602785A (Manpower/Personnel/Training Technology), PE 0602787A (Medical Technology) and PE 0603007A (Manpower, Personnel and Training Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy. FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work is performed by the U.S. Army Futures Command.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603015A *I Next Generation Training & Simulation Systems*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	16.434	25.682	26.471	-	26.471
Current President's Budget	15.778	28.650	0.000	-	0.000
Total Adjustments	-0.656	2.968	-26.471	-	-26.471
• Congressional General Reductions	-0.013	-0.032			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	3.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.643	-			
• Adjustments to Budget Years	-	-	-26.471	-	-26.471

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: S28: *Immersive Learning Environments*		
Congressional Add: *Program increase - Immersive Learning Environments*	-	3.000
Congressional Add Subtotals for Project: S28	-	3.000
Congressional Add Totals for all Projects	-	3.000

Change Summary Explanation

FY19 congressional add for immersive learning environments ($3.000 million).

In FY20, this Program Element is eliminated as part of the Science and Technology portfolio restructure to align Army Modernization Priorities in support of the National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*	Project (Number/Name) S28 / *Immersive Learning Environments*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
S28: *Immersive Learning Environments*	-	0.464	3.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	3.464

Note

In FY 2019, this Project received a congressional add ($3.0 Million). There are no planned efforts beyond FY 2019 for this Project.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates immersive technologies that include the application of photorealistic synthetic environments, multi-sensory interfaces, virtual humans, and training applications on low-cost game platforms for Soldier training applications using simulation technologies. This Project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies that are created at the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC) at the University of Southern California to develop training demonstrators. These demonstrators focus on urban operations, asymmetric warfare, resilience and rehabilitation to support Warfighting units and Army Institutions (Army Training and Doctrine Command (TRADOC) and Army Medical Command (MEDCOM)). Resilience and rehabilitation research will focus on Post Traumatic Stress Disorder (PTSD). The ICT's collaboration with its entertainment partners creates a true synthesis of creativity and technology that harnesses the capabilities of industry, and the research and development community to advance the Army's capabilities.

The cited work is consistent with the S&T priorities of the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

In FY 2019, this Project received a congressional add ($3.0 Million). There are no planned efforts beyond FY 2019 for this Project.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Immersive Techniques for Training Applications	0.464	-	-
Description: This effort demonstrates and matures technological advancements from PE 0602308A/Project D02 into complex state-of-the-art simulation environments in support of multi-student and team training applications. This effort completes in FY 2018.			
Accomplishments/Planned Programs Subtotals	0.464	-	-

	FY 2018	FY 2019
Congressional Add: Program increase - Immersive Learning Environments	-	3.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S28 / *Immersive Learning Environments*

	FY 2018	FY 2019
FY 2019 Plans: Program increase - Immersive Learning Environments		
Congressional Adds Subtotals	-	3.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*				Project (Number/Name) S29 / *Modeling & Simulation - Adv Tech Dev*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
S29: *Modeling & Simulation - Adv Tech Dev*	-	6.023	17.122	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	23.145

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603118A Soldier Lethality Advanced Technology, Projects:
* BC8 Training Advanced Technology (Other than Synthetic Training Environment (STE))
* BE9 Synthetic Training Environment (STE) technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates next generation training and simulation systems that integrate virtual threats, asymmetric warfare concepts, network-centric operations, and embedding training capabilities as well as technologies into operational go-to-war future force systems to include dismounted warrior systems. The synergy between these embedded training capabilities and the immersive training advanced technology development in Project S28 provides Army units with a set of complementary embedded as well as deploy-on-demand systems that provide just-in-time, dynamic, realistic training, and mission rehearsal capabilities. Demonstrations include technologies that form a framework for future training applications for the range of future force operations such as robotic control and other sensor operations; mission planning and rehearsal; maneuver; Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network analysis to support distributed simulations; and vehicle system interface requirements. This Project creates a joint environment by synchronizing virtual and constructive simulated forces with the next generation and current training systems from the Army, Navy, Air Force, and Marine Corps forces.

The cited work is consistent with the S&T priorities of the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Training Effectiveness	1.300	1.300	-
Description: This research addresses the effectiveness of training Soldiers and teams in immersive environments. This effort will research and develop simulations to determine the interaction of realism, immersion, acceptance, and training effectiveness. A baseline of the key dimensions of realism and immersion for current training systems will be developed and will be extended to generate guidelines for the development of future training technologies. Cost effectiveness of these training components will also be considered.			
FY 2019 Plans: Mature and demonstrate automated training performance assessment algorithms for individuals in virtual training environments; provide a baseline of measures and methods for use in assessing effectiveness of collective training for a subset of technologies			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
used in various training environments (mixed reality and live); identify impacts and tradeoffs associated with effectiveness of collective training using current (training) simulation architectures and the expected effectiveness of collective training associated with using future training technologies (mixed reality and live). ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort concludes in FY19.			
Title: Mixed and Augmented Reality ***Description:*** This effort matures and demonstrates mixed and augmented reality technologies that seamlessly blend synthetic and real environments to provide a more realistic training environment for Soldiers. Efforts matured by this effort transition to PEO-STRI. ***FY 2019 Plans:*** Mature and begin internal demonstrations of Augmented Reality subcomponents such as advanced optics for the helmet mounted display, occlusion, and increased computational of the man-wearable computer to reduce size, weight, power, and cooling while also reducing logistics to enable a future augmented reality training environment that can represent the complexities of the future operational environment within which soldiers must operate. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603015A / Project S29 will be funded in PE 0603118A / Projects BC8 (Training Advanced Technology (Other than STE)) and BE9 (STE Advanced Technology)	4.723	4.151	-
Title: Mixed and Augmented Reality for Complex Environments ***Description:*** This effort matures and demonstrates the models and simulations that enable immersive training in future complex operational environments involving megacity terrain and unmanned autonomous systems. These technologies support the Army capability needs for the soldier to have better asymmetric vision and decide faster for dismounted soldiers in a complex urban environment. ***FY 2019 Plans:*** Mature modeling and simulations for megacities environments that will be used for urban interactive immersive training capability, components will include the simulated terrain environment representing complex and dense urban environments as well as manned/unmanned teaming models; mature the components of the dismounted soldier augmented reality visual system and occlusion algorithms for manned/unmanned teaming training operations. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	-	1.144	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
PE 0603015A / Project S29 will be funded in PE 0603118A / Projects BC8 (Training Advanced Technology (Other than STE)) and BE9 (STE Advanced Technology)			
Title: Synthetic Training Environment Acceleration ***Description:*** This effort matures and demonstrates technologies to enable a Synthetic Training Environment which is a single, interconnected training system in which units from squad through ASCC can train in the most appropriate domain - live, virtual, constructive, and gaming, or in all four simultaneously. ***FY 2019 Plans:*** Mature and demonstrate training simulation software technologies, which enable the representation of a relevant Multi Domain Battle (MDB) within a global terrain, in direct support of the Army?s synthetic training environment; optimize the use of distributed computing and cloud infrastructures to demonstrate dynamic content updates (e.g. terrain) and point-of-need training, including the maturation of human-machine interfaces; exploit the maturations in fidelity of the global terrain, the increase in simulated entities and increase concurrent role-players for demonstration in a relevant collective training exercise. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603015A / Project S29 will be funded in PE 0603118A BE9 (STE Advanced Technology)	-	9.900	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.627	-
Accomplishments/Planned Programs Subtotals	6.023	17.122	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S29 / *Modeling & Simulation - Adv Tech Dev*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603015A / *Next Generation Training & Simulation Systems*	Project (Number/Name) S31 / *Modeling And Simulation Infrastructure Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
S31: *Modeling And Simulation Infrastructure Technology*	-	9.291	8.528	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	17.819

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603118A Soldier Lethality Advanced Technology, Projects:
* BC4 Soldier Decision Making & Comms Performance Advanced Technology
* BC8 Training Advanced Technology (Other than Synthetic Training Environment (STE))
* BE9 STE Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a distributed modeling and simulation (M&S) environment that integrates a collection of multi-fidelity models and simulations and tools that map to an evolving architecture and M&S activities to support decisions throughout the acquisition life-cycle. This provides a unifying M&S architecture that synchronizes and integrates multi-resolution modeling applications such as Live, Virtual, and Constructive (LVC) experimentation. This effort focuses on researching cutting-edge M&S methods to enable the Army and the Department of Defense (DoD) to perform critical System of Systems (SoS) analysis, experimentation, technology tradeoffs, capability assessments, concept development, and training that saves time and resources while increasing the effectiveness of acquisition and training activities.

Efforts in this Project support the Under Secretary of Defense for Research and Engineering S&T priorities and the Army Modernization Strategy.

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Simulation Tools and Models	7.391	6.216	-
Description: This effort matures and demonstrates modeling & simulation (M&S) technologies and techniques that support training and experimentation to assess and support system acquisition and military planning decision-making and System of Systems architecture, technology tradeoffs, etc. This research transitions to the U.S Army Program Executive Office for Simulation, Training and Instrumentation (PEO STRI).			
FY 2019 Plans: Demonstrate simulation architecture technologies for a single synthetic environment that supports multiple M&S Communities in a relevant context; optimize composable modeling methods focused on broad model reuse; improve repeatable measurement			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
methodologies for human behavior modeling; refine visualization and interaction technologies that improve human-computer interaction for training simulation; mature cyber data exchange models to enhance synthetic and live integrated training. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603015A / Project S31 will be funded in PE 0603118A / Projects BC4 (Soldier Decision Making & Comms Performance AdvTech), BC8 (Training Adv Technology (Other than STE) and BE9 (STE Advanced Technology) for FY 2020 as part of the financial restructure.			
Title: Early Human Systems Integration Demonstrations ***Description:*** This effort will mature and demonstrate state of the art methods, tools and techniques to integrate human systems integration (HSI) early in the science and technology (S&T) and requirements analysis process to ensure effective and efficient design and development of future Soldier systems. The goal of this effort is to demonstrate the effect early HSI can have on developing the most effective, efficient, and affordable design and on predicting and improving total system performance. This effort is coordinated with the U.S. Army Human Systems Integration Directorate, G1. ***FY 2019 Plans:*** Develop enhanced Soldier performance metrics and training development tools; identify technologies to improve early system design using Soldier-centered design tools and systems engineering architecture. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603015A / Project S31 will be funded in PE 0603118A / Projects BC4 (Soldier Decision Making & Comms Performance AdvTech), BC8 (Training Adv Technology (Other than STE) and BE9 (STE Advanced Technology) for FY 2020 as part of the financial restructure.	1.900	2.000	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.312	-
Accomplishments/Planned Programs Subtotals	9.291	8.528	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603015A / *Next Generation Training & Simulation Systems*	**Project (Number/Name)** S31 / *Modeling And Simulation Infrastructure Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603117A *I Army Advanced Technology Development*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	63.338	-	63.338	68.043	68.814	68.327	69.439	0.000	337.961
BS2: *Army Advanced Technology Development*	-	0.000	0.000	63.338	-	63.338	68.043	68.814	68.327	69.439	0.000	337.961

A. Mission Description and Budget Item Justification

The Army Advanced Technology Development budget line includes development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in a simulated environment.

Efforts develop proof of technological feasibility and assessment of subsystem and component operability that may lead to full system development and prototyping.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	63.338	-	63.338
Total Adjustments	0.000	0.000	63.338	-	63.338
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	63.338	-	63.338

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	118.468	-	118.468	109.968	107.394	103.007	101.772	0.000	540.609
AY5: *Soldier Squad Small Arms Armaments Advanced Tech*	-	0.000	0.000	8.000	-	8.000	6.500	6.500	6.374	6.446	0.000	33.820
AY7: *Small Arms Fire Control Advanced Technology*	-	0.000	0.000	12.880	-	12.880	13.468	13.032	1.500	1.517	0.000	42.397
AY9: *Body Armor & Integrated Headborne Advanced Tech*	-	0.000	0.000	14.809	-	14.809	8.512	5.819	5.935	6.001	0.000	41.076
AZ6: *Soldier Signature Management Advanced Technology*	-	0.000	0.000	1.711	-	1.711	1.745	1.780	1.816	1.836	0.000	8.888
AZ8: *Soldier Squad Small Arms Armaments Adv Tech*	-	0.000	0.000	2.175	-	2.175	3.000	0.000	0.000	0.000	0.000	5.175
BB3: *Dismounted Soldier Survivability Equip/Tech Integ*	-	0.000	0.000	1.466	-	1.466	1.020	2.748	2.803	2.834	0.000	10.871
BB6: *Physical Augmentation: Adv Tech for Field Demo*	-	0.000	0.000	4.000	-	4.000	4.000	0.000	0.000	0.000	0.000	8.000
BB8: *Soldier Centric Advanced Technology*	-	0.000	0.000	7.797	-	7.797	7.336	7.406	8.413	5.951	0.000	36.903
BC1: *Human Performance AdvTech for Mobility & Lethality*	-	0.000	0.000	4.832	-	4.832	5.720	6.776	2.129	2.066	0.000	21.523
BC4: *Soldier Decision Making&Comms Performance AdvTech*	-	0.000	0.000	2.000	-	2.000	2.000	2.040	2.081	2.105	0.000	10.226
BC8: *Training Advanced Technology (Other than STE)*	-	0.000	0.000	1.335	-	1.335	3.011	3.034	1.156	1.158	0.000	9.694
BC9: *Adv Soldier Sensors/ Displays AdvTech for Dismounts*	-	0.000	0.000	13.659	-	13.659	15.403	20.716	28.498	28.815	0.000	107.091
BD7: *Soldier Sys Interfaces/ Integration-Sensor AdvTech*	-	0.000	0.000	9.671	-	9.671	9.069	8.486	8.653	8.991	0.000	44.870

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*								
BD9: *Soldier & Sm Unit Tactical Energy AdvTech*	-	0.000	0.000	3.101	-	3.101	3.163	3.226	4.300	4.362	0.000	18.152
BE2: *Joint Service Combat Feeding Advanced Technology*	-	0.000	0.000	1.782	-	1.782	1.819	1.856	2.048	2.071	0.000	9.576
BE5: *Personnel & Airdrop Safety Advanced Technology*	-	0.000	0.000	6.770	-	6.770	6.299	6.970	6.960	7.052	0.000	34.051
BE9: *STE Advanced Technology*	-	0.000	0.000	22.480	-	22.480	17.903	17.005	20.341	20.567	0.000	98.296

Note

In Fiscal Year (FY) 2020 this Program Element (PE) was previously funded, with continuity of effort realigned from the following PEs:
* 0603001A Warfighter Advanced Technology
* 0603004A Weapons and Munitions Advanced Technology
* 0603015A Next Generation Training & Simulation Systems
* 0603606A Landmine Warfare and Barrier Advanced Technology
* 0603607A Joint Service Small Arms Program
* 0603710A Night Vision Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates Soldier Lethality technologies that improve Soldier operational performance by increasing lethality, mobility, protection, and optimizing situational awareness across the spectrum of operating environments and missions. This PE matures Soldier weapons and enabling components/ subsystems, demonstrates lethal weapons systems with potential to provide greater lethality, target acquisition, fire control, and range at a significantly reduced weight for optimized Soldier and Small Unit system performance. The major focus areas for Soldier Lethality S&T are Soldier weapons and ammunition technologies, protection technologies, cognitive and physical performance measures, training in synthetic training environments, and mission support capabilities such as situational awareness sensors and displays, dismounted power and energy technologies, and Soldier and Small Unit sustainment capabilities. This technology diverse PE also matures and demonstrates sensor technologies that increase Warfighter situational understanding, survivability, and lethality by providing sensor capabilities to acquire and engage all targets and threats at longer ranges in complex environments and operational conditions (e.g. day/night, obscured, smoke, adverse weather, and other degraded visual environments), and for advancing live training technologies that accurately replicate and realistically represent the effects of current and future weapons systems during force-on-force and force-on-target training. This PE matures and demonstrates effective technology in personal combat clothing, protective equipment such as personal armor, helmets, and eyewear, combat rations, shelters, logistical support items for aerial delivery of personnel and cargo, and energy systems to power current and emerging Soldier-born ISR, sensor, optical, and communication systems with the least weight and sustainment burden on the Soldiers and Small Combat Units. This PE matures and demonstrates technologies supporting the Army's Synthetic Training Environment (STE), a single, interconnected synthetic training system that will enable Army units and leaders to conduct realistic multi-echelon / multi-domain combined arms maneuver and mission command training, increasing proficiency through repetition. A specific research thrust area is applying systems-based practices to mature and demonstrate scientific and tailored knowledge of Soldiers' physical and cognitive architecture to facilitate rapid and efficient designs, assessments and trade-off analyses of technology insertions on the Soldier. Significant S&T investments are directed to improve the effectiveness of the technologies a Soldier utilizes while reducing the size and weight of the form factor of the equipment.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603118A *I Soldier Lethality Advanced Technology*

Work in this PE complements PE 0602143A-Soldier Lethality Technology.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in Support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	118.468	-	118.468
Total Adjustments	0.000	0.000	118.468	-	118.468
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	118.468	-	118.468

Change Summary Explanation

FY 2020 funding reflects a strategic financial restructure of the Science and Technology portfolio in support of Army Modernization Priorities. Efforts in this PE were previously funded in other PEs as noted above.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) AY5 / *Soldier Squad Small Arms Armaments Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AY5: *Soldier Squad Small Arms Armaments Advanced Tech*	-	0.000	0.000	8.000	-	8.000	6.500	6.500	6.374	6.446	0.000	33.820

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603607A Joint Service Small Arms Program, Project:
* 627 Joint Service Small Arms Program (JSSAP)

A. Mission Description and Budget Item Justification

This Project demonstrates individual and crew-served weapon designs and technologies that enhance the fighting capabilities and survivability of the dismounted Warfighter in support of the Army's Soldier Lethality Modernization priority and all of the Services. All work is led by the Joint Service Small Arms Program (JSSAP) and is based upon the Joint Service Small Arms Master Plan (JSSAMP) and the Joint Capabilities Integration Development System's Small Arms Analyses.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

This effort complements work done in 0602143A (Soldier Lethality Technology) / AY6 (Soldier Squad Small Arms Armaments Technology).

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier Squad Small Arms Armaments Advanced Technology	-	-	8.000
Description: This effort matures and demonstrates the next generation Family of Ammunition by optimizing small arms ammunition and weapon system technologies for integration into live fire demonstrations. It refines weapon system integration and supports the Joint Warfighter?s small arms capability needs. Validates small arms weapon system technology readiness levels and confidence of design functionality in advanced operating scenarios.			
FY 2020 Plans: Will mature the technologies for the Next Generation Family of Ammunition (NGFoA) Advanced Armor Piercing (ADVAP) round to technology readiness level (TRL) 6, System/subsystem model or prototype demonstration in a relevant environment, to ensure optimal performance against hard and soft targets; mature and demonstrate Joint Remote Weapon Station technologies and optimize Advanced Weapon Operating Technologies for Technology Insertions into emerging systems.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** AY5 / *Soldier Squad Small Arms Armaments Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
PE 0603118A / Project AY5 was previously PE 0603607A / Project 627 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	8.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) AY7 / *Small Arms Fire Control Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AY7: *Small Arms Fire Control Advanced Technology*	-	0.000	0.000	12.880	-	12.880	13.468	13.032	1.500	1.517	0.000	42.397

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603710A Night Vision Advanced Technology, Project:
* K70 Night Vision Advanced Technology
PE 0603004A Weapons and Munitions Advanced Technology, Project:
* 232 Advanced Lethality & Survivability Demonstration

A. Mission Description and Budget Item Justification

This Project matures and demonstrates fire control and targeting sensor technologies and techniques to improve targeting and lethality in order to maintain overmatch at longer ranges in all operational environments and to meet the capability needs of Army Science and Technology Soldier Lethality, Next Generation Combat Vehicle, and Long Range Precision Fires modernization priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

This effort complements work done in 0602143A (Soldier Lethality Technology) / AY8 (Small Arms Fire Control Technology).

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier Squad Small Arms Armaments Advanced Technology	-	-	12.880
Description: This effort will mature and demonstrate fire control and targeting sensor technologies and techniques to improve targeting and lethality, and maintain overmatch at longer ranges in all environments. This effort is coordinated with PE 0602143A, 0602145A, 0603462A, and 0603463A.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** AY7 / *Small Arms Fire Control Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature and configure modular, multispectral, digital weapon sensor technologies and modalities; optimize identification range and integrate with lighter weight payload; optimize design of multifunction sensor system for fire support and dismounted Scout Operations; optimize illuminator and designator laser source; and mature image processing approaches. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work in PE 0603118/ Project AY7 was previously PE 0603710/K70 in FY19.			
Accomplishments/Planned Programs Subtotals	-	-	12.880

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) AY9 / *Body Armor & Integrated Headborne Advanced Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AY9: *Body Armor & Integrated Headborne Advanced Tech*	-	0.000	0.000	14.809	-	14.809	8.512	5.819	5.935	6.001	0.000	41.076

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* FF6 Individual Protection

A. Mission Description and Budget Item Justification

This Project matures and demonstrates body armor weight reductions and improves the performance of personal protection and survivability equipment. It also demonstrates combat helmet ballistic, blast, and small arms protection performance enhancements and the integration and optimization of power, energy, and digital sensor and display headborne technologies.

This effort supports Force Protection capability demonstrations for Soldiers and Small Units and demonstrated technologies from this effort transition to various Program Executive Office (PEO) Soldier programs. This effort complements work done in PE 0602143A (Soldier Lethality Technology) / AZ2 (Body Armor & Integrated Headborne Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Body Armor & Integrated Headborne Advanced Technology	-	-	14.809
Description: This effort focuses on maturing, integrating and demonstrating personal protective capabilities against ballistic, blast and directed energy threats as well as the development and demonstration of Soldier worn platform architectures to optimize the integration of personal protective equipment and Soldier lethality enabling technologies. Demonstrates advanced test methods to validate personal protective equipment performance enhancements against current and emerging small arms, fragmentation and blast threats from anti-personnel munitions. The objective of these technology development efforts is to significantly increase Soldier lethality by enhancing the protective capabilities and reducing sub-system and system level weight of individual protective equipment to reduce the Soldier burden and increase survivability.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** AY9 / *Body Armor & Integrated Headborne Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature combat helmet forming processes to enhance protective performance by integrating state of the art, high performance polyethylene materials; exploit hybridized material configurations and architectures to demonstrate a combat helmet with lower weight small arms protective capability; demonstrate a real time ballistic helmet test methodology to improve behind-helmet blunt trauma measurement capabilities and provide performance data for correlation to emerging head/brain injury criteria to inform future combat helmets requirements; integrate hearing and eyewear protection findings onto optimized platforms to enhance individual Soldier hearing protection and maximize operational situational awareness; optimize and mature head-borne shock tube test methodology as a means to improve blast-over pressure profiles that can be correlated to operational blast environment conditions; exploit existing and developmental ballistic resistant materials in new system architectures to provide vital torso region protection against emerging, near peer, small arms threats to provide near term performance trade space analysis. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project AY9 was previously PE 0603001A/ Project FF6 in FY19. Funding has been realigned to reflect the financial restructure. PE 0603118A/AY9 is not a new start in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	14.809

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) AZ6 / *Soldier Signature Management Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AZ6: *Soldier Signature Management Advanced Technology*	-	0.000	0.000	1.711	-	1.711	1.745	1.780	1.816	1.836	0.000	8.888

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* FF6 Individual Protection

A. Mission Description and Budget Item Justification

This Project optimizes, matures and demonstrates advances novel materials, technologies, techniques and applications increasing the capabilities of camouflage and concealment against known and emerging sensor threats, providing effective deception capabilities, as well as combinations of physical and electronic signature decoy components and maturing analytical processes for modeling performance of signature management technologies during multi-domain operations. These technologies will produce demonstrator proof of concept systems that decrease the probability of detection and targeting by peer and near-peer adversaries, enabling freedom of movement of semi-independent and dispersed formations and increased protection of high-valued assets. Demonstrations conducted under this Project will support S&T efforts in Soldier Lethality protection/survivability Projects to provide disruptive Camouflage, Concealment and Deception technologies to the Operational Army, supporting expeditionary maneuver in the Multi-Domain Battle Environment to open and retain windows of advantage.

Work in this Project supports key Army needs and leverages/complements the technical research of several PEs to include 0602143/BB4, Dismounted Soldier Survivability Materials, 0602143/AZ5, Soldier-Borne Advanced Protection Materials, 0602143/BE1 Support Technology to Mission Command, 0602143A/AZ9, Soldier-Small Unit Protection Technology Detectability, 0601102A, Defense Science Research, and 0602712/H35 Camouflage and Counter-Recon Tech.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier Camouflage, Concealment and Decoys Demonstration	-	-	1.711
Description: This effort demonstrates innovative camouflage, concealment and deception technologies for the dismounted Soldier to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats and to reduce the probability of detection, identification across the electromagnetic spectrum. Matures physics-based models for material and system performance that support probability of detection metrics in the multi-domain operational environment, assisting in			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** AZ6 / *Soldier Signature Management Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
closing the capability gap between current camouflage, concealment and deception technologies and defeating enemy sensorial capabilities in future operating environments. ***FY 2020 Plans:*** Will improve coatings and overgarment clothing for Soldier clothing and individual equipment that reduces the probability of Soldier detection from thermal sensors; mature topical applications to conceal exposed skin (i.e. face, hands) from thermal sensors; demonstrate performance of advanced textile printing that imparts multiple functionalities to include durable camouflage patterns to clothing and individual equipment from visual and thermal sensors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project AZ6 was previously PE 0603001A/ Project FF6 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	1.711

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) AZ8 / *Soldier Squad Small Arms Armaments Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AZ8: *Soldier Squad Small Arms Armaments Adv Tech*	-	0.000	0.000	2.175	-	2.175	3.000	0.000	0.000	0.000	0.000	5.175

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* FF6 Individual Protection

A. Mission Description and Budget Item Justification

This Project optimizes, matures and demonstrates novel materials, technologies, techniques and applications that increase camouflage and concealment capabilities for high-value assets against known and emerging sensor threats, provide effective deception capabilities, mature analytical processes for modeling performance of signature management technologies during multi-domain operations as well as developing combinations of physical and electronic signature decoy components. These technologies will produce proof of concept system demonstrators that decrease the probability of detection and targeting by peer and near-peer adversaries, enabling freedom of movement of semi-independent and dispersed formations and increased protection of high-valued assets. Demonstrations conducted under this project will support S&T efforts in Soldier Lethality protection/survivability projects to provide disruptive Camouflage, Concealment and Deception technologies to the Operational Army, supporting expeditionary maneuver in the Multi-Domain Battle Environment to open and retain windows of advantage.

Work in this Project supports key Army needs and leverages/complements the technical research of several PEs to include 0601102A, Defense Science Research,0602143/BB4, Dismounted Soldier Survivability Materials, 0602143/AZ5, Soldier-Borne Advanced Protection Materials, 0602143/BE1 Support Technology to Mission Command, 0602143A/AZ9, Soldier-Small Unit Protection Technology Detectability, and 0602712/H35 Camouflage and Counter-Recon Tech.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020**
Title: High-Value Asset Camouflage, Concealment and Decoys Demonstration	-	-	2.175
Description: This effort demonstrates innovative camouflage, concealment and deception technologies for high-value assets to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats, including multispectral, hyperspectral and Light Detection and Ranging (LiDAR) sensors, and to reduce the probability of detection in multi-domain operations. Matures physics-based models for material and system performance that support probability of			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** AZ8 / *Soldier Squad Small Arms Armaments Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
detection metrics in the multi-domain operational environment, assisting in closing the capability gap between current camouflage, concealment and deception technologies and defeating enemy sensorial capabilities in future operating environments. ***FY 2020 Plans:*** Will mature the performance of advanced camouflage laminate and textile systems and decoy technology on high value assets (i.e. mission command platforms, battle management centers); mature and demonstrate integrated signature management technologies for high-valued assets to improve effectiveness against visual and thermal sensors to enable expeditionary maneuver and mission command during multi-domain operations and to increase survivability of friendly forces while retaining combat power and resilient formations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project AZ8 was previously PE 0603001A/ Project FF6 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	2.175

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BB3 / *Dismounted Soldier Survivability Equip/Tech Integ*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BB3: *Dismounted Soldier Survivability Equip/Tech Integ*	-	0.000	0.000	1.466	-	1.466	1.020	2.748	2.803	2.834	0.000	10.871

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* FF6 Individual Protection

A. Mission Description and Budget Item Justification

This Project matures and demonstrates the integration of Soldier survivability materials and technologies to increase the speed and efficiency of dismounted Soldier movement and maneuver. This Project focuses on reducing Soldier worn equipment weight, improving Soldier and system integration and reduce the dismounted Soldier's detectability, susceptibility and vulnerability to operational threats. Operational threats are characterized as combat threats (e.g. flame and thermal, blast and ballistic, multispectral sensors, and laser threats), environmental threats (e.g. cold, heat, wet, vector, water contamination, concealment, antimicrobial, etc.), and Soldier system components and system limitations (e.g. size, weight, and bulk). This effort includes the demonstration and validation of integrated technologies, novel subsystems/systems, and test methods.

This effort complements work done in 0602143A (Soldier Lethality Technology) / Project BB4 (Dismounted Soldier Survivability Materials).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Dismounted Soldier Survivability Equipment and Technology Integration	-	-	1.466
Description: This effort matures and integrates multifunctional protective materials, sub-components and systems for field demonstrations to significantly increase the survivability of the Soldier through their multi-functional clothing and individual protective equipment. This effort also demonstrates and validates tradeoff analyses in sub-component and system level designs of ballistic, blast, signature management and integrated protection clothing and equipment technologies. ***FY 2020 Plans:*** Will optimize integration opportunities of Soldier individual protective and loadbearing equipment to realize near term system level weight reduction; demonstrate 3D woven and knit garments for cold weather applications to reduce the bulk and weight of the			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BB3 / *Dismounted Soldier Survivability Equip/Tech Integ*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
extreme climate protective ensemble; demonstrate operational benefit of advanced textile printing capabilities at the sub-system and system level for individual equipment that can impact multiple functionalities (e.g. signature management, vector protection, flame resistance, etc.) in a single, more cost-effective process and more durable capability. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BB3 was previously funded in PE 0603001A / Project FF6.			
Accomplishments/Planned Programs Subtotals	-	-	1.466

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BB6 / *Physical Augmentation: Adv Tech for Field Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BB6: *Physical Augmentation: Adv Tech for Field Demo*	-	0.000	0.000	4.000	-	4.000	4.000	0.000	0.000	0.000	0.000	8.000

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* J50 Future Warrior Technology Integration

A. Mission Description and Budget Item Justification

This Project investigates human augmentation technologies for enhanced Soldier mobility & lethality to provide an advantage over adversaries during close combat and infantry tasks. This will be achieved by demonstrating and validating operationally ready physical augmentation systems that meet the mission requirements by optimizing movement & maneuver and logistics sustainment task performance.

Work in this Project leverages research of PEs including PE 0602143A (BC2, BB9 and BC5) and PE 0603118A (BC1, BB5 & BB8). Additionally, work in this Project complements and is coordinated with Military Research and Materiel Command and the Veteran Administration's exoskeleton research area. This Project is also coordinated with work performed across the DoD under the Reliance 21 Human Systems Community of Interest: Protection, Sustainment, and Warfighter Performance.

Results of these efforts may transition to the Program Executive Office (PEO) Soldier, Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), Human Systems Integration (HSI) Directorate (Army G1), and Army Test and Evaluation Command (ATEC).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Wearable Assistive Devices Advanced Technology for Feld Demo	-	-	4.000
Description: This effort demonstrates wearable physical augmentation devices to validate Soldier metrics such as endurance, survivability, speed, and strength, as well as system metrics such as power consumption and duration, actuator and controller performance, and integration with Soldier clothing and individual equipment (CIE). Results will demonstrate if the Army will benefit from leveraging industry investments and determine if these systems enhance Soldier mobility and lethality in operational environments.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BB6 / *Physical Augmentation: Adv Tech for Field Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2020 Plans: Will conduct representative operational field demonstrations and augmentation/assist devices integration with Soldier CIE to measure operational and physical impacts of augmentation systems and the applicability in military environments; conduct manufacturing and industrial design analyses to measure key augmentation metrics (e.g. power usage and duration, system weight, performance in military relevant environment, and integration with CIE) and physiological impacts to Soldiers using established human performance methodologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BB6 was previously PE 0603001A/ Project J50 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	4.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BB8 / *Soldier Centric Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BB8: *Soldier Centric Advanced Technology*	-	0.000	0.000	7.797	-	7.797	7.336	7.406	8.413	5.951	0.000	36.903

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* J50 Future Warrior Technology Integration

A. Mission Description and Budget Item Justification

This Project will demonstrate optimized Warfighting function (e.g. shoot, move, perceive, decide, and communicate) with technologies, systems and/or subsystems designed to augment Soldier ability during missions. This Project capitalizes on operational partnerships by providing Science and Engineering subject matter experts (SMEs) the ability to assist Commanders in course of action development for potential near term solutions and condition setting for mid/far term science objectives. Provides Soldier touch points to optimize, improve performance, validate and integrate technologies and methodologies with users. Research focuses on the Warfighter as the capability and will rapidly iterate user driven solutions that maximize their tactical performance.

This PE is fully coordinated across PE 0602143A and PE 0603118A in the human sciences, as well as work conducted by Medical Research & Materiel Command (MRMC), Army Research Institute (ARI), U.S. Military Academy (USMA), and other academic and industry partners. This work is in partnership with Forces Command (FORSCOM) operational units and the appropriate Training and Doctrine Command (TRADOC) organizations as well as established transition partners, including Army Test and Evaluation Command (ATEC) & Program Executive Office- Soldier (PEO-S).

Work in this Project complements and is fully coordinated with Military Research and Materiel Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5). This project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Reliance 21 Human Systems Community of Interest: Systems Interfaces & Cognitive Processes and Protection, Sustainment, and Warfighter Performance.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Operational Unit Partnership and Soldier Touch Point	-	-	7.797

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BB8 / *Soldier Centric Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort optimizes innovation through S&T touch points with the Operational force, resulting in rapid iteration, concept maturation, integration, validation of laboratory findings, and transition of technologies and methodologies in response to operational unit demand signal. This effort streamlines demonstration, data collection, and technology maturation for near term Doctrine, Organization, Training and Education, Materiel, Leadership, Personnel, and Facilities (DOTMLPF) solutions, enabling faster delivery of materiel and non-materiel products/knowledge refined with direct Soldier input. This body of work allows validated, empirical, assessment of any equipment capability or training intervention as part of the Soldier architecture to inform future acquisition investments, training, and operational trade space decisions. ***FY 2020 Plans:*** Will conduct operational user group field demonstration to validate the integration of technologies/methods that maximize the Warfighter?s physical and cognitive performance; conduct large scale field studies in coordination with operational units on mission essential tasks in a realistic, constructive tactical environment employing a cross-assessment of variables such as lightweight equipment, situational awareness tools, sleep, nutrition, human augmentation for load carriage, etc. These assessments will inform multiple training/education and materiel solutions designed to maximize the tactical performance to overcome Soldier limitations in order to achieve overmatch. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BB8 was previously PE 0603001A/J50 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	7.797

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) BC1 / *Human Performance AdvTech for Mobility & Lethality*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BC1: *Human Performance AdvTech for Mobility & Lethality*	-	0.000	0.000	4.832	-	4.832	5.720	6.776	2.129	2.066	0.000	21.523

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* J50 Future Warrior Technology Integration

A. Mission Description and Budget Item Justification

This Project matures technologies, methodologies, and human performance models to demonstrate increased mobility & lethality of the individual and small unit to achieve overmatch. It validates and integrates human performance assessment methods and algorithms into training/education, test and evaluation methodologies, and materiel solutions to compare performance impacts between different materiel and non-materiel solutions to maximize the individual Warfighter and small unit. These methods and algorithms have potential to enable the development of aspects of DOTMLPF (doctrine, organization, training, materiel, leadership and education, personnel and facilities) improvements and efficiencies.

This work is directly supported by PE 62143/BC2 (Next Generation Mobility & Lethality Technology for Warfighters) and BB9 (Human Performance Technology for Mobility & Lethality). It is fully coordinated and complementary to PE 63118/ BB8 (Soldier Centric Advanced Technology).

Work in this Project complements and is fully coordinated with Medical Research and Materiel Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5) and the Army Research Laboratory (ARL). This project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Reliance 21 Human Systems Community of Interest: Systems Interfaces & Cognitive Processes and Protection, Sustainment, and Warfighter Performance.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier/Squad Performance Metrics for Lethality	-	-	4.832
Description: This effort validates and matures technologies, methodologies, and human performance models to demonstrate increased Soldier and Small Unit mobility & lethality to achieve overmatch. The effort validates and integrates human performance sensors, models, and design guidance into training/education, test and evaluation, and materiel. The results of this work will allow			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BC1 / *Human Performance AdvTech for Mobility & Lethality*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
the Army to develop equipment, systems and training devices that maximize the close combat Soldier and small unit performance in multi-domain operations. ***FY 2020 Plans:*** Will demonstrate the performance impacts of biometric Soldier readiness information portrayed to small units via dismounted mission command platforms; demonstrate an enhanced small unit tactical decision making process with measurable and actionable information to maximize physical and cognitive readiness levels; mature and demonstrate assessment tools and methodologies for operational test and evaluation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BC1 was previously PE 0603001A / Project J50 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	4.832

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) BC4 / *Soldier Decision Making&Comms Performance AdvTech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BC4: *Soldier Decision Making&Comms Performance AdvTech*	-	0.000	0.000	2.000	-	2.000	2.000	2.040	2.081	2.105	0.000	10.226

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603015A Next Generation Training & Simulation Systems, Projects:
* S31 Modeling And Simulation Infrastructure Technology

A. Mission Description and Budget Item Justification

This Project integrates research, theory and applied operations to maximize effectiveness of Soldiers and their equipment. Efforts in this Project support early application of Human Systems Integration (HSI) by translating research findings into performance-based design criteria for use in the Army's requirements definition process and materiel acquisition process for Army Modernization. Application of this work will yield reduced workload, fewer errors, reduced task times, enhanced Soldier protection, user acceptance, and allow the Soldier to extract maximum performance from the equipment. Major efforts address Soldier cognitive load and cognitive fusion research, advanced aircraft design to include flight in degraded visual environments, and development of human performance measures and methods to address current and future human system integration challenges. Individual efforts exploit adaptive learning methods and strategies, applied methods to accelerate expertise development, integration of displays for ease of use and optimized situational awareness, and development of technical frameworks for crew automation integration in Command and Control Systems (C2). Efforts also support flight crew decision-aiding and autonomy, advanced crew station design for aircraft, full mission operations in degraded visual environments, and advanced manned-unmanned teaming concepts.

Results of these efforts are transitioned to the Program Executive Offices (PEO), Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), Human Systems Integration (HSI) Directorate (Army G1), and Army Test and Evaluation Command (ATEC). This effort complements work done in PE 0602143A Soldier Lethality Technology, Project BC3 Soldier Decision Making & Communications Performance Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Early Human System Integration Demonstration	-	-	2.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BC4 / *Soldier Decision Making&Comms Performance AdvTech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort will provide early front end analysis and assessment for Human System Integration (HSI) in Army systems acquisition to influence specifications and design. Research findings will translate into performance-based design standards for use in the Army's requirements definition process and materiel acquisition process. ***FY 2020 Plans:*** Will provide a technical framework, knowledge products that identify candidate technologies for degraded visual environments (DVE) mitigation, and summaries of HSI work to support the Future Vertical Lift material solution analysis and Milestone A, as well as recommendations to the Fires Center of Excellence for M-SHORAD and the Integrated Air and Missile Defense (IAMD) program. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603015A / Project S31 has been realigned to PE 0603118A / Project BC4 for FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BC8 / *Training Advanced Technology (Other than STE)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BC8: *Training Advanced Technology (Other than STE)*	-	0.000	0.000	1.335	-	1.335	3.011	3.034	1.156	1.158	0.000	9.694

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603115A Next Generation Training & Simulation Systems, Projects:
* S29 Modeling & Simulation - Advanced Technology Development
* S31 Modeling And Simulation Infrastructure Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced live training technologies in support of the Army's need for live simulations that accurately replicate and realistically represent the effects of current and future weapons systems during force-on-force and force-on-target training.

This effort complements work done in 0602143A Soldier Lethality Technology, Project BC7 Training Technology (Other than Synthetic Training Environment (STE)).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Live Training Technology Applications	-	-	1.335
Description: This effort investigates technology to enhance the fidelity of live training systems and develops future live training capabilities for conducting force-on-force, combined arms exercises to enhance readiness at Army home stations and Combat Training Centers.			
FY 2020 Plans: Will mature and demonstrate integrated software and hardware components such as artificial intelligence algorithms to aid in target recognition, weapon modeling, next generation magnetometers, high resolution three dimensional terrain, and weapon orientation sensors to enhance live training technology.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BC8 / *Training Advanced Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
PE 0603118A / Project BC8 was previously PE 0603018 / Projects S29 and S31 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	1.335

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BC9 / *Adv Soldier Sensors/Displays AdvTech for Dismounts*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BC9: *Adv Soldier Sensors/ Displays AdvTech for Dismounts*	-	0.000	0.000	13.659	-	13.659	15.403	20.716	28.498	28.815	0.000	107.091

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603606A Landmine Warfare and Barrier Advanced Technology, Projects:
* 608 Countermine & Bar Development
PE 0603710A Night Vision Advanced Technology, Projects:
* K70 Night Vision Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, optimizes, and demonstrates fully digital sensor systems, architectures, and interfacing capabilities to fuse sensors, and network situational understanding information and and targeting capabilities to enable mounted and dismounted US Soldiers maintain visual advantage, increased situational awareness, decreased fratricide, and respond expeditiously to all threats in all environments. Work in this Project supports the Army Science and Technology Soldier Lethality, Next Generation Combat Vehicle, and Future Vertical Lift Army Modernization priorities.

This effort complements work done in PE 0602143A Soldier Lethality Technology, Project BD1 Advanced Soldier Sensors/Displays Tech for Dismounts.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Soldier Sensors/Displays Advanced Technology for Dismounts	-	-	13.659
Description: This effort will mature and demonstrate low cost Soldier-borne situational understanding systems with greater fidelity for improved maneuver and lethality, as well as mature automated algorithms to increase probability of recognition/identification and tracking of threats in all environments. This effort is coordinated with PE 0602143A Soldier Lethality Technology, 0602145A Next Generation Combat Vehicle Technology, 0603462A Next Generation Combat Vehicle Advanced Technology, 0603463A Network C3I Advanced Technology, and 0603465A Future Vertical Lift Advanced Technology.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BC9 / *Adv Soldier Sensors/Displays AdvTech for Dismounts*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature augmented reality situational understanding and visual three dimensional (3D) information capabilities for mounted and dismounted Soldiers; provide an overlay and display of 3D point cloud information to Soldiers for increased scene context in near peer environments; mature explosive and hazard detection components for integration with adaptable target detection algorithms to create a baseline capability that increases Soldiers situational understanding of threats in near-peer environments; validate sensor designs. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / BC9 was previously PE 0603710A / K70 and PE 060606A / 608 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	13.659

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BD7 / *Soldier Sys Interfaces/Integration-Sensor AdvTech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BD7: *Soldier Sys Interfaces/ Integration-Sensor AdvTech*	-	0.000	0.000	9.671	-	9.671	9.069	8.486	8.653	8.991	0.000	44.870

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* J50 Future Warrior Technology Integration

A. Mission Description and Budget Item Justification

This Project will integrate technologies for sensing, processing, displaying information, interfacing with users, and cognitive improvement to enhance Soldier & Small Unit situational awareness & understanding. This effort will integrate battlefield and body worn sensors and data fusion algorithms to provide the dismounted Small Unit leader with clear, actionable information for making well informed, rapid, tactical decisions. This effort will mature and integrate advanced dismounted Soldier robotic and autonomous systems technologies to demonstrate autonomous navigation, manned-unmanned teaming, and networked reconnaissance to improve Soldier lethality, situational awareness, and survivability during tactical operations.

Work in this Project several PEs to include (PE 0602143A/BD6) Soldier System Interfaces & Integration (Sensor Technology), (PE 0602143A/BB9) Human Performance Technology for Mobility & Lethality, and (PE 0603118A/BC9) Advanced Soldier Sensors/Displays Advanced Technology for Dismounts.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Soldier System Interfaces & Integration (Sensor Advanced Technology)	-	-	9.671
Description: This effort will integrate battlefield and body-worn sensors and mature data fusion algorithms to provide the dismounted Small Unit leader with clear, actionable information to make well informed, rapid, tactical decisions. This effort will mature and integrate advanced dismounted Soldier robotic and autonomous systems technologies to demonstrate autonomous navigation, manned-unmanned teaming, and networked reconnaissance to improve Soldier lethality, situational awareness, and survivability during tactical operations.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BD7 / *Soldier Sys Interfaces/Integration-Sensor AdvTech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will integrate battlefield and Soldier worn sensors with body area networks and the Nett Warrior architecture; mature and integrate sensor fusion algorithms and user interfaces to provide actionable and timely information to the dismounted Soldier and small unit; demonstrate integrated sensor capabilities in lab and virtual environments; mature and integrate algorithms for dismounted Small Unmanned Aerial Systems (SUAS) to enable autonomous operations; mature soldier-robotic user interfaces to minimize Soldier dedicated control of robotic assets; mature and demonstrate modular robotics architectures to allow for rapid integration and demonstration of advanced capabilities; integrate dismounted robotic systems with Nett Warrior to enable sharing of tactical data between Small Units. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BD7 was previously PE 0603001A / J50 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	9.671

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BD9 / *Soldier & Sm Unit Tactical Energy AdvTech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BD9: *Soldier & Sm Unit Tactical Energy AdvTech*	-	0.000	0.000	3.101	-	3.101	3.163	3.226	4.300	4.362	0.000	18.152

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* J50 Future Warrior Technology Integration

A. Mission Description and Budget Item Justification

This Project will demonstrated advanced Power and Energy (P&E) technologies for the dismounted Soldier to lighten equipment load, reduce resupply need, and enhance mobility. This effort will conduct Soldier and Small Unit power and energy technology maturation, integration with clothing and individual equipment, technical analysis, and operational assessment.

Work in this Project complements several PEs to include (PE 62143/BD6) Soldier System Interfaces & Integration (Sensor Technology), (PE 0602143/BB9) Human Performance Technology for Mobility & Lethality, (PE 0602143A/BD8) Soldier and Small Unit Tactical Energy Technology, and (PE 0603118/BC9) Advanced Soldier Sensors/Displays Advanced Technology for Dismounts.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Dismounted Soldier Power and Energy	-	-	3.101
Description: This effort matures, integrates, and demonstrates advanced Soldier Power and Energy (P&E) technologies that are used to power the dismounted Soldier and small unit?s command and control, communications, computers, and sensor devices during tactical operations. This work will result in the Army being able to provide the power and energy the future Soldier requires to operate effectively, while doing so at a reduced physical burden.			
FY 2020 Plans: Will mature, integrate, and demonstrate advanced dismounted Soldier power and energy technologies, including lightweight, energy dense power sources and efficient power generation technologies to reduce the Soldier?s physical burden and increase the run-time of electronics; demonstrate Soldier power management and distribution technologies to efficiently manage the			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BD9 / *Soldier & Sm Unit Tactical Energy AdvTech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
transfer of power on the Soldier; analyze and assess dismounted Soldier power and energy technologies during laboratory and field experiments to characterize their performance and validate their operation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BD9 was previously PE 0603001A / J50 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	3.101

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*				Project (Number/Name) BE2 / *Joint Service Combat Feeding Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BE2: *Joint Service Combat Feeding Advanced Technology*	-	0.000	0.000	1.782	-	1.782	1.819	1.856	2.048	2.071	0.000	9.576

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* C07 Joint Service Combat Feeding Tech Demo

A. Mission Description and Budget Item Justification

This project matures and demonstrates combat ration and field feeding technologies to optimize warfighter performance, decrease the risk of exposure to chemical and biological contaminants in foods, and reduce the logistics burden to enable semi-independent operations. The Army serves as the Executive Agent for this Department of Defense (DoD) program, with oversight and coordination provided by the DoD Combat Feeding Research and Engineering Board.

This effort complements work done in 0602143A (Soldier Lethality Technology) / Project BE3 (Joint Service Combat Feeding Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Joint Service Combat Feeding Advanced Technology Demonstration	-	-	1.782
Description: This effort matures and demonstrates combat ration and field feeding technologies to optimize warfighter performance, decrease risk of exposure to chemical and biological contaminants in foods, and reduce the logistics burden to enable semi-independent operations.			
FY 2020 Plans: Mature alternative packaging configurations to reduce weight/logistics burden and provide flexibility in rations processing applications to enable semi-independent operations; mature novel food processing and nutritional intervention strategies to validate Close Combat Assault Ration concept for reduced Soldier/squad reliance on ration resupply during extended operations; demonstrate densification technologies that maximize nutrient value while minimizing ration weight; demonstrate portable, rapid			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BE2 / *Joint Service Combat Feeding Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
biosensor platforms to improve food safety and reduce risk of food-borne illness on the battlefield; transition demonstrated refrigeration technology that reduces reliance on hydrofluorocarbons to Product Manager ? Force Sustainment Systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BE2 was previously PE 0603001A / Project C07 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	1.782

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BE5 / *Personnel & Airdrop Safety Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BE5: *Personnel & Airdrop Safety Advanced Technology*	-	0.000	0.000	6.770	-	6.770	6.299	6.970	6.960	7.052	0.000	34.051

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603001A Warfighter Advanced Technology, Projects:
* 242 Airdrop Equipment
* XW6 Small Unit Expeditionary Maneuver

A. Mission Description and Budget Item Justification

This Project matures and demonstrates equipment and innovative techniques for precision aerial delivery of cargo and personnel. Technologies support Army Modernization Priority, Soldier Lethality. Aerial delivery is a key capability for rapid force projection and global precision delivery to support the mission readiness profile for Global Response Force (GRF). These efforts are designed to advance state of the art precision delivery technologies such as parachutes; guidance, navigation, and control (GNC) components and subsystems; tracking sensors; software algorithms; and safety rigging that integrates with currently equipped aircraft, unmanned aerial systems (UAS), and advanced rotary wing aircraft. These efforts provide the Warfighter with highly accurate, timely cargo/payload delivery and resupply in all terrain and weather conditions. Precision delivery/resupply reduces vulnerability of ground Soldiers, aircraft, and aircrew. Precision aerial delivery supports remote warfare with activities such as placement of battlefield sensors and reduction of Soldier load.

This effort complements work done in the Science & Technology Precision, Navigation and Timing Modernization priority.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Personnel & Airdrop Safety Advanced Technology	-	-	6.770
Description: This effort matures and demonstrates parachute materials and designs, precision guidance and navigation software and hardware, tracking sensors, and safety devices to increase the accuracy of delivering cargo to remote locations and/or complex terrains in GPS denied environments. This effort also provides technologies that increase safety during personnel insertions into theaters of operation. This effort supports capability demonstrations for mitigating the Army' s challenge of			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BE5 / *Personnel & Airdrop Safety Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
overburdened Soldiers through the use of tactical aerial resupply technologies, as well as supporting Anti-Access/Area Denial (A2/AD) and manned-unmanned teaming (MUM-T) operational concepts by demonstrating airdrop from non-traditional platforms. ***FY 2020 Plans:*** Will demonstrate precision aerial delivery software and hardware components in a GPS denied/degraded environment as well as in Dense, Urban, and Complex Terrain. Efforts will provide high precision resupply in austere environments and expand the operational footprint of the Soldier/Squad without significant impact to existing logistics requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A / Project BE4 was previously PE 0603001A / XW6 and PE 0603001A / 242 in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	6.770

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603118A / *Soldier Lethality Advanced Technology*	Project (Number/Name) BE9 / *STE Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BE9: *STE Advanced Technology*	-	0.000	0.000	22.480	-	22.480	17.903	17.005	20.341	20.567	0.000	98.296

Note

In Fiscal Year (FY) 2020 this Project is being realigned from:
Program Element (PE) 0603115A Next Generation Training & Simulation Systems, Projects:
* S29 Modeling & Simulation - Advanced Technology Development
* S31 Modeling And Simulation Infrastructure Technology

A. Mission Description and Budget Item Justification

This Project investigates and develops technologies supporting the Army's Synthetic Training Environment (STE), a comprehensive live-virtual-constructive architecture that will enable Soldiers to train the spectrum of missions in virtual environments involving thousands of virtual combatants and miles of complex terrain including megacities. The STE will enable Army units and leaders to conduct realistic multi-echelon / Multi-Domain Operations, combined arms maneuver, and mission command training at the point of need anywhere in the world, increasing Soldier and Small Unit proficiency through repetition. Units can then master collective training tasks in the live environment. The Project leverages the capabilities of industry and the research and development community, to include work at the Institute for Creative Technologies (ICT). This project matures and demonstrates a distributed modeling and simulation (M&S) environment that integrates a collection of multi-fidelity models and simulations and tools that map to an evolving architecture and M&S activities to support decisions throughout the acquisition life-cycle; and provides a unifying M&S architecture that synchronizes and integrates multi-resolution modeling applications such as Live, Virtual, and Constructive (LVC) experimentation utilizing Artificial Intelligence (AI) enabled attributes. This Project focuses on researching cutting-edge M&S methods to enable the Army and the Department of Defense (DoD) to perform critical System of Systems (SoS) analysis, experimentation, technology tradeoffs, capability assessments, concept development, and training that saves time and resources while increasing the effectiveness of acquisition and training activities.

This effort complements work done in 0602143A (Soldier Lethality Technology) / Project BE8 (Synthetic Training Environment (STE) Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: STE Soldier/Squad Virtual Trainer	-	-	6.135

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BE9 / *STE Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort demonstrates a common battle drill squad-level mixed reality based system that allows for the rapid conduct and repetition of squad-level training. The training system will make it possible to conduct diverse, repeatable and effective training without extensive training infrastructure. ***FY 2020 Plans:*** Will demonstrate advancements based on STE accelerated tasks to include dynamic occlusion algorithms for complex urban environments and advanced position tracking for spatialization. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BE9 was previously PE 0603018A/S29 and 0603015A/S31 in FY 2019.			
Title: STE Training Management Tool ***Description:*** This effort matures and demonstrates user-friendly interfaces that allow for authoring individual and collective training scenarios, tools that automatically adapt training to the learner's skill level and conducts intelligent after action reviews, and technologies that enable visualization of and interaction with a Mixed Reality Common Operating Picture of the battlespace. ***FY 2020 Plans:*** Will mature and demonstrate an authoring tool for individual training scenarios; demonstrate ways to automatically tailor training based on existing learner records; and demonstrate models that predict individual competencies and tailor training to target deficiencies. Will demonstrate large-scale, mixed reality Common Operating Picture visualization and interaction of emerging STE technologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BE9 was previously PE 0603018A/S29 and 0603015A/S31 in FY 2019.	-	-	1.366
Title: STE One World Terrain ***Description:*** This effort matures and demonstrates tools and methods that improve the speed, fidelity and delivery of synthetic terrain and environmental data needed to support mission planning, mission rehearsal, and mission training in the synthetic training environment. ***FY 2020 Plans:*** Will demonstrate applications that enhance environmental representations commonly found in urban areas including Megacities and underground environments; exploit and modify non-traditional data sources such as Open Street Maps, crowd-sourced information, and other available data from which geo-specific information can guide placement; enhance the environment with procedural placement of appropriate urban feature models; exploit and modify a common terrain engine representation for use	-	-	5.950

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BE9 / *STE Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
across game engines (i.e. consumed without modification); mature the commonality and differences between candidate game engines to derive common representations for environment elements (terrain surface, feature meshes, textures/materials, etc.); optimize terrain reasoning data needs, especially those not typically represented in game engines; exploit a proposed common representation that is flexible and compatible with multiple game engines; validate the tradeoffs between compiled/derived formats versus close-to-source formats and articulate how engines with specialized internal formats would leverage the proposed representation; and demonstrate the viability of the proposed representation in at least three different game engines. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BE9 was previously PE 0603018A/S29 and 0603015A/S31 in FY 2019.			
Title: STE Training Simulation Software ***Description:*** This effort matures and demonstrates technologies that support Multi-Domain Operations modeling, maturing simulation configuration and scalability technologies for collective training. In addition, matures and demonstrates technologies that allow the synthesis of robust military behaviors that enable the ?scaling? of Synthetic Training Environment (STE) collective training configurations to support squad to Army Service Component Command (ASCC) synthetic representations and delivery to the Point of Need through the exploitation of emerging computing and networking technologies that optimize computing architectures for integrating components (models, behaviors, data, etc.) of the Training Simulation Software (TSS). ***FY 2020 Plans:*** Will mature models of Multi-Domain Operations to include cyber effects and patterns of life, demonstrating state-of-the-art simulated entities and concurrent role-players in a relevant collective training exercise. In addition, will mature methods to create simulation agnostic behavior algorithms from authoritative sources to show broad applicability to multi-echelon collective training; demonstrate hybrid scalability and Point of Need technologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603118A/ Project BE9 was previously PE 0603018A/S29 and 0603015A/S31 in FY 2019.	-	-	9.029
Accomplishments/Planned Programs Subtotals	-	-	22.480

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603118A / *Soldier Lethality Advanced Technology*	**Project (Number/Name)** BE9 / *STE Advanced Technology*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	12.593	-	12.593	15.511	21.013	24.009	26.428	0.000	99.554
BK8: *Robotics for Engineer Operations Adv Tech*	-	0.000	0.000	1.923	-	1.923	4.357	9.307	9.179	9.040	0.000	33.806
BK9: *Ground System Fluids and Fuels Adv Tech*	-	0.000	0.000	2.118	-	2.118	2.157	2.214	2.258	2.283	0.000	11.030
BL3: *Explosives Forensics Advanced Technology*	-	0.000	0.000	2.038	-	2.038	2.079	2.123	2.165	2.189	0.000	10.594
BL6: *Expedient Passive Protection Advanced Technology*	-	0.000	0.000	3.703	-	3.703	3.169	0.000	2.533	4.343	0.000	13.748
BL8: *Power Projection in A2AD Environments Adv Tech*	-	0.000	0.000	0.892	-	0.892	1.268	3.010	3.400	3.218	0.000	11.788
BM1: *Protection from Advanced Weapon Effects Adv Tech*	-	0.000	0.000	1.919	-	1.919	2.481	4.359	4.474	5.355	0.000	18.588

Note

This Program Element (PE) was previously funded, with continuity of effort realigned from the following PEs:
* 0603004A Weapons and Munitions Advanced Technology
* 0603005A Combat Vehicle and Automotive Advanced Technology
* 0603728A Environmental Quality Technology Demonstrations
* 0603734A Military Engineering Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates ground movement and maneuver technologies that support and enable the Army's modernization priority for the Next Generation of Combat Vehicles. This Project matures, integrates and demonstrates advanced technologies that are necessary and foundational for legacy and future ground platforms and ground maneuver. These technology areas include: robotic and autonomous Army Combat Engineer equipment, liquid logistics (i.e., fuels, lubricants, and oils) and related monitoring and distribution, forensic analysis of explosives and other chemical materials, rapidly deployable passive protection technologies, entry and maneuver assessment technologies and structural hardening technologies to protect personnel and critical assets from advanced weapon effects.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603119A *I Ground Advanced Technology*

Work is performed by the U.S. Army Futures Command and the U.S. Army Engineer Research and Development Center.

Work in this PE complements PE 0602114A (Ground Technology), PE 0602145A (Next Generation Combat Vehicle Technology), and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	12.593	-	12.593
Total Adjustments	0.000	0.000	12.593	-	12.593
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	12.593	-	12.593

Change Summary Explanation

FY20 adjustments reflect realignment of program funds from other PEs in the Science and Technology portfolio in support of Army Modernization Priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*				Project (Number/Name) BK8 / *Robotics for Engineer Operations Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BK8: *Robotics for Engineer Operations Adv Tech*	-	0.000	0.000	1.923	-	1.923	4.357	9.307	9.179	9.040	0.000	33.806

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603728A Environmental Quality Technology Demonstrations, Projects:
* 002 Environmental Compliance Technology

A. Mission Description and Budget Item Justification

This Project demonstrates robotized engineer technology capabilities that can remotely characterize the environment to allow mission planning for autonomous Army Combat Engineer actions that create or reduce barriers and obstacles, as well as maintain, repair, and construct expedient infrastructure working either semi-autonomous or autonomously to support Combat Engineer missions of mobility, counter-mobility, and survivability operations in complex environments.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground and Next Generation Combat Vehicle Portfolio.

Work is performed by the U.S. Army Futures Command and the U.S. Army Engineer Research and Development Center.

Work in this PE complements PE 0602114A (Ground Technology), PE 0602145A (Next Generation Combat Vehicle Technology), and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Robotic Integrated Engineer Operations (RIENO)	-	-	1.923
Description: This effort matures and demonstrates remote control and semi-autonomous protocols and processes on small scale construction equipment to provide information that scales to larger legacy equipment as well as assess the applicability of small scale equipment working in collaboration and coordination.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BK8 / *Robotics for Engineer Operations Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate and assess remote control and semi-autonomous characterization of the environment to include geologic, hydrologic, and man-made features. Such information is crucial for many autonomous construction related behaviors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE0603728A (Environmental Quality Technology Demonstrations) / Project 002 (Environmental Compliance Technology) in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	1.923

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*	Project (Number/Name) BK9 / *Ground System Fluids and Fuels Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BK9: *Ground System Fluids and Fuels Adv Tech*	-	0.000	0.000	2.118	-	2.118	2.157	2.214	2.258	2.283	0.000	11.030

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603005A Combat Vehicle and Automotive Advanced Technology, Projects:
* 441 Combat Vehicle Mobility

A. Mission Description and Budget Item Justification

This Project matures and demonstrates liquid logistics technologies such as alternative fuels, lubricants, oils, powertrain fluids, coolants, bulk fluid treatment, monitoring, metering, storage, and distribution in support of established Army regulations and requirements. This Project matures products and technologies to improve fuel efficiency, meet new hardware fluid requirements, modernize fluids, ensure bulk fluid meets quality requirements, and provide bulk fluid asset visibility, to optimize logistics and reduce logistics requirements. This Project executes the demonstration and qualification of candidate alternative fuels, gear oils, anti-lock brake system-compatible brake fluid, smart bulk fuel metering and monitoring products and technologies. This Project matures liquid logistics products and technologies that are critical enablers for multi-domain operations requiring semi-independent operations to enable dispersed operations to extend operational reach, prolong endurance and allow freedom of action for the Joint Force.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground and Next Generation Combat Vehicle Portfolio.

Work is performed by the U.S. Army Futures Command.

Work in this PE complements PE 0602114A (Ground Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Alternative Fuels and Petroleum, Oil & Lubricants	-	-	2.118
Description: This effort focuses on reducing the logistics footprint, improving fuel efficiency, and ensuring mobility by maturing and demonstrating technologies in areas such petroleum quality monitoring, filtration, storage and distribution, hydraulic fluids; alternative fuels and fuel additives, lubricants, oil, powertrain fluids and coolants.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BK9 / *Ground System Fluids and Fuels Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2020 Plans: Will begin assessing additional candidate synthetic fuel blends to determine their suitability for military ground systems. Candidate fuel efficient gear oils that maintain and improve vehicle axle durability and provide extended performance time over current gear oil will be qualified for military use. Performance requirements will be developed for a new military brake fluid that is compatible with ABS brake systems and candidate fluid technologies will be investigated. Smart fuel metering technology will be integrated into self-correcting devices that will automatically report fuel quantity and fuel filter effectiveness testing will be conducted to establish fuel particle contamination limits for new fuel monitoring technology. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility) in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.118

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*	Project (Number/Name) BL3 / *Explosives Forensics Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BL3: *Explosives Forensics Advanced Technology*	-	0.000	0.000	2.038	-	2.038	2.079	2.123	2.165	2.189	0.000	10.594

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Projects:
* L97 Smoke and Obscurants Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures instrumentation and algorithms required to provide improved point, proximity, and stand-off detection of explosives and precursor materials to enable the warfighter to integrate chemical and explosive hazard detection equipment. This Project integrates explosive detection into the family of Chemical, Biological, Radiological, and Nuclear point and stand-off sensors, alternative chemical detection modalities and algorithms that will improve the probability of detection and attribution of an explosive hazard or Home-made Explosive manufacturing/assembly location.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground and Next Generation Combat Vehicle Portfolio.

Work is performed by the U.S. Army Engineer Research and Development Center.

Work in this Project is related to, and fully coordinated with, PE 0602144A (Ground Technology) / Project BL2 (Explosives Forensics Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Detection Mechanisms for Contaminants	-	-	2.038
Description: This effort demonstrates improved point and standoff detection of military and homemade explosives and their precursors, and other chemicals and hazardous materials.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BL3 / *Explosives Forensics Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will integrate ultra violet laser, spectrometer and algorithm technology improvements for trace explosive detection. Will assess technology improvements for trace explosives sensors against homemade and military explosives, as well as narcotics. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology) in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.038

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*	Project (Number/Name) BL6 / *Expedient Passive Protection Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BL6: *Expedient Passive Protection Advanced Technology*	-	0.000	0.000	3.703	-	3.703	3.169	0.000	2.533	4.343	0.000	13.748

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Projects:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates: rapidly deployable protection solutions to protect small distributed units; decision support applications and software; and tactics, techniques, and procedures to increase the survivability of personnel, critical assets, and facilities from a range of threats. Force protection technologies will be matured and demonstrated for the complex, urban environment as well as to protect against advanced energetic threats and large caliber rockets and missiles.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground portfolio.

Work in this Project conducted by the U.S Army Futures Command and the U.S Army Engineer Research and Development Center.

This effort is coordinated with PE 0602144A (Ground Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Force Protection in the Urban Environment Demonstrations	-	-	3.703
Description: This effort matures and demonstrates force protection solutions for urban environments focusing on the use of existing structures; rapidly deployable protection systems; decision support applications and software; and tactics, techniques, and procedures to provide protection with consideration for a complex three-dimensional threat.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BL6 / *Expedient Passive Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate an expedient retrofit kit for existing buildings and a rapidly deployable force protection barrier; will demonstrate applications for quickly calculating small arms protection levels and wall vulnerability to blast. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems) in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	3.703

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*	Project (Number/Name) BL8 / *Power Projection in A2AD Environments Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BL8: *Power Projection in A2AD Environments Adv Tech*	-	0.000	0.000	0.892	-	0.892	1.268	3.010	3.400	3.218	0.000	11.788

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Projects:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates remote assessment technologies to determine entry and maneuver corridors, provides site selection tools and decision support technologies for all climates in all season conditions including aviation site selection tools, enhanced automated route reconnaissance technologies, mobility models for extreme climates, and road capacity assessment technologies. These technologies reduce reliance on manned on-site reconnaissance for force projection assessments and provide all-season predictions to ensure air and ground battlespace entry and maneuver. This Project also matures and demonstrates material solutions to repair, rebuild and construct infrastructure required for movement and maneuver in highly contested, complex operational environments such as Anti-Access/Area Denial.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground portfolio.

Work in this project conducted by the U.S. Army Futures Command and the U.S Army Engineer Research and Development Center.

This effort is coordinated with PE 0602144A (Ground Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Entry and Sustainment in Complex Contested Environments Demonstrations	-	-	0.892
Description: This effort matures and demonstrates geospatial planning tools to expand engineering analysis of ground surfaces for entry, sustainment, and maneuver operations and to automate processes for selecting suitable maneuver corridors.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BL8 / *Power Projection in A2AD Environments Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will expand, mature, and automate site selection algorithms for geospatial planning tools, allowing aviation mission planning cells to select region of interest and rapidly identify best suited terrain for air assault missions and forward arming and refueling needs. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems) in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.892

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603119A / *Ground Advanced Technology*	Project (Number/Name) BM1 / *Protection from Advanced Weapon Effects Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BM1: *Protection from Advanced Weapon Effects Adv Tech*	-	0.000	0.000	1.919	-	1.919	2.481	4.359	4.474	5.355	0.000	18.588

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Projects:
* T08 Combat Eng Systems
PE 0603728A Environmental Quality Technology Demonstrations, Projects:
* 03E Robotics for Engineer Operations

A. Mission Description and Budget Item Justification

This Project matures and demonstrates structural hardening solutions and force protection technologies to increase survivability of facilities and provide critical updates to protective design specifications and guidance. Additionally, this project matures and demonstrates passive protection technologies and provides protective design criteria advancements to mitigate attack from emerging advanced threats.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Ground portfolio.

Work in this Project is conducted by the U.S. Army Futures Command and the U.S. Army Engineer Research and Development Center.

This effort is coordinated with PE 0602144A (Ground Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Applications of Environmentally-Inspired Unconventional Countermeasures	-	-	0.242
Description: This effort will demonstrate rapidly-deployable, eco-friendly materials with spectral signatures that alter or obscure underlying target spectral signatures.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603119A / *Ground Advanced Technology*	**Project (Number/Name)** BM1 / *Protection from Advanced Weapon Effects Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate living tone-down formulas at larger scale outdoor level; demonstrations will include application of select formulations on Army relevant structural material. Will deliver algorithms to detect and compare spectral features essential for the performance of unconventional countermeasures. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems) and PE 0603728A (Environmental Quality Technology Demonstrations) / Project 03E (Robotics for Engineer Operations) in FY 2020.			
Title: Defeat of Complex Attack Demonstrations ***Description:*** This effort demonstrates force protection technologies that mitigate the effects of emerging peer and near peer adversaries? advanced penetrating threats and high yield blast effects by optimizing high-performance, logistically feasible material solutions and processes. ***FY 2020 Plans:*** Will demonstrate baseline protection of current structural hardening solutions against fragmentation effects and scaled high velocity penetrator effects from precision strike weapons. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project was realigned from PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems) and PE 0603728A (Environmental Quality Technology Demonstrations)/ Project 03E (Robotics for Engineer Operations) in FY 2020.	-	-	1.677
Accomplishments/Planned Programs Subtotals	-	-	1.919

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603125A / *Combating Terrorism - Technology Development*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	44.088	36.757	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	80.845
DF5: *Agile Integration & Demonstration*	-	27.088	3.757	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.845
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	17.000	33.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.000

Note

In FY 2020, this PE is being eliminated, with continuity of effort realigned to the following PEs:
* 0602145A (Next Generation Combat Vehicle Technology)

A. Mission Description and Budget Item Justification

This PE demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the United States (U.S.) Department of Energy (DOE) to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; and field demonstrations to stress and assess emerging technologies earlier in the systems development life cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this Project is complementary to and is fully coordinated with PE 0602618A (Ballistics Technology) / Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and PE 0603005A (Combat Vehicle and Automotive Advanced Technology).

The cited work is consistent with the Under Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

This work is performed by the U.S. Army Futures Command.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603125A *I Combating Terrorism - Technology Development*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	26.903	3.762	2.741	-	2.741
Current President's Budget	44.088	36.757	0.000	-	0.000
Total Adjustments	17.185	32.995	-2.741	-	-2.741
• Congressional General Reductions	-0.022	-0.005			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	17.000	33.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.260	-			
• SBIR/STTR Transfer	-1.053	-			
• Adjustments to Budget Years	-	-	-2.741	-	-2.741

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: DW4: *Energy Technologies (Congressional Adds (CAs))*		
Congressional Add: *Congressional Increase.*	17.000	-
Congressional Add: *Atificial Intelligence Enabled Sensor Networks*	-	8.000
Congressional Add: *Enhanced Propulsion Systems for UAS*	-	6.000
Congressional Add: *Lightweight Low Power Radar System*	-	8.000
Congressional Add: *Long Endurance UAV Research*	-	8.000
Congressional Add: *Open Source ISR Research*	-	3.000
Congressional Add Subtotals for Project: DW4	17.000	33.000
Congressional Add Totals for all Projects	17.000	33.000

Change Summary Explanation

FY18 congressional adds for Lightweight Low Power Radar Systems ($6.000 million), Long Endurance UAV Research ($8.000 million), and Open Source ISR Research ($3.000 million).

FY19 congressional adds for artificial intelligence enabled sensor networks ($8.000 million), enhanced propulsion systems for UAS ($6.000 million), lightweight low power radar systems ($8.000 million), long endurance UAV research ($8.000 million), and open source ISR research ($3.000 million).

FY20 adjustments realign program funds to PE 0602145A (Next Generation Combat Vehicle Technology).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603125A / *Combating Terrorism - Technology Development*	Project (Number/Name) DF5 / *Agile Integration & Demonstration*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
DF5: *Agile Integration & Demonstration*	-	27.088	3.757	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.845

Note

In FY 2020 this Project is being realigned to:
PE 0602145A (Next Generation Combat Vehicle Technology), Projects:
* BH5 (Platform Electrification and Mobility Tech)
* BI4 (Materials Application and Integration Technology)

A. Mission Description and Budget Item Justification

This Project demonstrates and evaluates emerging technologies and systems with high payoff potential to address current technology shortfalls or future capability gaps. Efforts include hybrid electric power technologies to reduce use of fossil fuel in tactical generators; collaboration with the United States Department of Energy (DOE) to demonstrate technologies that provide significant gains in ground vehicle energy efficiency; demonstration of ground platform power management, generation, and distribution technologies that increase energy efficiencies and support the integration of advanced future capabilities; and field demonstrations to stress and assess emerging technologies earlier in the systems development life cycle, thus reducing potential vulnerabilities and providing an improved understanding of employment risks against potential threats.

Work in this Project is complementary to and is fully coordinated with PE 0602618A (Ballistics Technology) / Project H80 (Ballistics Technology/Survivability and Lethality Technology), PE 0602601A (Combat Vehicle and Automotive Technology), and PE 0603005A (Combat Vehicle and Automotive Advanced Technology).

The cited work is consistent with the Under Secretary of Defense, Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

This work is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Ground Platform Subsystem Demonstrations	4.006	1.073	-
Description: This effort contributes to the Army's ground platform risk reduction efforts which seek to address technical and integration challenges in the areas of mobility, survivability, vehicle architecture, and systems integration. Specifically, this effort focuses on maturing and demonstrating integrated vehicle power management, generation and distribution technologies to increase ground vehicle energy efficiencies and ensure ground platforms have enough power to enable future capabilities such as electromagnetic armor, active protection systems, improvised explosive device detect and defeat technologies, advanced			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
situational awareness and future network integration technologies. This effort is coordinated with PE 0603005A (Combat Vehicle and Automotive Advanced Technology). ***FY 2019 Plans:*** Complete optimization of VEA Mobile Demonstrator (VMD) performance during hardware integration onto vehicle platform, and validate system performance against future power and data requirements. Complete validation of powertrain controls architecture and algorithms, improving powertrain efficiencies and minimizing parasitic losses. Complete validation of integrated starter generator, advanced thermal management system, and advanced modular lithium ion battery technologies to improve subsystem fuel efficiency and increase electrical power generation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort ends in FY 2019.			
Title: Ground Vehicle Power and Energy ***Description:*** This effort matures and demonstrates advanced technologies that enable military ground vehicles to become significantly more energy efficient. It collaborates with the DOE to demonstrate technologies in: advanced combustion engines and transmissions; lightweight structures and materials; energy recovery and thermal management; alternative fuels and lubricants; hybrid propulsion systems; batteries and energy storage; and analytical tools (e.g., modeling and simulation). This effort is coordinated with PE 0602601A (Combat Vehicle and Automotive Technology). ***FY 2019 Plans:*** Continue to support the AVPTA with the DOE to mature and demonstrate technologies within the alliance technology focus areas. Develop methodology and software for optimal sizing of fuel cells and battery packs for military vehicles. Develop advanced electrolytes to increase Lithium Metal Battery energy density, performance and life. Develop and test Thermal Barrier Coatings to reduce heat loss/improve fuel economy of combustion engines. Develop and evaluate next-generation, light-weight materials, manufacturing and related processes. Support the AVPTA project portfolio via "Extended Enterprise" efforts such as Improving the Fuel Efficiency of the Current Ground Tactical Fleet; JP-8 Fuel Cell Power; and other activities that will enhance Operational Energy efficiency and reduce energy consumption. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Beginning in FY 2020, this sub-effort realigns to PE 0602145A (NGCV Technology) / Project BH5 (Platform Electrification and Mobility Tech) and PE 0602145A (NGCV Technology) / Project BI4 (Materials Application and Integration Technology) as part of the financial restructure to continue the AVPTA partnership with the DOE.	5.413	2.563	-
Title: Red Teaming Field Demonstration	7.450	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort conducts field demonstrations to stress emerging technologies in realistic environments and scenarios, using warfighters and adaptive adversaries. Field demonstration activities seek to place emerging technologies in the hands of Warfighters early in the development cycle to leverage their feedback and to uncover potential vulnerabilities in future systems, allowing identification of design fixes and improvements while mitigations are less expensive. Red Teaming Field Demonstration activities are coordinated with PE 0602618A (Ballistics Technology).			
Title: Red Teaming Systems Intensive Analysis ***Description:*** This effort conducts in-depth analysis (from concepts to employment to interoperability) of selected high priority emerging technology sub-systems and systems with planned transitions to future programs of record. The intent is assess technologies using virtual and laboratory experiments across a broad range of potential threat vectors, environments, and use cases to identify and mitigate any identified vulnerabilities as early as possible.. These venues allow for detailed analysis in areas that would be too dangerous or too expensive to assess during a live, field demonstration.	4.394	-	-
Title: Red Teaming Vulnerability Exercises ***Description:*** This effort conducts tabletop exercises for in-depth assessments of emerging threats and technologies to anticipate future challenges in contested and congested environments, inform threat concepts, adapt system development practices, and maintain overmatch capability. Outputs of these exercises influence technologies and scenarios chosen for Systems Analysis and Field Demonstrations.	2.866	-	-
Title: Unmanned Teaming Technology Assessment ***Description:*** This effort provides an assessment of technology components and enablers required to establish a manned-unmanned teaming capability for enhanced combat power in complex and contested environments. The assessment will consider Soldiers, unmanned ground vehicles, unmanned air vehicles, command and control, communications, and lethality technologies.	2.959	-	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.121	-
Accomplishments/Planned Programs Subtotals	27.088	3.757	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DF5 / *Agile Integration & Demonstration*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603125A / *Combating Terrorism - Technology Development*				Project (Number/Name) DW4 / *Energy Technologies (Congressional Adds (CAs))*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
DW4: *Energy Technologies (Congressional Adds (CAs))*	-	17.000	33.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	50.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for technology development and demonstration.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Congressional Increase. ***FY 2018 Accomplishments:*** Congressional Increase.	17.000	-
Congressional Add: Atificial Intelligence Enabled Sensor Networks ***FY 2019 Plans:*** Atificial Intelligence Enabled Sensor Networks	-	8.000
Congressional Add: Enhanced Propulsion Systems for UAS ***FY 2019 Plans:*** Enhanced Propulsion Systems for UAS	-	6.000
Congressional Add: Lightweight Low Power Radar System ***FY 2019 Plans:*** Lightweight Low Power Radar System	-	8.000
Congressional Add: Long Endurance UAV Research ***FY 2019 Plans:*** Long Endurance UAV Research	-	8.000
Congressional Add: Open Source ISR Research ***FY 2019 Plans:*** Open Source ISR Research	-	3.000
Congressional Adds Subtotals	17.000	33.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603125A / *Combating Terrorism - Technology Development*	**Project (Number/Name)** DW4 / *Energy Technologies (Congressional Adds (CAs))*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603130A *I TRACTOR NAIL*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	4.880	4.896	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.776
DS8: *Tractor Nail*	-	4.880	4.896	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.776

Note

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1)

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	4.880	4.896	4.943	-	4.943
Current President's Budget	4.880	4.896	0.000	-	0.000
Total Adjustments	0.000	0.000	-4.943	-	-4.943
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-4.943	-	-4.943

Change Summary Explanation

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603131A *I TRACTOR EGGS*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	4.326	6.041	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.367
DS9: *Tractor Eggs*	-	4.326	6.041	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	10.367

Note

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

A. Mission Description and Budget Item Justification

This program is reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	4.326	6.041	8.591	-	8.591
Current President's Budget	4.326	6.041	0.000	-	0.000
Total Adjustments	0.000	0.000	-8.591	-	-8.591
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-8.591	-	-8.591

Change Summary Explanation

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603270A *I Electronic Warfare Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	33.249	41.458	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	74.707
CY3: *Offensive Cyber Operations Mirror Adv Tech*	-	0.000	6.475	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.475
K12: *EW Demonstrations (CA)*	-	3.000	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.000
K15: *Advanced Comm Ecm Demo*	-	9.038	2.439	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.477
K16: *Non-Commo Ecm Tech Dem*	-	21.211	22.544	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	43.755

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being realigned to the following PEs:
* 0603463A Network C3I Advanced Technology
* 0603465A Future Vertical Lift Advanced Technology Project:
* 0603462A Next Generation Combat Vehicle Advanced Technology
* 0603457A C3I Cyber Advanced Development

A. Mission Description and Budget Item Justification

In FY 2020 this PE is being eliminated, with continuity of effort realigned to other PEs as part of the United States (U.S.) Army's Science and Technology portfolio financial restructure. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

This PE matures and demonstrates electronic warfare (EW) sensors and software intended to deny, disrupt, locate or destroy the enemy's command, control and communications (C3) systems and intelligence, surveillance and reconnaissance assets. This PE matures both countermeasures (CM) and counter-countermeasures (CCM) to deny the enemy the use of their systems while protecting United States (U.S.) assets from enemy deception and jamming. Project CY3 matures and demonstrates architecture, sensor and software techniques to provide operationally relevant capabilities for cyber support at Corps level and below and enables cyber situational awareness, command and control, mission rehearsal, observable reporting, and framework to incrementally advance cyber tool development. Project K15 matures and demonstrates capabilities to locate and exploit enemy communication systems including computer networks. Project K16 matures and demonstrates multifunctional EW capabilities (jamming) to enhance platform survivability and provide near real-time situational awareness to the Commander through the detection, identification and geo-location of emitters of interest.

Work in this PE complements PE 0602120A (Sensors and Electronic Survivability), PE 0602782A (Command, Control, Communications Technology), PE 0602270A (Electronic Warfare Technology), PE 0603772A (Advanced Tactical Computer Science) and PE 0603794A (Command, Control and Communications Advanced Technology), and is coordinated with PE 0602601A (Combat Vehicle and Automotive Technology), PE 0602618A (Ballistics Technology), PE 0603003A (Aviation

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603270A *I Electronic Warfare Technology*

Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603313A (Missile and Rocket Advanced Technology) and PE 0603794A (Command, Control and Communications Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	31.296	31.491	35.317	-	35.317
Current President's Budget	33.249	41.458	0.000	-	0.000
Total Adjustments	1.953	9.967	-35.317	-	-35.317
• Congressional General Reductions	-0.021	-0.033			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	3.000	10.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.026	-			
• Adjustments to Budget Years	-	-	-35.317	-	-35.317

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: K12: *EW Demonstrations (CA)*		
Congressional Add: *PACOM multi-domain battle exercise capabilities (CA)*	3.000	-
Congressional Add: *Tactical Cyber-Electronic Warfare Readiness*	-	10.000
Congressional Add Subtotals for Project: K12	3.000	10.000
Congressional Add Totals for all Projects	3.000	10.000

Change Summary Explanation

FY19 congressional add for tactical cyber-electronic warfare readiness initiative ($10.000 million).
FY20 decrease aligns program requirements with Army Modernization priorities in support of the National Defense Strategy as part of the S&T financial restructure.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / *Electronic Warfare Technology*	Project (Number/Name) CY3 / *Offensive Cyber Operations Mirror Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
CY3: *Offensive Cyber Operations Mirror Adv Tech*	-	0.000	6.475	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.475

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Project:
*AQ4 Network Access and Effects
PE 0603457 C3I Cyber Advanced Development, Project:
* CB4 Offensive Cyber Operations (OCO) Mirror Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates architecture, sensor and software techniques to provide operationally relevant capabilities for cyber support at Corps and Below. This Project enables cyber situational awareness, command and control, mission rehearsal, observable reporting, and framework to incrementally advance cyber tool development to realize the desired intent against any threat, to perform Cyber/EW/SIGINT operations and to assist in answering the commanders understanding of the battlespace in a hostile electromagnetic and cyber environment.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Offensive Operations	-	6.238	-
Description: This effort matures and demonstrates integrated electronic attack (EA) and cyberspace electromagnetic activities (CEMA) hardware and software to execute force protection (FP), EA, electronic surveillance (ES), signals intelligence (SIGINT), electronic warfare (EW) and cyber missions in a dynamic, distributed and coordinated fashion. This results in the capability to engage a multitude of diverse multi-node, multi-waveform, multi-platform and cyber (internetworked computers) targets while maximizing overall network efficiency and effectiveness, and preserving Blue Force and non-combatant communications. Work being accomplished under Program Element (PE) 0603270A/Projects K15 and K16 and PE 0602270A/Projects CYB and 906 complement this effort. In FY 2019 this effort was moved from Project K15 per an Office of the Secretary of Defense directive to identify cyber investments in cyber unique Projects.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** CY3 / *Offensive Cyber Operations Mirror Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Mature CEMA mission management software to augment the Commander's ability to build courses of action that achieve desired intent by allowing the Commander to choose the right cyber toolset for the mission based on availability of tools and computing resources on Blue Force platforms; optimize methods to employ tactical cyber/EW/SIGINT platforms as sensors to ascertain sufficient situational understanding of the mission space; demonstrate mature cyber and EW techniques against validated threats in support of and for transition to Programs of Record; use Modeling and Simulation to demonstrate how machine learning can be used to overcome technology hurdles, operational complexities, and enable timely Blue Force response; and use software and subsystem improvements to mature a simulated laboratory-based offensive cyber infrastructure for advanced EW/cyber development, tactical rehearsal, and training capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603270A/Project CY3 realigned to PE 0603463A/Project AQ4 in FY20. The remainder realigned into a new Project CY2 effort (Offensive Cyber Operations (OCO) Mirror) in FY20.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.237	-
Accomplishments/Planned Programs Subtotals	-	6.475	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / *Electronic Warfare Technology*	Project (Number/Name) K12 / *EW Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
K12: *EW Demonstrations (CA)*	-	3.000	10.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Electronic Warfare Technology and Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: PACOM multi-domain battle exercise capabilities (CA) ***FY 2018 Accomplishments:*** PACOM multi-domain battle exercise capabilities (CA)	3.000	-
Congressional Add: Tactical Cyber-Electronic Warfare Readiness ***FY 2019 Plans:*** Tactical Cyber-Electronic Warfare Readiness	-	10.000
Congressional Adds Subtotals	3.000	10.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / *Electronic Warfare Technology*	Project (Number/Name) K15 / *Advanced Comm Ecm Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
K15: *Advanced Comm Ecm Demo*	-	9.038	2.439	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.477

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* AN8 COE - Every Receiver is a Sensor Advanced Tech
* AO7 EW for Maneuver Operations (EMO) Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates sensor and software technologies to locate and identify modern tactical enemy and blue force (friendly) radio frequency (RF) communications, radars, signals of interest (SOI) and computer networks/nodes. This Project enables uninterrupted air and ground based intelligence collection and long range targeting operations in a hostile electromagnetic and cyber environment, and enables communications countermeasures (CM) and counter-countermeasures (CCM) to first intercept, identify and locate tactical communications; then degrade threat-computer networks and their components.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Offensive Operations	5.927	-	-
Description: This effort matures and demonstrates integrated electronic attack (EA) and cyberspace electromagnetic activities (CEMA) hardware and software to execute force protection (FP), EA, electronic surveillance (ES), signals intelligence (SIGINT), electronic warfare (EW) and cyber missions in a dynamic, distributed and coordinated fashion. This results in the capability to engage a multitude of diverse multi-node, multi-waveform, multi-platform and cyber (internetworked computers) targets while maximizing overall network efficiency and effectiveness, and preserving blue force and non-combatant communications. Work being accomplished under Program Element (PE) 0603270A/Projects CY3 and K16 and PE 0602270A/Projects CYB and 906 complement this effort. In FY 2019 this effort was moved to Project CY3 in accordance with Volume 2B, Chapter 18, of the DoD Financial Management Regulation (FMR), requiring all "cyberspace activities" funding move into pure budget Projects.			
Title: Stand-off Non-Cooperative Multi-Intelligence (Multi-INT) Technologies	3.111	2.439	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K15 / *Advanced Comm Ecm Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates hardware and software to conduct standoff electronic warfare (EW) intelligence, surveillance reconnaissance, planning and effects in a three dimensional urban battlespace. Work being accomplished under Program Element (PE) 0603270A/Project K16 and PE 0602270A/Project 906 complement this effort. ***FY 2019 Plans:*** Mature modeling & simulation (M&S) capabilities to analyze advanced threat scenarios to optimize future Blue Force multi-function EW sensor employment; conduct a laboratory demonstration of EW operations coordinated with other Warfighting functions (Fires, Maneuver, etc.) within the context of the EWPMT POR; demonstrate the implementation of ES and EA C2 functions in a laboratory environment to support future Terrestrial Layer Intelligence. Will support requirements development using EWPMT and/or surrogate sensors/systems; and mature and demonstrate software algorithms that optimize the planning of coordinated disparate airborne EW (i.e. the Air large increment of the Multifunction EW POR) and Intel assets (i.e. Enhanced Medium Altitude Reconnaissance and Surveillance System and Tactical SIGINT Payload PORs) with ground-based multi-function assets (i.e. dismounted/mounted Intel/EW systems) to illustrate the value of a combined Intel and CEMA common operating picture for enhanced situational understanding. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 063270A/Project K15 realigned to PE 063463A/Project AO7 (Electronic Warfare Maneuver Operations) in FY 2020.			
Accomplishments/Planned Programs Subtotals	9.038	2.439	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603270A / *Electronic Warfare Technology*	Project (Number/Name) K16 / *Non-Commo Ecm Tech Dem*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
K16: *Non-Commo Ecm Tech Dem*	-	21.211	22.544	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	43.755

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603465A Future Vertical Lift Advanced Technology, Project:
*AK3 Aviation Survivability Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Project:
*BG7 Ground Systems Active Defense (GSAD) Advanced Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates non-communication, multi-functional electronic warfare (EW) capabilities that enhance the survivability of Army air and ground platforms and dismounted Soldiers. This Project matures and demonstrates radio frequency (RF), infrared (IR) and electro-optical (EO) sensors and jamming sources to detect, locate, deceive, and neutralize (jam) booby traps, radar-directed target acquisition systems, target-tracking sensors, surface-to-air missiles (SAMs), air-to-air missiles (AAMs), and top-attack and electronically-fuzed munitions. This Project also enables electronic support (ES) hardware and software to detect, identify and geolocate emitters of interest from an effective standoff distance to provide near real-time situational awareness.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Multispectral Threat Detection and Countermeasure Technologies	5.650	6.274	-
Description: This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against electro-optical (EO), infrared (IR) and radio frequency (RF) guided threats. Work accomplished under Program Element (PE) 0602270A/Project 906 complements this effort. ***FY 2019 Plans:*** Develop demonstrator sensor system leveraging previously developed digital readout integrated circuit for threat warning, advanced focal plane array, and processing; use demonstrator sensor to collect threat signatures and background data; will integrate new sensor model into the M&S environment; assess algorithm performance with prior data sets and additionally with			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
newly collected data from demonstrator sensor system; evaluate algorithm performance using models of projected threats with modified signature characteristics; and analyze function and capability of demonstrator sensor system as part of an integrated survivability suite and demonstrate end-to-end functionality of demonstrator sensor system in laboratory environment. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603270A/Project K16 realigned to PE 0603465A/Project AK3 in FY 2020.			
Title: Advanced Tactical EW Countermeasure Technologies ***Description:*** This effort matures and demonstrates integrated electronic warfare (EW)/direction finding technologies that provide protection of ground and dismounts from emerging radio frequency (RF) threats at standoff distances. Work accomplished under Program Element (PE) 0602270A/Project 906 and PE 0603270A/Project K15 complements this effort. ***FY 2019 Plans:*** Develop functions to intelligently identify threat, assess effectiveness, and optimize soft-kill (SK) countermeasure response for Homing and Laser Beam Rider threat variants; refine threat and system models that enable training of cognitive algorithms; conduct hardware breadboarding and techniques development of advanced SK countermeasure system; provide feedback to Open Standards Community of Interest on EW requirements; demonstrate integrated SK countermeasure hardware and intelligent software in simulation environment; perform technology assessment of the advanced SK countermeasure performance in the areas of identification, effectiveness assessment, optimization, improvements to total survivability, and extensibility to unknown threats. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603270A/Project K16 realigned to PE 0603462A/Project BG7 in FY 2020.	5.056	4.922	-
Title: EW Counter Countermeasures ***Description:*** This effort matures and demonstrates hardware and software to counter emerging electronic warfare threats to command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) platforms. Work being accomplished under PE 0603772A/Project 243 and PE 0602270A/Project 906 complements this effort. ***FY 2019 Plans:*** Continue maturation and integration of EP software and algorithms in open standards and open architecture designs with a focus on different classes of radar systems across the Army portfolio; continue to conduct hardware in the loop (HWIL) analysis of prioritized emerging threat interference techniques; assess potential interactions on emerging Blue Force systems, (i.e. communication, radar) and apply EP algorithms to mitigate the electromagnetic interference caused by these effects; mature and complete EP algorithms for detection, localization and neutralization of electronic interference, and will demonstrate their performance against a current threat; leverage HWIL assessment capabilities to support a future threat analysis and develop	3.502	3.382	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
techniques for mitigating future threats; expand efforts into developing advanced EA capabilities based on predicted future threats to create a red-team / blue-team EA/EP optimization loop for development of more advanced EP techniques. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0633270A/Project K16 realigned to a Classified program in FY 2020.			
Title: Active Protection System (APS) Soft Kill (SK)/Hard Kill (HK) Sensors (formerly titled Active Protection System (APS) Soft Kill) ***Description:*** This effort matures and demonstrates hardware, software and techniques to provide an electronic warfare (EW) soft kill, and cueing/tracking capability to the APS suite. This effort supports the Army's APS program to mature and demonstrate technologies to reduce vehicle weight by reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. Work being accomplished under PE 0602601A/Project C05, PE 0602618A/Project H80, PE 0603004A/Project 232, PE 0603005A/ Project 221 and PE 0603313A/Project 263 complements this effort. ***FY 2019 Plans:*** Demonstrate soft-kill (SK) and hard-kill (HK) capability and perform system analysis of their respective passive electro-optic/ infrared and active radar sensors, SKCM, and Modular APS (MAPS) Controller on the MAPS platform demonstrator and MAPS Virtual software and hardware integration laboratories; passive and active sensor interface designs will be verified with modular active protection framework by demonstrating real time cueing, tracking and handoff of the threat message to the SKCM and hard-kill countermeasure (HKCM); develop, integrate and demonstrate the message pass through of multiple subsystems (cueing and tracking sensors, controller, SKCM and HKCM); continue integration of the passive and active sensors into the additional SK and HK APS; integrate new passive and active sensor techniques into the SKCM and HKCM software/hardware to address a wider list of current and emerging threats. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 06033270A/K16 realigned to PE 06033462A/Project BG7 in FY 2020.	3.251	3.345	-
Title: Modeling Simulation and Technique Maturation for Integrated RF Operations (formerly titled Integrated RF Operations) ***Description:*** This effort matures and demonstrates a capability to perform modeling and simulation (M&S) of geographically dispersed radio frequency (RF) systems to provide a coordinated, collaborative and interoperable suite of electronic warfare (EW) capabilities. A modular software architecture will allow for rapid, cost effective technique development and integration of new EW capabilities, target signals of interest and environmental simulations. Work being accomplished under PE 0602270A/Project 906 and PE 0603794A/Project EL4 complements this effort. ***FY 2019 Plans:***	1.751	1.207	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Mature and extend the collaborative sensor M&S environment to be capable of assessing system of systems performance for EW and other sensors across various scenarios to support analysis of performance requirements and development of concepts of employment; mature EW techniques and methods (i.e. active, reactive, surgical and protocol based software) developed in FY 18 under the Multi-Function Electronic Warfare (MFEW) Technique Development effort. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 06033270A/K16 has been realigned to PE 06033463A/AO7 in FY 2020.			
Title: Intelligence Processing and Architecture Modernization ***Description:*** This effort will leverage Intelligence Community investments in software frameworks and exploits against threat SOIs to develop a library of open, modular, and scalable software solutions to address identified capability gaps and to provide the commander with electronic situational awareness while at the same time protecting his assets from enemy deception and jamming. Work accomplished under PE 0602270A/Project 906 and PE 0603772A/Project 243 complements this effort. ***FY 2019 Plans:*** Integrate electronic situational awareness assets into a multifunction system capable of demonstrating integrated intelligence, surveillance and reconnaissance (ISR)/electronic warfare (EW) enabling enhanced performance through sensor fusion and agility to changing threat environments; integrate distributed sensing algorithms with the high frequency (HF) software defined radio within a modular multifunction open radio frequency (RF) architecture and will demonstrate single sensor geolocation techniques in a laboratory environment for use within existing ES and EW sensors; demonstrate mitigation techniques for noise within the HF frequency band from small unmanned air systems to facilitate deployment of HF applications on platforms. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work in PE 0603270A/Project K16 is realigned to 0603463A/Project AN8 in FY 2020.	2.001	2.654	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.760	-
Accomplishments/Planned Programs Subtotals	21.211	22.544	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603270A / *Electronic Warfare Technology*	**Project (Number/Name)** K16 / *Non-Commo Ecm Tech Dem*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603313A *I Missile and Rocket Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	133.433	94.561	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	227.994
206: *Missile Simulation*	-	2.384	2.487	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.871
263: *Future Msl Tech Integr(FMTI)*	-	33.387	37.665	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	71.052
704: *Advanced Missile Demo*	-	24.662	19.409	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.071
NA6: *Missile and Rocket Initiatives (CA)*	-	73.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	108.000

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
? 0603462A Next Generation Combat Vehicle Advanced Technology
? 0603464A Long Range Precision Fires Advanced Technology
? 0603465A Future Vertical Lift Advanced Technology
? 0603466A Air and Missile Defense Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures, fabricates, and demonstrates advanced rocket, missile, interceptor, and guided munition technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability. Project 206 develops high fidelity simulations for advanced tactical missiles and interceptors. Project 263 demonstrates missile and interceptor systems with capabilities to provide protection against rockets, artillery, and mortars; provide precision weapons for small units in close combat; provide precision long-range fires; and provide minimum smoke propulsion for aviation missiles. Project 704 demonstrates the capability to detect and track rocket, artillery, mortar, and unmanned air vehicles threats. Project NA6 is a congressional increase Project.

In FY 2018/FY 2019, work in this PE is complimentary to PE 0602303A (Missile Technology) and is fully coordinated with PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technology), PE 0603003A (Aviation Advanced Technology), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603125A (Combating Terrorism Technology Development), PE 0603270A (Electronic Warfare Technology), PE 0603734A (Combat Engineering Systems), and PE 0708045A (Manufacturing Technology).

In FY 2020 this PE is being eliminated, with continuity of effort realigned to other PEs as part of a strategic financial restructuring of the Science and Technology (S&T) portfolio. All FY 2020 adjustments align program requirements with Army Modernization priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603313A *I Missile and Rocket Advanced Technology*

The work in this PE is performed by the U.S. Army Futures Command.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	62.850	61.132	56.578	-	56.578
Current President's Budget	133.433	94.561	0.000	-	0.000
Total Adjustments	70.583	33.429	-56.578	-	-56.578
• Congressional General Reductions	-0.049	-0.071			
• Congressional Directed Reductions	-	-1.500			
• Congressional Rescissions	-	-			
• Congressional Adds	73.000	35.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-2.368	-			
• Adjustments to Budget Years	-	-	-56.578	-	-56.578

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: NA6: *Missile and Rocket Initiatives (CA)*		
Congressional Add: *Cybersecurity & Supply Chain Risk Management Research*	10.000	-
Congressional Add: *Program Increase - House*	2.000	-
Congressional Add: *Program Increase - Senate*	45.000	-
Congressional Add: *Program Increase - Conference*	6.000	-
Congressional Add: *Land-based Anti-Ship Missile Development & Integration*	10.000	-
Congressional Add: *Program increase - cybersecurity and supply chain risk management*	-	10.000
Congressional Add: *Program increase - cyber security*	-	15.000
Congressional Add: *Program increase - tactically mobile, shoot-on-the-move SHORAD demonstration*	-	10.000
Congressional Add Subtotals for Project: NA6	73.000	35.000
Congressional Add Totals for all Projects	73.000	35.000

Change Summary Explanation

FY18 congressional adds for Cybersecurity and supply chain risk management research ($10.000 million), Program increase ($53.000 million), and Land-based anti-ship missile development & integration ($10.000 million).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603313A *I Missile and Rocket Advanced Technology*

FY19 congressional adds/rescission for: Multi-domain demonstration unjustified request (decrease of $1.500 million); cybersecurity and supply chain risk management (increase $10.000 million); cyber security (increase $15.000 million); tactically mobile, shoot-on-the-move SHORAD demonstration (increase $10.000 million).

FY20 decrease - PE eliminated due to S&T Financial Restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / *Missile and Rocket Advanced Technology*	Project (Number/Name) 206 / *Missile Simulation*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
206: *Missile Simulation*	-	2.384	2.487	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.871

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603464A Long Range Precision Fires Advanced Technology, Projects:
* AF4 Missile Simulation Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced modeling and simulation technologies for missile design and analysis. Evaluation of missile technology by means of modeling and simulation provides a cost-effective method that supports missile maturation throughout the weapon system life cycle. This effort permits a reduction in the number of flight tests required for programs of record as well as improves the confidence of flight test readiness and probability of flight test success.

This Project support efforts in the Army Science and Technology Lethality portfolio.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Missile Simulation	2.384	2.412	-
Description: This effort matures and demonstrates advanced analysis and high fidelity modeling and simulation technologies for advanced missiles and interceptor design and analysis. Evaluation of missile technology through modeling and simulation provides a cost-effective method to support missile maturation throughout the weapon system life cycle. This effort shortens component design timelines, reduces integration activities, enables a reduction of flight tests required for programs of record and improves the confidence of flight test readiness and the probability of flight test success.			
FY 2019 Plans: Mature and demonstrate algorithms for forecasting air and missile tactical threat maneuvers, improve the missile threat maneuver forecaster, and will mature algorithms for engagement tailoring and predicted intercept point (pip) management and demonstrate capabilities in experiments to quantify engagement performance; will validate a System-of-Systems simulation which provides a virtual context for research, development, and evaluation of advanced fire control and missile guidance algorithms; will mature and demonstrate cross cutting technologies that enable rapid and cost effective integration of new weapon and sensor technologies into complex system architectures; will expedite the engineering of complex software intensive systems by transforming models of interactive algorithmic behaviors into prototype software; will further mature cost-estimating tools for propulsion systems, software,			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 206 / *Missile Simulation*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
modular systems, and for converting commercial off-the-shelf cost to military off-the-shelf cost; will establish behind armor debris prediction capabilities for multiple shaped charge materials and designs. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this Project has been realigned to PE 0603464/AF4 (Long Range Precision Fires Advanced Technology/Missile Simulation Advanced Technology).			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.075	-
Accomplishments/Planned Programs Subtotals	2.384	2.487	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / *Missile and Rocket Advanced Technology*	Project (Number/Name) 263 / *Future Msl Tech Integr(FMTI)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
263: *Future Msl Tech Integr(FMTI)*	-	33.387	37.665	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	71.052

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603464A Long Range Precision Fires Advanced Technology, Projects:
* AE8 Land-Based Anti-Ship Missile Advanced Technology
* AE9 Low-Cots Tactical Extended Range Missile Advanced Technology
* AH1 Multiple Simultaneous Engagement Technologies Advanced Technology
* AH3 Single Multi-Mission Attack Missile Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BG7 Ground System Active Defense Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures, fabricates, and demonstrates advanced missile and interceptor technologies, such as seekers, guidance and controls, propulsion, and airframes. The project goal is to reduce the life-cycle costs and cost per kill of precision guided missiles and interceptors.

This Project support efforts in the Army Science and Technology Lethality and Ground Maneuver portfolios.

In FY18/FY19, this Project matures technologies from Program Element (PE) 0602303A and directly supports systems managed by the Program Executive Officer for Missiles and Space. Work in this Project is in collaboration with PE 0602618A (Ballistics Technology), PE 0602624A (Weapons and Munitions Technologies), PE 0603004A (Weapons and Munitions Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology) and PE 0708045A (Manufacturing Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Low Cost Tactical Extended Range Missile	8.038	9.470	-
Description: This effort focuses on maturation, fabrication, and demonstration of technologies for low-cost precision fires missile capable of deep strike engagements. The aim is to provide extended range and expanded target set capability through advanced propulsion, new payload technology, and maintain effectiveness in Global Positioning System (GPS) challenged environments			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
through new and novel navigation technologies. This effort supports the Army need for developing capability enablers in the area of Extended Range Precision Fires. ***FY 2019 Plans:*** Mature and evaluate the long range fires missile components in the areas of navigation, propulsion, and payload technologies; will conduct system simulation to assess improved missile performance provided by these technologies and guide their continued development; will continue to develop and test navigation integration architectures and algorithms and refine navigations system design concepts based on updated program requirements and technology developments and begin testing of enhanced navigation system designs at the sub-system level; will conduct fabrication and testing of high strength fiber and high temperature matrix materials for the solid rocket motorcase and missile airframe to meet objective requirements. Will conduct analysis of results from Single Warhead for Area and Point Targets (SWAP) warhead testing to facilitate technology transition for multi-effects lethality for Fire Support applications. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort has been realigned to PE 0603464A/AE9 (Long Range Precision Fires Advanced Technology).			
Title: Active Protection System Interceptor Demonstration ***Description:*** This effort matures, integrates and demonstrates modular hard-kill Active Protection System (APS) technologies with the Hit Avoidance Architecture and APS Common Controller and matures modeling and simulation for system integration and demonstration. Specifically the hard-kill APS portion and modeling and simulation efforts will be addressed by the United States (U.S.) Army Aviation and Missile Research, Development and Engineering Center (AMRDEC). This effort supports the Army's APS program to mature and demonstrate APS technologies to reduce vehicle weight while reducing reliance on armor through the use of other means such as sensing, warning, hostile fire detection, and active countermeasures to achieve increased protection against current and emerging threats. This effort supports the development of an APS Common Architecture enabling adaptable APS solutions that can be integrated across Army vehicle platforms as required. This effort compliments work being accomplished under PE 0602601A/Project C05, PE 0602618A/Project H80, PE 0603004A/Project 232, PE 0603005A/Project 221, and PE 0603270A/Project K16. ***FY 2019 Plans:*** Continue maturation and adaptation of a hard-kill countermeasure and fire control sensor to improve performance of survivability equipment; will improve modeling and simulation of APS countermeasure and fire control sensor alternatives. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort has been realigned to PE 063462A/ Project BG7 (Next Generation Combat Vehicle Advanced Technology).	6.250	3.516	-
Title: Affordable Extended Range Precision Missile Demonstration	12.549	7.700	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort focuses on the maturation, fabrication, integration, hardware-in-the-loop (HWIL) test, and flight demonstration of technology for an affordable discriminate extended range precision missile to include critical component technologies such as advanced propulsion, seekers, fire control, datalink, guidance and controls, and maneuverable airframes. Critical subsystem technology development transitions to 0603313A/263 Low Cost Extended Range Missile and 0603313A/704 Low Cost Extended Range Air Defense and to future fire support efforts for further maturation. ***FY 2019 Plans:*** Develop radio frequency (RF) sensor technology, perform integration and will demonstration for multiple platforms to improve performance of missiles in an Anti-Access/Anti-Denial environment; critical attributes will include target detection, target acquisition, target classification, target tracking and target aim point selection. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort has been realigned to PE 0603464A/Project AE8 (Long Range Precision Fires Advanced Technology).			
Title: Close Combat Weapons Technology ***Description:*** This effort addresses close combat weapon systems trade studies, and technology maturation and demonstration for a next generation close combat precision missile system for dismounted and mounted maneuver. ***FY 2019 Plans:*** Optimize missile design with multi-effects lethal mechanism and integrate with expeditionary launcher for short to medium range precision strike with man-in-the-loop and loitering capability with lethal effects against hard and soft targets; will begin validation of the optimized design through lab and field demonstration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort has been realigned to PE 0603464A/AH3 (Long Range Precision Fires Advanced Technology).	6.550	5.572	-
Title: Multi-Domain Lethality Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, Hardware-in-the-Loop (HWIL) development and test, and flight demonstration of critical missile technology that supports Multi-Domain Battle Concept/Cross-Domain Fires and Manned-Unmanned Teaming (MUM-T) System of Systems. The objective is to develop capability for missile systems to destroy enemy air defenses in the land and the maritime domains. This effort will develop and demonstrate appropriate sensor and payload component technologies for engaging and destroying maritime- and land-based air defense systems; integrate these component technologies into prototype missile hardware; and demonstrate hardware in a relevant flight environment. ***FY 2019 Plans:***	-	10.011	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 263 / *Future Msl Tech Integr(FMTI)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature component development of 1) multi-mode seeker (anti-radiation homing and imaging infrared) for target classification/ discrimination and aim-point selection on critical target features and 2) warhead and fuze that maximizes lethal effects against multi-domain target sets; will conduct critical design review of component technologies; will perform test and evaluation of key enabling component technologies; will refine concepts for system integration; will mature modeling and simulation HWIL capabilities for testing and validation of integrated components. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 this effort has been realigned to PE 0603464/AE8 (Long Range Precision Fires Advanced Technology).			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	1.396	-
Accomplishments/Planned Programs Subtotals	33.387	37.665	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603313A / *Missile and Rocket Advanced Technology*	Project (Number/Name) 704 / *Advanced Missile Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
704: *Advanced Missile Demo*	-	24.662	19.409	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	44.071

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603466A Air and Missile Defense Advanced Technology, Projects:
* AC8 Low Cost Extended Range Air Defense Advanced Technology
* AD4 Maneuver Air Defense Advanced Technology
PE 0603465A Future Vertical Lift Advanced Technology, Projects:
* AK5 Multi-Role Small Guided Missile Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures advanced missile system concepts and related hardware to enhance weapon system lethality, survivability, agility, versatility, deployability, and affordability for defense against future air and ground, armored and non-armored threats.

This Project support efforts in the Army Science and Technology Lethality portfolio.

Work in this Project is in collaboration with PE 0602624A (Weapons and Munitions Technologies).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Counter Rockets, Artillery, Mortars (RAM), Unmanned Aerial Systems (UAS), and Cruise Missile Tracking and Fire Control	7.197	2.273	-
Description: This effort matures and demonstrates system technology to provide 360 degree, near hemispherical coverage for tracking and intercept of UAS and/or Cruise Missile threats. This effort matures fire control methodology for engagement of threat UAS and/or Cruise Missile to generate firing solutions and determine interceptors available for an air defense mission. These efforts will be evaluated through Hardware-in-the-Loop (HWIL) experiments and multiple interceptor flights. Effort will also mature tactical launcher configurations and designs for alternative mission profiles. The technologies demonstrated will be applicable to the Indirect Fire Protection Capability (IFPC) and other Air and Missile Defense programs.			
FY 2019 Plans: mature and integrate digital data link ground station, inertial network alignment technology, and ground station components with a surrogate demonstration launcher for demonstration; will mature fire control methodology and software for air defense			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
engagement planning and flight test demonstration planning. Will exploit data gathered from multi-mission radar and other sensors in order to mature algorithm to autonomously detect, track, identify, rank and defeat counter-Unmanned Aerial System threat. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 PE 0603313A/704 has been realigned to PE 0603466A/AC8.			
Title: Low-cost Extended Range Air Defense ***Description:*** This effort matures key technologies of a lower-cost interceptor system with a low- to medium-altitude, medium- to long-range capability. This effort will enable lower cost interceptor integration into a net-enabled Air and Missile Defense Task Force for the protection of high value assets. Technologies will address the defeat of air defense threats such as Unmanned Aerial System (UAS) and Cruise Missile threats with secondary capabilities against Large Caliber Rockets (LCR), Short Range Ballistic Missiles (SRBM), and Tactical Air-to-Surface Missiles (TASMS). ***FY 2019 Plans:*** Integrate the guidance electronics unit (GEU) and control system into HWIL for demonstration of the entire guidance, navigation, and control system. Will begin HWIL flight simulation, demonstrating GEU and control system performance with a false target generator and flight motion simulator using an emulated target with the correct radar signature and kinematics, and the emulated body motion and loading of simulated flight environments. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 PE 0603313A/704 has been realigned to PE 0603466A/AC8.	8.582	7.991	-
Title: Seeker and Guidance Technology for Air Defense ***Description:*** This effort focuses on the maturation, integration, and fabrication of seeker and guidance technologies supporting air defense missile systems. Technologies addressed enable the defeat of multiple air defense threats such as Rockets, Artillery, and Mortars, Unmanned Aerial System (UAS), and Cruise Missile threats with secondary capabilities against Large Caliber Rockets (LCR), Short Range Ballistic Missiles (SRBM), and Tactical Air-to-Surface Missiles (TASMS). ***FY 2019 Plans:*** Continue maturation of the active RF seeker in the HWIL simulation facility; will refine seeker calibration, optimizing acquisition and track algorithms, optimizing seeker control algorithms, and debugging software; will continue maturation of guidance algorithms in hardware-in-the-loop (HWIL) for accurate mid-course and terminal homing guidance at extended ranges; will provide flight control scripts for testing the speed, accuracy, and stability of the flight control system for use in future flight testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	6.880	6.537	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
In FY 2020 PE 0603313A/704 has been realigned to PE 0603466A/AC8.			
Title: Multi-Role Missile Demonstration ***Description:*** This effort focuses on the maturation, fabrication, integration, hardware-in-the-loop (HWIL) development and test, and flight demonstration of critical technology that supports an open systems architecture to enable modular designs of guided and unguided missiles for smaller and lighter missile options with multi-role engagement capabilities reducing the life cycle cost for missiles. Critical component technologies include advanced propulsion, payload (lethal and non-lethal), seekers, fire control, datalink, guidance and controls, and maneuverable airframes. This effort matures and demonstrates technology from PE 0602303A, Multi-Role Missile Technology. ***FY 2019 Plans:*** Continue demonstration in a ground-launched flight test the guidance and control performance of the guided forward firing configuration and will continue maturation of the component technology of the drop/glide configuration from PE 602303A (Multi-Role Missile Technology) which includes seeker, payload, guidance electronics unit, control actuation subsystem, propulsion subsystem, and subsystem interface bus; will perform laboratory testing and simulation evaluations; will integrate modular missile technology subsystems; and will perform air dropped, unguided/ballistic flight tests to verify mechanical and electrical integrity of the drop/glide variant. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020 PE 0603313A/704 has been realigned to PE 0603465A/AK5.	2.003	1.922	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.686	-
Accomplishments/Planned Programs Subtotals	24.662	19.409	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** 704 / *Advanced Missile Demo*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603313A / *Missile and Rocket Advanced Technology*				Project (Number/Name) NA6 / *Missile and Rocket Initiatives (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
NA6: *Missile and Rocket Initiatives (CA)*	-	73.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	108.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Missile and Rocket advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Cybersecurity & Supply Chain Risk Management Research	10.000	-
FY 2018 Accomplishments: Cybersecurity & Supply Chain Risk Management Research		
Congressional Add: Program Increase - House	2.000	-
FY 2018 Accomplishments: Program Increase - House		
Congressional Add: Program Increase - Senate	45.000	-
FY 2018 Accomplishments: Program Increase - Senate		
Congressional Add: Program Increase - Conference	6.000	-
FY 2018 Accomplishments: Program Increase - Conference		
Congressional Add: Land-based Anti-Ship Missile Development & Integration	10.000	-
FY 2018 Accomplishments: Land-based Anti-Ship Missile Development & Integration		
Congressional Add: Program increase - cybersecurity and supply chain risk management	-	10.000
FY 2019 Plans: Program increase - cybersecurity and supply chain risk management		
Congressional Add: Program increase - cyber security	-	15.000
FY 2019 Plans: Program increase - cyber security		
Congressional Add: Program increase - tactically mobile, shoot-on-the-move SHORAD demonstration	-	10.000
FY 2019 Plans: Program increase - tactically mobile, shoot-on-the-move SHORAD demonstration		
Congressional Adds Subtotals	73.000	35.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603313A / *Missile and Rocket Advanced Technology*	**Project (Number/Name)** NA6 / *Missile and Rocket Initiatives (CA)*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603322A *I TRACTOR CAGE*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	12.323	16.845	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.168
B92: *DB92*	-	12.323	16.845	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	29.168

Note

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

A. Mission Description and Budget Item Justification

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	12.323	16.845	17.661	-	17.661
Current President's Budget	12.323	16.845	0.000	-	0.000
Total Adjustments	0.000	0.000	-17.661	-	-17.661
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-17.661	-	-17.661

Change Summary Explanation

The details of this program are reported in accordance with Title 10, United States Code, Section 119(a)(1).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603457A *I C3I Cyber Advanced Development*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	13.769	-	13.769	18.795	21.441	22.298	22.381	0.000	98.684
6CY: *Autonomous Cyber Advanced Technology*	-	0.000	0.000	6.000	-	6.000	6.000	8.000	9.059	9.319	0.000	38.378
7CY: *Decoy and Deterrence Advanced Technology*	-	0.000	0.000	2.135	-	2.135	4.527	4.525	3.002	2.975	0.000	17.164
8CY: *Information Trust Advanced Technology*	-	0.000	0.000	2.203	-	2.203	3.500	4.199	4.998	4.956	0.000	19.856
9CY: *Network Access and Effects Advanced Technology*	-	0.000	0.000	1.431	-	1.431	2.768	2.717	3.239	3.109	0.000	13.264
CB4: *Offensive Cyber Operations (OCO) Mirror Adv Tech*	-	0.000	0.000	2.000	-	2.000	2.000	2.000	2.000	2.022	0.000	10.022

Note

In Fiscal Year (FY) 2020 this Program Element (PE) was previously funded, with continuity of effort realigned from the following PEs:
* 0603270A Electronic Warfare Technology
* 0603794A C3 Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates technologies for offensive and defensive cyber operations in tactical environments. Efforts optimize devices, techniques, services, software and algorithms to enable cyber situational understanding and Cyber Electromagnetic Activities (CEMA). For offensive cyber, efforts demonstrate integrated electronic attack (EA) and CEMA hardware and software to execute force protection (FP), EA, electronic surveillance (ES), signals intelligence (SIGINT), electronic warfare (EW) and cyber missions in a dynamic, distributed and coordinated fashion. For defensive cyber, efforts demonstrate hardware and software to protect tactical wired and wireless networks against modern cyber attacks and focuses on configuration, operation, monitoring, data integrity, and defense in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army					Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603457A *I C3I Cyber Advanced Development*		
B. Program Change Summary ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	13.769	-	13.769
Total Adjustments	0.000	0.000	13.769	-	13.769
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	13.769	-	13.769

Change Summary Explanation

FY20 increase due to Science & Technology portfolio restructure. Efforts in this PE were previously funded elsewhere.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / *C3I Cyber Advanced Development*	Project (Number/Name) 6CY / *Autonomous Cyber Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
6CY: *Autonomous Cyber Advanced Technology*	-	0.000	0.000	6.000	-	6.000	6.000	8.000	9.059	9.319	0.000	38.378

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 06030794A C3 Advanced Technology, Project:
* EL5 Secure Tactical Information Integration

A. Mission Description and Budget Item Justification

This Project will demonstrate defensive effects to adversarial use of artificial intelligence (AI) and machine learning (ML) to avoid detection and deceive our automated technologies driving the network decisions. This Project provides cyber autonomy through science & technology advancements.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Autonomous Cyber	-	-	6.000
Description: This effort will develop proof-of-concept sensors that can adapt to and autonomously react to adversary cyber-attack and develop a cyber response course of action decision aid for cyber defenders to validate correctness of actions and to speed response decisions. ***FY 2020 Plans:*** Will develop proof-of-concept sensors that can adapt to and autonomously react to adversary cyber-attack; develop a cyber response course of action decision aid for cyber defenders to validate correctness of actions and to speed response decisions. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603794/Project EL5 in FY20 as part of the financial restructure and supports the Army's Modernization Priorities.			
Accomplishments/Planned Programs Subtotals	-	-	6.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603457A / *C3I Cyber Advanced Development*	**Project (Number/Name)** 6CY / *Autonomous Cyber Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603457A / *C3I Cyber Advanced Development*				Project (Number/Name) 7CY / *Decoy and Deterrence Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
7CY: *Decoy and Deterrence Advanced Technology*	-	0.000	0.000	2.135	-	2.135	4.527	4.525	3.002	2.975	0.000	17.164

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology:
* Project EL5 Secure Tactical Information Integration

A. Mission Description and Budget Item Justification

This Project demonstrates disruption of enemy cyber attacked through the use of cyber decoy applications with realistic user behavior algorithms, such as software that creates fake users, applications, systems, documents, networks, and communication traffic. Work in this Project complements PE 0602213A C3I Applied Cyber \ Project CY9 Decoy and Deterrence Technology.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Decoy and Deterrence Advanced Technology	-	-	2.135
Description: This Project demonstrates disruption of enemy cyber attacked through the use of cyber decoy applications with realistic user behavior algorithms, such as software that creates fake users, applications, systems, documents, networks, and communication traffic. ***FY 2020 Plans:*** Will continue development of techniques incorporating application diversity to control and vary the network attack surface to inhibit the cyber attacker's ability to detect and exploit pre-placed cyber decoys. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603794 C3 Advanced Technology/ Project EL5 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.135

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603457A / *C3I Cyber Advanced Development*	**Project (Number/Name)** 7CY / *Decoy and Deterrence Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / *C3I Cyber Advanced Development*	Project (Number/Name) 8CY / *Information Trust Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
8CY: *Information Trust Advanced Technology*	-	0.000	0.000	2.203	-	2.203	3.500	4.199	4.998	4.956	0.000	19.856

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology:
* Project EL5 Secure Tactical Information Integration

A. Mission Description and Budget Item Justification

This Project demonstrates enhanced awareness of the information's "provenance" from originator to consumer (e.g. sensor to shooter) in the presence of cyber attacks, such as an attempt to manipulate data traversing the network. Work in this Project complements PE 06022213A C3I Applied Cyber \ Project 2CY Information Trust Technology.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Information Trust Advanced Technology	-	-	2.203
Description: This project demonstrates enhanced awareness of the information's "provenance" from originator to consumer (e.g. sensor to shooter) in the presence of cyber attacks, such as an attempt to manipulate data traversing the network. ***FY 2020 Plans:*** Will develop a suitable trust score architecture that can provide real time analytics of the data through distributed processing and minimization of network traffic. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603794 C3 Advanced Technology / Project EL5 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.203

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603457A / *C3I Cyber Advanced Development*	**Project (Number/Name)** 8CY / *Information Trust Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / *C3I Cyber Advanced Development*	Project (Number/Name) 9CY / *Network Access and Effects Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
9CY: *Network Access and Effects Advanced Technology*	-	0.000	0.000	1.431	-	1.431	2.768	2.717	3.239	3.109	0.000	13.264

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 060270A C3 Advanced Technology:
* Project CY3 Offensive Cyber Operations Mirror Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced mission management tools and workflows, to promote efficient selection and sequencing of effects to support the agile deployment and execution of Offensive Cyber Operations(OCO) / Radio Frequency (RF) Enabled capabilities.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Offensive Cyber Enabling Mission Support	-	-	1.431
Description: This effort matures and demonstrates advanced mission management tools and workflows, to promote efficient selection and sequencing of effects to support the agile deployment and execution of Offensive Cyber Operations(OCO)/Radio Frequency(RF) Enabled capabilities. ***FY 2020 Plans:*** Will mature and demonstrate protocol-based access and Deny, Degrade, and Disrupt, Destroy, and manipulate (D4M) off-net techniques from tactical Radio Frequency (RF) enabled platforms against emerging hybrid commercial/military technologies used for Adversary Command, Control, Communication, Computers, and Intelligence (AC4I); mature decision aid tools for selection and optimization of RF enabled techniques in support of the Commander's desired intent. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE060270 C3 Advanced Technology/Project CY3 in FY20.			
Accomplishments/Planned Programs Subtotals	-	-	1.431

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603457A / *C3I Cyber Advanced Development*	**Project (Number/Name)** 9CY / *Network Access and Effects Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603457A / *C3I Cyber Advanced Development*	Project (Number/Name) CB4 / *Offensive Cyber Operations (OCO) Mirror Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
CB4: *Offensive Cyber Operations (OCO) Mirror Adv Tech*	-	0.000	0.000	2.000	-	2.000	2.000	2.000	2.000	2.022	0.000	10.022

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603270A Electronic Warfare Technology, Project:
* CY3 Offensive Cyber Operations Mirror Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates methods, tools and techniques to enable rapid instantiation of an operationally relevant cyberspace environment supporting critical Offensive Cyber Operations (OCO) mission functions to include but not limited to development, exercise, mission rehearsal and provide technical reach back to units during operations.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Offensive Cyber Operations (OCO) Mirror	-	-	2.000
Description: This effort will mature and demonstrate technologies and real world behavioral models of sufficient fidelity to replicate Offensive Cyber Operations environments (for cyber development, deployment, exercises, and mission rehearsal) to reduce risk for critical offensive cyber mission functions.			
FY 2020 Plans: Mature and demonstrate technologies and real world behavioral models of sufficient fidelity to replicate Offensive Cyber Operations environments (for cyber development, deployment, exercises, and mission rehearsal) to reduce risk for critical offensive cyber mission functions.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603457A / *C3I Cyber Advanced Development*	**Project (Number/Name)** CB4 / *Offensive Cyber Operations (OCO) Mirror Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Effort is realigned from PE0603270/Project CY3 in FY 2020 as part of the financial restructure and supports the Army's Modernization Priorities.			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603461A *I High Performance Computing Modernization Program*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	214.100	218.098	184.755	-	184.755	188.205	191.644	197.808	198.507	0.000	1,393.117
DS7: *High Performance Computing Modernization Program*	-	175.100	183.098	184.755	-	184.755	188.205	191.644	197.808	198.507	0.000	1,319.117
DW5: *HIGH PERF COMP MODERN (HPCM) (CA)*	-	39.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	74.000

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) addresses the supercomputing requirements of Department of Defense (DoD) scientists and engineers by: (1) demonstrating and maturing the most advanced, leading-edge computational architectures while exploiting the resulting systems by employing complementary specialized expertise; (2) demonstrating and maturing the Defense Research and Engineering Network (DREN), which investigates, demonstrates, and matures leading-edge digital networking and security technologies to securely deliver computational capabilities to the distributed DoD Research, Development, Test, and Evaluation (RDTE) community; and (3) leveraging specialized expertise from DoD, other federal departments and agencies, industry, and academia to demonstrate and mature leading-edge software application codes. DoD Supercomputing Resource Centers (DSRCs) provide extensive computational capabilities to demonstrate and mature emerging technologies that address the supercomputing requirements of the DoD RDTE community in the areas of hardware, software, and programming environments. All HPCMP sites are interconnected to each other, the DoD High Performance Computing (HPC) RDTE community, and other major defense sites via the DREN, a research network which investigates, demonstrates, and matures (a) state-of-the-art digital networking technologies to ensure a robust distributed environment and (b) the most advanced digital security capabilities to protect the intellectual property of the DoD and its contract entities as they employ HPCMP capabilities. The HPCMP's software application effort (a) optimizes, enhances, demonstrates, and matures critical DoD physics-based and engineering software to allow scientists and engineers to execute calculations with precision and efficiency on leading-edge supercomputers, (b) demonstrates and matures immersive collaborative programming environments to improve science and engineering workflows, and (c) demonstrates and matures leading-edge computational technology from academia and industry. These synergistic activities collectively demonstrate and mature horizontal technologies that are exploited across the DoD RDTE community, ensuring the DoD maintains the most advanced research and development ecosystem in computationally-intensive modeling and design.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603461A *I High Performance Computing Modernization Program*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	182.331	183.322	186.329	-	186.329
Current President's Budget	214.100	218.098	184.755	-	184.755
Total Adjustments	31.769	34.776	-1.574	-	-1.574
• Congressional General Reductions	-0.148	-0.224			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	39.000	35.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-7.083	-			
• Adjustments to Budget Years	-	-	-1.574	-	-1.574

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: DW5: *HIGH PERF COMP MODERN (HPCM) (CA)*		
Congressional Add: *Congressional Increase*	39.000	35.000
Congressional Add Subtotals for Project: DW5	39.000	35.000
Congressional Add Totals for all Projects	39.000	35.000

Change Summary Explanation

FY 2018 congressional increase in Project DW5 for High Performance Computing Modernization.
FY 2019 congressional add ($35.0 million) for "Program increase" in Project DW5.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army					Date: March 2019							
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603461A / *High Performance Computing Modernization Program*				Project (Number/Name) DS7 / *High Performance Computing Modernization Program*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
DS7: *High Performance Computing Modernization Program*	-	175.100	183.098	184.755	-	184.755	188.205	191.644	197.808	198.507	0.000	1,319.117

A. Mission Description and Budget Item Justification

The High Performance Computing Modernization Program (HPCMP) addresses the supercomputing requirements of Department of Defense (DoD) scientists and engineers by (1) demonstrating and maturing the most advanced, leading-edge computational architectures and exploiting the resulting systems by employing complementary specialized expertise; (2) demonstrating and maturing the Defense Research and Engineering Network (DREN) which investigates, demonstrates, and matures leading-edge digital networking and security technologies to securely deliver computational capabilities to the distributed DoD Research, Development, Test, and Evaluation (RDTE) community; and (3) leveraging specialized expertise from DoD, other federal departments/agencies, industry, and academia to demonstrate and mature leading-edge software application codes. DoD Supercomputing Resource Centers (DSRCs) provide extensive computational capabilities and demonstrate and mature emerging technologies that address the supercomputing requirements of the DoD RDTE community in the areas of hardware, software, and programming environments. All HPCMP sites are interconnected to each other, the DoD High Performance Computing (HPC) RDTE community, and other major defense sites via DREN, a research network which investigates, demonstrates, and matures (a) state-of-the-art digital networking technologies to ensure a robust distributed environment and (b) the most advanced digital security capabilities to effectively protect the intellectual property of the DoD and its contract entities as they employ HPCMP advanced capabilities. The HPCMP's software application effort (a) optimizes, enhances, demonstrates, and matures critical DoD physics-based and engineering software to allow scientists and engineers to execute calculations with precision and efficiency on leading-edge supercomputers, (b) demonstrates and matures immersive collaborative programming environments to improve science and engineering workflows, and (c) demonstrates and matures leading-edge computational technology from academia and industry. These synergistic activities collectively demonstrate and mature horizontal technologies that are exploited throughout the DoD RDTE community, ensuring the DoD maintains the most advanced research ecosystem in the areas of computationally-intensive modeling and design.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Department of Defense Supercomputing Resource Centers	90.067	93.484	97.880
Description: The effort investigates, demonstrates, and matures general and special-purpose supercomputing environments that incorporate the most advanced, leading-edge computational architectures, distributed mass storage technologies, and data analysis methodologies; employs complementary specialized expertise to mature and exploit these environments; enables the DoD Research, Development, Test and Evaluation (RDTE) community to effectively and efficiently investigate, demonstrate, and mature a broad range of technologies through advanced computational methods.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Continue to refine and exploit the advanced capabilities of previously demonstrated supercomputers (utilizing the existing capability complete 31,000 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the following 11 CTAs: (1) space and astrophysical sciences, (2) structural mechanics, (3) fluid dynamics, (4) chemistry and materials science, (5) electromagnetics and acoustics, (6) climate/weather/ocean modeling and simulation, (7) signal and image processing, (8) forces modeling and simulation, (9) electronics, networking, and systems, (10) environmental quality, and (11) integrated modeling and test environments. Will demonstrate the viability of two (or more) large, tightly-integrated supercomputers containing leading-edge (i.e. 2019) processor, memory, disk I/O, interconnect, and OS capabilities (adding an additional capability of 11,000 trillion floating point operations per second) to conduct complex, tightly coupled, large-scale, scientific calculations to address DoD challenges in the 11 CTAs cited above; will continue to further mature GUI access to supercomputers without requiring software to be added to the client machine to allow scientists and engineers at sites with prohibitive security practices to apply supercomputing to DoD use cases; will continue to further mature the ability to use both general purpose and accelerated processors collectively in a single supercomputer (i.e. a hybrid supercomputer) to expand the breadth of DoD use cases that can be addressed by supercomputing; will continue to mature data-intensive supercomputing architectures for DoD use cases in which it is more economical to move (in real-time) the executable code to the data (as opposed to the standard approach of moving the data to the executable code) to expand the breadth of DoD use cases that can be addressed by supercomputing; will continue to mature shared above secret capabilities to address critical DoD mission requirements. ***FY 2020 Plans:*** Will accelerate technology capabilities with a suite of supercomputers to address DoD priorities that satisfy the diverse needs of DoD stakeholders including security, workload, and architecture requirements. Refine and exploit the advanced capabilities of previously demonstrated supercomputers (utilize the existing capability to complete 54,000 trillion floating point operations per second) to conduct complex, tightly-coupled, large-scale, scientific calculations to address DoD challenges in the essential computational domains. Will demonstrate the potential benefits of multiple architectures (scientific, analytics, machine learning, etc.) that are tightly-integrated and incorporate leading-edge (i.e. 2020) processor, memory, disk I/O, interconnect, and OS capabilities. Will demonstrate enhanced access solutions to supercomputers ? solutions that do not require software to be added to the client machine to allow scientists and engineers located at sites with prohibitive security practices to access supercomputers. Will demonstrate new mechanisms to access and reduce barriers to supercomputers. Will leverage data-intensive supercomputing architectures for DoD use cases in machine learning, artificial intelligence, and data sciences. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Adjustment due to inflation.			
Title: Defense Research and Engineering Network	31.284	30.946	32.400

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020

Description: This effort investigates, demonstrates, and matures state-of-the-art digital networking technologies to ensure a robust distributed environment among High Performance Computing Modernization Program (HPCMP) sites, the DoD High Performance Computing (HPC) Research, Development, Test and Evaluation (RDTE) community, and other major defense sites; investigates, demonstrates, and matures the most advanced digital security capabilities to effectively protect the intellectual property of the DoD and its contract entities as they employ HPCMP advanced capabilities; employs complementary specialized expertise to mature and exploit this environment.

FY 2019 Plans:
Continue to refine and exploit DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDTE communities with specific efforts targeted at the unique requirements of the Test & Evaluation (T&E) and Acquisition Engineering communities; will continue strategic technical planning and acquisition strategy development for DREN IV, a follow-on to DREN III, with next-generation technical capabilities and significantly increased bandwidths to support the HPCMP and DoD RDTE communities; will continue to refine and exploit the HPCMP's DISA-accredited Tier 2 cybersecurity service provider capability to effectively protect the intellectual property of the DoD and its contract entities as they utilize HPCMP advanced capabilities; will continue to mature the advanced network technologies and complex cybersecurity mechanisms required to implement logically-separated networked COIs at multiple classification levels; will continue to demonstrate hardware architecture and software stack enhancements for network sensors to simultaneously allow (1) active support for the HPCMP's DISA-accredited Tier 2 cybersecurity service provider capabilities and (2) active experimentation for novel, adaptive cybersecurity detection and intervention methods; will continue to demonstrate the ability to employ SDNs to allow traditional IP and experimental protocol networks to coexist within a common DoD networking infrastructure; will continue to mature an ISCM and cyber situational awareness capability to ingest robust, diverse, host-based and network-based near-real-time information by harnessing HPC resources for advanced mission essential task elements; improve cybersecurity methods to aid in the detection of insider threats.

FY 2020 Plans:
Will continue to refine and exploit DREN III (an advanced digital DoD research network) which provides robust, high-bandwidth, low-latency, low-jitter connectivity among the HPCMP and DoD RDTE communities with specific efforts targeted at the unique requirements of the Test & Evaluation (T&E) and Acquisition Engineering communities. Formalize the strategic technical planning and acquisition strategy development for DREN IV, the follow-on to DREN III, with next-generation technical capabilities and significantly increased bandwidths to support the HPCMP and DoD RDTE communities; complete source selection for DREN IV. Will complete final configuration and fine tune the IAP Security Gateway Enhancement Project to enhance HPCMP's DISA-accredited Tier 2 cybersecurity service provider capability to effectively protect the intellectual property of the DoD and its contract entities as they utilize HPCMP advanced capabilities. Will continue to mature the advanced network technologies and complex cybersecurity mechanisms required to implement logically-separated networked COIs at multiple classification levels. Will

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
continue to demonstrate hardware architecture and software stack enhancements for network sensors to simultaneously allow; (1) active support for the HPCMP's DISA-accredited Tier 2 cybersecurity service provider capabilities; and (2) active experimentation for novel, adaptive cybersecurity detection and intervention methods; Implement the ability to employ SDNs to allow traditional IP and experimental protocol networks to coexist within a common DoD networking infrastructure. Will implement a prototype ISCM and cyber situational awareness capability to ingest robust, diverse, host-based and network-based near-real-time information by harnessing HPC resources for advanced mission essential task elements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Adjustment due to inflation			
Title: Software Applications ***Description:*** This effort optimizes, enhances, demonstrates, and matures software applications to provide for the adaptation of widely used applications and algorithms to address Research, Development, Test and Evaluation (RDTE) requirements. The Computational Research Engineering Acquisition Tools and Environments (CREATE) initiative demonstrates and matures advanced application codes to allow scientists and engineers to use supercomputers to design and analyze virtual prototypes of DoD ships, fixed-wing aircraft, rotorcraft, ground vehicles, and radio frequency (RF) antennas; HPCMP Institutes demonstrate and mature advanced supercomputing application codes to address critical high-impact DoD challenges (e.g. blast protection for platforms and personnel, high-power microwaves and lasers, munition sensitivities, and mobile network designs/prototypes); High Performance Computing Applications Software Initiative (HASI) projects address the need to mature and refine critical DoD software that can take advantage of new and emerging hardware advances; the Frontier initiative represents and supports the DoD's highest-priority, highest-impact computational work, both from a technical and mission-relevance standpoint; the Productivity, Enhancement, Technology Transfer, and Training (PETTT) initiative (1) optimizes and enhances critical DoD physics based and engineering software to allow scientists and engineers to execute scientific calculations with precision and efficiency on leading-edge supercomputers, (2) demonstrates and matures immersive collaborative programming environments to improve science and engineering workflows, and (3) demonstrates and matures leading-edge computational technology from academia and industry. ***FY 2019 Plans:*** Continue to mature multi-disciplinary software technology in support of current and future defense programs. For aeronautical systems of all types (i.e., fixed and rotary-wing aircraft, munitions, missiles, rockets, etc.), this endeavor will continue maturing model-centric conceptual design software technology to support pre Milestone-A Defense acquisition processes, enabling application of physics-based analysis of alternatives, technology trade-space exploration, and cost implications. For fixed-wing aircraft, this will include, but will not be limited to, high-fidelity physics-based analysis capabilities for coupled aerodynamics, structural dynamics, propulsion, and flight controls in support of flight certifications (e.g., air worthiness, store carriage and release, etc.), mission planning for fielded and new systems and associated upgrades, and acquisition decisions associated	53.749	52.027	54.475

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
with exploration and design analysis of future manned and unmanned aerial vehicle concepts. Additionally, it will include implementation of foundational software improvements necessary to begin development of physics-based design analysis tools for future hypersonic weapon systems (High Speed Strike, Tactical Boost-Glide, and Manned/Unmanned Conventional Prompt Global Strike). For rotorcraft, exemplars will include aeromechanics analysis associated with maneuvers, airframe-propulsion system integration, and weapons carriage and release, as well as infrared suppression analysis, chaff trajectory prediction, debris ingestion analysis, and loads prediction capability necessary for structural airworthiness assessments. These capabilities will be deployed in support of the FVL Program, as well as for sustainment of existing rotorcraft-based programs and associated upgrades, such as the ITEP. For RF antenna design analysis, will further mature computational electromagnetics capabilities to assist in design and evaluation of next generation radar for aircraft, ships, and ground-based platforms; will demonstrate capability for assessment of electromagnetic hazards on ordnance and will optimize computational methods for electronic warfare assessments and evaluation of multiple antenna systems on a single platform. For Naval Ships (surface and submarine), will further mature conceptual and early modeling capabilities in sync with detailed design and analyses, to realize full-lifecycle management of systems and platforms, and for conducting AoAs.			
FY 2020 Plans: Will continue to mature and enhance multi-disciplinary software technology in support of current and future defense programs. For aeronautical systems of all types (i.e., fixed and rotary-wing aircraft, munitions, missiles, rockets, etc.), this endeavor will continue to mature model-centric conceptual design software technology to support pre Milestone-A Defense acquisition processes, enabling application of physics-based analysis of alternatives, technology trade-space exploration, and analysis of cost implications. Will continue implementation of foundational software improvements necessary to begin development of physics-based design analysis tools for future hypersonic weapon systems (High Speed Strike, Tactical Boost-Glide, and Manned/Unmanned Conventional Prompt Global Strike). For fixed-wing aircraft, will a) incorporate new generation of high order accuracy solvers; b) implement hypersonic terminal maneuvers; and c) begin incorporation of hypersonic long-duration/heat soak algorithms. For rotorcraft, will continue aeromechanics analysis associated with maneuvers, airframe-propulsion system integration, and weapons carriage and release, as well as infrared suppression analysis, chaff trajectory prediction, debris ingestion analysis, and loads prediction capability necessary for structural airworthiness assessments. These capabilities will be deployed in support of the FVL Program, as well as for sustainment of existing rotorcraft-based programs and associated upgrades, such as the ITEP. RF antenna design and analysis is maturing computational electromagnetics capabilities to assist in design and evaluation of next generation radar for aircraft, ships, and ground-based platforms; demonstrating capability for assessment of electromagnetic hazards on ordnance and optimizing computational methods for electronic warfare assessments and evaluation of multiple antenna systems on a single platform. Will conclude efforts in aircraft radar signature prediction capabilities that effectively include propulsion system inlet and exhaust. Will continue efforts to incorporate high-resolution (X-Band frequencies) virtual test and analysis capabilities for fighter-scale aircraft. For Naval Ships (surface and submarine), will continue incorporation of; a) hullform optimization; b) multi-hull seakeeping capabilities; and c) virtual ship powering algorithms.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DS7 / *High Performance Computing Modernization Program*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will begin efforts to incorporate 6-DOF submarine maneuvering. For Ground Vehicles a) will complete advanced model interfacing standards; b) will complete incorporation of sensing and autonomy capabilities; and c) will expand autonomy capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Adjustment due to inflation.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	6.641	-
Accomplishments/Planned Programs Subtotals	175.100	183.098	184.755

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603461A / *High Performance Computing Modernization Program*	Project (Number/Name) DW5 / *HIGH PERF COMP MODERN (HPCM) (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
DW5: *HIGH PERF COMP MODERN (HPCM) (CA)*	-	39.000	35.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	74.000

Note

Congressional interest item for Program increase

A. Mission Description and Budget Item Justification

This project enables the Defense Research, Development, Test and Evaluation (RDT&E) community to resolve critical scientific and engineering problems more quickly, and with more precision, using advanced, physics-based computer simulation supported by high performance computing (HPC) technology. The computational expertise and resources enable Department of Defense (DoD) personnel to analyze phenomena that are often impossible, not cost effective, too time-consuming, or too dangerous to study any other way. The High Performance Computing Modernization Program (HPCMP) supports the requirements of the DoD's scientists and engineers in three major areas of effort: supercomputing resource centers, the Defense Research and Engineering Network (DREN), and software applications. DoD Supercomputing Resource Centers (DSRCs) provide extensive capabilities and demonstrate new technologies that address user requirements for hardware, software, and programming environments. Efforts of the DSRCs are augmented by dedicated HPC project investments (DHPIs) that address near real-time and real-time HPC requirements. All sites in the HPC Modernization Program are interconnected to one another, the user community, and major defense sites via the DREN, a research network which matures and demonstrates state-of-the-art computer network technologies. The Software Application effort optimizes and improves the performance of critical common DoD applications programs to run efficiently on advanced HPC systems, matures and demonstrates leading-edge computational technology from academic and commercial partners, and provides collaborative programming environments.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Congressional Increase	39.000	35.000
FY 2018 Accomplishments: Congressional Increase		
FY 2019 Plans: Congressional Increase		
Congressional Adds Subtotals	39.000	35.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603461A / *High Performance Computing Modernization Program*	**Project (Number/Name)** DW5 / *HIGH PERF COMP MODERN (HPCM) (CA)*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	160.035	-	160.035	174.428	188.506	201.083	207.420	0.000	931.472
BF2: *Autonomous Ground Resupply (AGR) Adv Tech*	-	0.000	0.000	18.772	-	18.772	19.296	0.000	0.000	0.000	0.000	38.068
BF4: *Combat Vehicle Robotics Adv Tech*	-	0.000	0.000	10.308	-	10.308	8.829	25.829	24.305	24.511	0.000	93.782
BF5: *Adv Lethality & Accuracy Sys for Med Cal Adv Tech*	-	0.000	0.000	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	2.000
BF7: *Crew Augmentation and Optimization Adv Tech*	-	0.000	0.000	3.871	-	3.871	4.415	4.416	4.341	4.292	0.000	21.335
BG1: *Sensors for Auto Oper and Survivability Adv Tech*	-	0.000	0.000	10.128	-	10.128	8.747	6.116	9.028	9.127	0.000	43.146
BG3: *Modeling and Simulation for MUMT Advanced Tech*	-	0.000	0.000	3.530	-	3.530	3.367	4.399	4.540	4.590	0.000	20.426
BG4: *Adv Mobility Experimental Prototype Adv Tech Demo*	-	0.000	0.000	9.658	-	9.658	3.907	2.930	0.000	0.000	0.000	16.495
BG5: *Extended Line of Sight (ELOS) Advanced Technology*	-	0.000	0.000	12.000	-	12.000	8.000	0.000	0.000	0.000	0.000	20.000
BG7: *Ground Systems Active Defense (GSAD) Advanced Tech*	-	0.000	0.000	23.387	-	23.387	30.203	30.425	31.189	31.954	0.000	147.158
BG9: *Obscuration Advanced Technology*	-	0.000	0.000	3.085	-	3.085	3.147	3.210	3.275	3.312	0.000	16.029
BH1: *Survivability Systems Controls Advanced Technology*	-	0.000	0.000	13.022	-	13.022	13.693	14.107	14.022	13.786	0.000	68.630
BH3: *C4ISR Modular Autonomy Advanced Technology*	-	0.000	0.000	3.926	-	3.926	3.972	4.100	4.347	4.396	0.000	20.741
BH4: *Ground Vehicle Holistic Defense Adv Tech**	-	0.000	0.000	0.000	-	0.000	0.000	14.158	15.808	15.825	0.000	45.791
BH6: *Platform Electrification and Mobility Adv Tech*	-	0.000	0.000	5.198	-	5.198	15.469	18.006	22.872	22.768	0.000	84.313

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*								
BH8: *Enhanced VETRONICS Advanced Technology*	-	0.000	0.000	12.960	-	12.960	12.409	10.122	10.768	10.156	0.000	56.415
BI1: *Protection for Autonomous Systems Adv Tech*	-	0.000	0.000	4.100	-	4.100	3.705	5.282	5.371	5.431	0.000	23.889
BI3: *Sensor Protection Advanced Technology*	-	0.000	0.000	1.500	-	1.500	2.000	2.000	2.000	2.022	0.000	9.522
BI5: *Materials Application and Integration Adv Tech*	-	0.000	0.000	3.625	-	3.625	3.628	3.729	3.804	3.846	0.000	18.632
BI8: *All-Electric Combat Powertrain Advanced Technology**	-	0.000	0.000	0.000	-	0.000	1.950	2.700	6.070	12.690	0.000	23.410
BJ1: *Vehicle System Security Advanced Technology*	-	0.000	0.000	1.250	-	1.250	1.750	3.250	4.476	4.953	0.000	15.679
BJ6: *Hydrogen Based Combat System Advanced Technology*	-	0.000	0.000	4.485	-	4.485	6.299	6.686	8.116	7.712	0.000	33.298
BJ8: *Detection of Explosive Hazards Advanced Technology*	-	0.000	0.000	5.130	-	5.130	5.480	5.156	3.680	3.721	0.000	23.167
BK1: *Autonomous Mobility Adv Tech*	-	0.000	0.000	7.140	-	7.140	9.800	8.100	7.200	6.741	0.000	38.981
BK4: *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	-	0.000	0.000	0.450	-	0.450	3.450	2.850	4.130	3.569	0.000	14.449
BK6: *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	-	0.000	0.000	0.510	-	0.510	0.912	10.935	11.741	12.018	0.000	36.116

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

Projects BH6 (Platform Electrification and Mobility Adv Tech), BK1 (Autonomous Mobility Adv Tech), BK4 (Next Gen Intelligent Fire Control (NG-IFC) Adv Tech), and BK6 (Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech) are new starts for Fiscal Year (FY) 2020.

Apart from these new starts, efforts in this Program Element (PE) were previously funded, with continuity of effort realigned from the following PEs:
* 0603004A (Weapons and Munitions Advanced Technology)

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*

* 0603005A (Combat Vehicle and Automotive Advanced Technology)
* 0603270A (EW Technology)
* 0603313A (Missile and Rocket Advanced Technology)
* 0603606A (Landmine Warfare and Barrier Advanced Technology)
* 0603710A (Night Vision Advanced Technology)
* 0603734A (Military Engineering Advanced Technology)
* 0603772A (Advanced Tactical Computer Science & Sensor Technology)

A. Mission Description and Budget Item Justification

This PE executes development, and demonstration for the Army's modernization priority for the Next Generation of Combat Vehicles. This PE matures, integrates and demonstrates combat vehicle technologies that enable the Army to have a smarter, faster, more lethal, more precise, more protected, and more adaptable force. Technology development builds upon the foundational vehicle architectures to support the Next Generation of Combat Vehicles, to include autonomy architecture, power architecture, vehicle electronic architecture, physical architecture, lethality architecture and vehicle protection architecture. Technologies developed, matured, and demonstrated will enable leap ahead capabilities for manned, optionally manned and unmanned vehicles that deliver decisive lethality.

Work in this PE complements PE 0602141A (Lethality Technology), PE 0602144A (Ground Technology), PE 0602145A (Next Generation Combat Vehicle Technology), PE 0602146A (Network C3I Technology), PE 0602782A (Command, Control, Communications Technology), PE 0603116A (Lethality Advanced Technology), PE 0603119A (Ground Advanced Technology), PE 0603463A (Network C3I Advanced Technology), PE 0604115A (Technology Maturation Initiatives), and PE 0708045A (End Item Industrial Preparedness Activities). Work in this PE also transitions to PE 0603645A (Armored Systems Modernization Adv Dev) and PE 0604017A (Robotics Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work is performed by the U.S. Army Futures Command and the U.S. Army Engineer Research and Development Center.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603462A *I Next Generation Combat Vehicle Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	160.035	-	160.035
Total Adjustments	0.000	0.000	160.035	-	160.035
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	160.035	-	160.035

Change Summary Explanation

FY 2020 funding has been realigned to this PE from other PEs within the Science & Technology portfolio in support of Army Modernization Priorities.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BF2: *Autonomous Ground Resupply (AGR) Adv Tech*	-	0.000	0.000	18.772	-	18.772	19.296	0.000	0.000	0.000	0.000	38.068

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603005A Combat Vehicle and Automotive Advanced Technology, Project:
* 515 Robotic Ground Systems
PE 0603734A Military Engineering Advanced Technology Development, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

Autonomous Ground Resupply (AGR) will mature and demonstrate an improved ground supply distribution system across multiple levels of strategic and tactical sustainment operations. The effort will equip existing military ground vehicles with scalable robotic technology through the integration of modular kits, common interfaces, and a common architecture to improve inter-node supply movement. Further, the system will modernize and optimize the operations within the supply nodes to improve accountability and throughput. The objective of AGR is to integrate new and emerging technologies into the Army's sustainment system to improve throughput, accountability, and safety and provide the Warfighter with the flexibility needed to meet future needs.

The work under this Project will transition to the Leader Follower Program of Record (PoR). The architecture and safety work under this Project also lays the groundwork for the Army Modernization Priority Next Generation Combat Vehicle (NGCV).

This Project matures and demonstrates simulation tools that predict autonomous vehicle performance. This Project matures and demonstrates a real-time simulator that provides the ability to design and assess ground vehicle autonomous behaviors in adverse environmental conditions, reducing the need for field testing. These simulation technologies can be integrated across Army vehicle platforms as required.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project is performed by the U.S. Army Futures Command and the U.S. Army Engineer Research and Development Center.

Work is also coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), and transitions to PE 0604017A (Robotics Development).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Architecture and Standards ***Description:*** This effort matures and validates the government-owned autonomous architecture for an inclusive military library of behaviors that are non-proprietary and modular format to allow for design and development of payloads across the enterprise. This architecture allows the development and implementation of the same government owned software across multiple robotic systems. This will enable interoperability and modularity within systems and will lay the foundation for an affordable and sustainable lifecycle management model. This effort is coordinated with PE 0602145A (NGCV Technology). ***FY 2020 Plans:*** Will improve the fail-safe architecture with common interfaces, software and algorithms for increased robotic capability, increased reliability, and autonomous testing methodologies and procedures. Will work within and make recommendations for improvements to the government-controlled interoperability profile (IOP) standard. Will validate that standardized interfaces are enforced between unmanned platforms, payloads, controllers, and wireless communication devices. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems) and PE 0603734A (Military Engineering Advanced Technology Development) / Project T08 (Combat Eng Systems).	-	-	7.310
Title: Hardware and Hardware-in-the-loop/Software-in-the-loop (HIL/SIL) ***Description:*** The HIL/SIL is a test system that uses real-time, physics-based models of the vehicle (multi-body dynamics), sensor systems (optics/signal processing and positioning), platform mobility (vehicle-terrain interaction) and weather/environment to provide a ?virtual proving ground? for the AGR system. This effort is coordinated with PE PE 0602145A (NGCV Technology). ***FY 2020 Plans:*** Will evaluate new hardware and software configurations to optimize AGR solutions throughout the full range of environmental conditions that are controllable and repeatable to optimize performance. Will utilize HIL SIL capability to improve and validate hardware and software configurations in the laboratory before field experimentation, reducing costs, saving time and improving overall system performance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems) and PE 0603734A (Military Engineering Advanced Technology Development) / Project T08 (Combat Eng Systems).	-	-	6.212
Title: Soldier Experimentation	-	-	4.750

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: In conjunction with TRADOC and Army Test and Evaluation Command (ATEC), this effort will employ unmanned systems in an operational evaluation to test the system in real word applications and environments. After the lab testing is complete and a safety test performed by ATC, then the soldier will provide the final test to determine if AGR is useful and rugged enough to enable the soldiers to increase through put on actual missions. This effort is coordinated with PE 0602145A (NGCV Technology). ***FY 2020 Plans:*** Will utilize soldier feedback to optimize utility and reliability within all AGR efforts. Will improve training and maintenance packages to enable expedient transition to the soldier. Will identify high risk and vulnerabilities of the system to increase survivability of the system from enemies to inform the Program of Record (PoR). ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems) and PE 0603734A (Military Engineering Advanced Technology Development) / Project T08 (Combat Eng Systems).			
Title: Simulation Tools for Autonomous Ground Resupply ***Description:*** This effort matures and demonstrates a real-time, hardware-in-the-loop simulator capable of rapid design and assessment of ground vehicle autonomous behaviors and integrates autonomy solutions into this tool. This effort is coordinated with PE 0602145A (NGCV Technology). ***FY 2020 Plans:*** Will demonstrate simulation environment performance and impact to autonomous deployment cost and timeline; will support Autonomous Ground Resupply capstone demonstrations via simulation-enabled analyses methods; and will integrate additional sensors and algorithms into simulation tools. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems) and PE 0603734A (Military Engineering Advanced Technology Development) / Project T08 (Combat Eng Systems).	-	-	0.500
Accomplishments/Planned Programs Subtotals	-	-	18.772

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF2 / *Autonomous Ground Resupply (AGR) Adv Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF4 / *Combat Vehicle Robotics Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BF4: *Combat Vehicle Robotics Adv Tech*	-	0.000	0.000	10.308	-	10.308	8.829	25.829	24.305	24.511	0.000	93.782

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603005A Combat Vehicle and Automotive Advanced Technology, Project:
* 515 Robotic Ground Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates innovative enabling technologies that enable scalable integration of multi-domain robotic and autonomous system capabilities teamed within Army formations supporting all combat warfighting functions (close combat, reconnaissance, targeting and acquisition, etc.). Project focus areas include Platform Electronic Control and Autonomy Safety Engineering.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work is performed by the U.S. Army Futures Command.

Work is also coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), and transitions to PE 0604017A (Robotics Development).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Platform Electronic Control	-	-	7.580
Description: This effort optimizes the electronic, closed loop control of by-wire vehicle systems to provide stable, reliable, and predictable control in the presence of potential malicious or unintended commands for both wheeled and tracked unmanned vehicles.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF4 / *Combat Vehicle Robotics Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will optimize sensors and software algorithms that provide for robotic vehicle perception to be continuously effective across adverse operational conditions. Will mature the interface technologies that allow for field changes to vehicle payload configurations that self-align with native vehicle control scheme and mission taskings. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems).			
Title: Autonomous Safety Engineering ***Description:*** This effort demonstrates a holistic approach to the development of Robotic and Autonomy System (RAS) Safety Standards, development of RAS Virtual Testing Procedures, and maturation of a Safety Based Design Methodology for Robotic Systems. ***FY 2020 Plans:*** Will develop the RAS Safety Standard utilizing the newly formed RAS Safety Review Board (Army) that exploits the published guidelines on best practices for isolation of safety critical software from other RAS behaviors. Will optimize process for obtaining a useable Safety Confirmation for robotic systems and reduce the overall time for developmental safety testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 515 (Robotic Ground Systems).	-	-	2.728
Accomplishments/Planned Programs Subtotals	-	-	10.308

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF5 / *Adv Lethality & Accuracy Sys for Med Cal Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BF5: *Adv Lethality & Accuracy Sys for Med Cal Adv Tech*	-	0.000	0.000	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	2.000

Note

In FY 2020 this Project is realigned from PE 0603004A (Weapons and Munitions Advanced Technology) / Project 232 (Advanced Lethality & Survivability Demo).

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced medium caliber ammunition, weapon, fire control, and Ammunition Handling Systems (AHS) optimized for remote operation. This effort demonstrates cannon super high elevation engagement, high performance stabilization, remote ammunition loading, weapon safety and reliability, improved lethality, accuracy, ability to fire a suite of ammunition from non-lethal to lethal, and escalation of force capability in one system.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is related to and fully integrated with the efforts funded in Program Element PE0604115A (Technology Maturation Initiative).

Work in this Project is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Lethality and Accuracy System for Medium Caliber Advanced Technology	-	-	2.000
Description: This effort matures and demonstrates advanced medium caliber ammunition, weapon, fire control, and AHS optimized for remote operation. This effort demonstrates cannon-super high elevation engagement, high performance stabilization, remote ammunition loading, weapon safety and reliability, improved lethality, accuracy, ability to fire a suite of ammunition from non-lethal to lethal, and escalation of force capability in one system.			
FY 2020 Plans: Will validate weapon system integration with demonstration of AHS and will complete system level performance optimization efforts of programmable air burst munition and armor piercing munition fire control solutions for stationary on stationary engagements against personnel and materiel targets. The maturation and demonstrations that will be conducted through FY20			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF5 / *Adv Lethality & Accuracy Sys for Med Cal Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
will inform technical updates to the level 2 technical data package that will be finalized for transition to Program Executive Office (PEO) Ground Combat Systems and PEO Ammunition. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603004A (Weapons and Munitions Advanced Technology) / Project 232 (Advanced Lethality & Survivability Demo).			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BF7 / *Crew Augmentation and Optimization Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BF7: *Crew Augmentation and Optimization Adv Tech*	-	0.000	0.000	3.871	-	3.871	4.415	4.416	4.341	4.292	0.000	21.335

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603005A Combat Vehicle and Automotive Advanced Technology, Project:
* 441 Combat Vehicle Mobility

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced technologies to enable crew augmentation and optimization for closed hatch operations of ground vehicle platforms in a complex multi-domain operations environment. This includes integration of intelligent technologies to improve dynamic tasking and full crew interactions, machine learning to improve decision aids, early warnings, reduce response times and shorten task durations, and machine learning to optimize tasking and function. Mature technologies are incorporated onto existing or prototype Army-owned technology demonstrators so that performance of the enabling technologies can be evaluated.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project is conducted by the U.S. Army Futures Command.

Work in this PE/Project is also coordinated with work in PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Crew Augmentation & Optimization Advanced Technology	-	-	3.871
Description: This effort focuses on optimizing crew station technologies while reducing crew sizes that will provide the same overall performance by exploiting human-interaction technologies, automation, machine intelligence and customization to permit soldiers to achieve performance beyond today's constrained ground vehicle environment. This effort is coordinated with PE 0602145A (NGCV Technology).			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BF7 / *Crew Augmentation and Optimization Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature crew station technologies by increasing crew performance over existing baseline capabilities. Will integrate and demonstrate advancements in multimodal hardware, displays and controls and task augmentation to provide greater situational awareness and faster decision timelines. Will validate effectiveness in relevant field demonstration utilizing Soldier subjects. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility).			
Accomplishments/Planned Programs Subtotals	-	-	3.871

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG1 / *Sensors for Auto Oper and Survivability Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BG1: *Sensors for Auto Oper and Survivability Adv Tech*	-	0.000	0.000	10.128	-	10.128	8.747	6.116	9.028	9.127	0.000	43.146

Note

In FY 2020 this Project is realigned from:
PE 0603606A (Landmine Warfare and Barrier Advanced Technology) / Project 683 (Area Denial Sensors)
PE 0603710A (Night Vision Advanced Technology) / Project K70 (Night Vision Advanced Technology)

A. Mission Description and Budget Item Justification

This Project matures, optimizes, and demonstrates automated, advanced multi-function sensors and algorithms enabling autonomous man-unmanned combined arms maneuver in full spectrum, complex environments, for next generation manned, optionally manned, and robotic platform applications. This Project will deliver sensor payloads which provide greatly increased situational awareness (e.g. pre-shot and hostile fire detection, threat classification) in all environments for manned and unmanned ground vehicle systems.

Work in this Project supports the Army Science and Technology Next Generation Combat Vehicle, Soldier Lethality, and Future Vertical Lift modernization priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the US Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Sensors for Autonomous Operations and Survivability Advanced Technology	-	-	10.128
Description: This effort will demonstrate aided target detection (AiTD) and aided target recognition (AiTR) for rapid search, and an automated, multi-spectral sensing capability to detect concealed threats and identify/apply countermeasures to enable decisive action and maneuver, for manned and unmanned platforms. This effort is coordinated with PE 0602145A (NGCV Technology), 0602143A (Soldier Lethality Technology), and 0603118A (Soldier Lethality Advanced Technology). ***FY 2020 Plans:*** Will validate performance of AiTD and AiTR algorithms against ground targets in cluttered environments with situational awareness and targeting sensors. Will mature sensors with multi-spectral response and increased dynamic range to enable innovative AiTR behaviors and tasking in moderately complex environments, and against asymmetric targets. Will improve			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG1 / *Sensors for Auto Oper and Survivability Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
embedded processing techniques to provide real-time performance on space-constrained platforms. Will mature and optimize threat optics detection with targeting sensors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603710A (Night Vision Advanced Technology) / Project K70 (Night Vision Advanced Technology).			
Accomplishments/Planned Programs Subtotals	-	-	10.128

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BG3 / *Modeling and Simulation for MUMT Advanced Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BG3: *Modeling and Simulation for MUMT Advanced Tech*	-	0.000	0.000	3.530	-	3.530	3.367	4.399	4.540	4.590	0.000	20.426

Note

In FY 2020 this Project was realigned from PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems).

A. Mission Description and Budget Item Justification

This Project matures and demonstrates Modeling and Simulation (M&S) tools/technologies to assess and improve freedom of movement for ground forces and supports vehicle developers by addressing challenges for robotic and ground vehicles. This Project matures and demonstrates a prototype warning systems for dynamic hazards in urban/complex environments. This Project also matures and demonstrates real-time mobility decision support tools, vehicle-terrain interaction models for autonomous convoy operations, simulation tools for vehicle mobility in highly altered terrain, and M&S tools for predicting the performance of autonomous vehicles. These M&S technologies can be integrated across Army vehicle platforms as required.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Science and Technology Next Generation Combat Vehicle portfolio.

Work is performed at the U.S. Army Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Mobility in Complex Urban Environments Demonstrations	-	-	3.530
Description: This effort matures and demonstrates a real-time, hardware-in-the-loop simulator capable of rapid design and assessment of ground vehicle autonomous behaviors and integrates autonomy solutions into this tool. This effort is coordinated with PE 0602145A (NGCV Technology).			
FY 2020 Plans: Will mature a fully integrated real-time hardware-in-the-loop simulator to validate autonomous vehicle maneuver configurations; will conduct field demonstrations to assess performance; will demonstrate mobility obstacle detection software to support real-time mobility decisions in urban environments; will integrate further sensor modalities into the simulator.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG3 / *Modeling and Simulation for MUMT Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Project resided in PE 0603734A (Military Engineering Advanced Technology) / Project T08 (Combat Eng Systems) in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	3.530

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG4 / *Adv Mobility Experimental Prototype Adv Tech Demo*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BG4: *Adv Mobility Experimental Prototype Adv Tech Demo*	-	0.000	0.000	9.658	-	9.658	3.907	2.930	0.000	0.000	0.000	16.495

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility).

A. Mission Description and Budget Item Justification

This Project matures and fabricates advanced powertrain, power generation and running gear technologies into a combat vehicle that will reduce the percentage of no-go terrain for ground vehicles, increase the maneuver speeds across all traversable terrain, reduce fuel demands thus extending operation time between resupply, and provide onboard power generation to enable the integration of energy based capabilities such as directed energy weapons and electromagnetic armor.

Coordinated work is also being conducted under PE 0604115A (Technology Maturation Initiatives).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is conducted by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Mobility Experimental Prototype (AMEP) Advanced Technology	-	-	9.658
Description: This effort develops the advanced powertrain, power generation and running gear technologies required to demonstrated leap ahead combat mobility and enabling of energy based capabilities such as directed energy weapons and electromagnetic armor. ***FY 2020 Plans:*** Will mature powertrain, power generation and running gear components for integration into surrogate ground vehicle system. Will develop powertrain controls architecture and algorithms to improve powertrain component efficiencies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is a continuation of work conducted in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility) in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	9.658

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG4 / *Adv Mobility Experimental Prototype Adv Tech Demo*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG5 / *Extended Line of Sight (ELOS) Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BG5: *Extended Line of Sight (ELOS) Advanced Technology*	-	0.000	0.000	12.000	-	12.000	8.000	0.000	0.000	0.000	0.000	20.000

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project develops a precision guided tank fire and forget 120mm munition to engage high value targets including heavy armor, the growing Anti-Tank Guided Munition (ATGM) threat (dismounted and mounted), and light armor at extended ranges (2 to 8 km (T), 2 to 12 km (O)).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is related to and fully integrated with the efforts funded in PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

Work in this Project is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Extended Line Of Sight (ELOS) Advanced Technology	-	-	12.000
Description: This effort demonstrates a 120mm Tank fired ELOS Munition that counters the growing Anti-Tank Guided Missile (ATGM) threat at extended line of sight ranges beyond current capability.			
FY 2020 Plans: Will optimize an ELOS Munition Air Frame (projectile) design to include fin stabilization element, Seeker Unit, Guidance Electronics Unit (GEU), Canard Actuation System (CAS), Warhead, GNC (Guidance, Navigation and Control) Software, Target Acquisition and Tracking (TA&T) Software, Propulsion system; will integrate these components to validate their performance through preprogram maneuver cannon fired experiments. Finalize Seeker Unit design, initiate Processor in the Loop (PIL) and Hardware in the Loop (HIL) analysis/testing.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG5 / *Extended Line of Sight (ELOS) Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort was previously funded in PE 0603004A (Weapons and Munitions Advanced Technology) / Project 232 (Advanced Lethality & Survivability Demo).			
Accomplishments/Planned Programs Subtotals	-	-	12.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BG7: *Ground Systems Active Defense (GSAD) Advanced Tech*	-	0.000	0.000	23.387	-	23.387	30.203	30.425	31.189	31.954	0.000	147.158

Note

In FY 2020 this Project is realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Projects:
* L97 Smoke and Obscurants Advanced Technology
PE 0603005A Combat Vehicle and Automotive Advanced Technology, Projects:
* 221 Combat Veh Survivability
PE 0603270A EW Technology, Projects:
* K16 Non-Commo ECM Tech Demo
PE 0603313A Missile and Rocket Advanced Technology, Projects:
* 263 Future MSL Tech Integr

A. Mission Description and Budget Item Justification

This Project matures and demonstrates protection and survivability technologies to increase the survivability of ground vehicles and the protection of the Soldiers who depend on them. The tasks will focus on component maturation and demonstration and transfer products for demonstration as holistic (vehicle level) solutions. The Project will mature technologies to defeat threats throughout the timeline of a threat engagement; from obscuring a target, to actively defeat a threat and through mitigating its effects after engagement. These include the active employment of smoke, physical and electronic active protection, advanced and adaptive armors, advanced and active blast mitigation systems and adaptive interior protection.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

Work in this project will be coordinated with PE 0602145A (Next Generation Combat Vehicle Technology) and transitions to PE 0604852A (Suite of Vehicle Protection Systems - EMD).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Ground Systems Active Defense Development	-	-	9.254

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates active and adaptive component sensors and effectors which, in combination with modular Survivability Subsystem Controls (SSC) architecture, provide the ability to sense, track, respond and neutralize pacing threats prior to catastrophic terminal effects. The components/subsystems will work in tandem in an efficient manner to provide threat defeat redundancy and layered survivability to optimize protection with reduced weights. This effort matures and demonstrates modern armors that directly complement active protection technologies in order to implement sophisticated mass efficient protection mechanisms and materials investments to act as a system in order to defeat advanced threats. This effort also matures and demonstrates active blast technologies to counter underbody attacks. ***FY 2020 Plans:*** Will further develop and mature sensor and effector technologies for inclusion in suite of threat defeat capability. Will validate compliance with SSC architecture, perform environmental and durability testing of developed components to mature the technology, and provide demonstration of pacing threat defeat in representative environment. Will optimize and mature subsystem packaging and integration methods for both active protection components as well as base vehicle armor protection for the defeat of residual fragments that result from countermeasure engagements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603462A (NGCV Advanced Technology) / Project BG7 (Ground System Active Defense Advanced Technology) was previously PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 Combat Veh Survivability), PE 0603270A (EW Technology) / Project K16 (Non-Commo ECM Tech Demo), PE 0603313A (Missile and Rocket Advanced Technology) / Project 263 (Future MSL Tech Integr), and PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology) in FY 2019. Funding has been realigned in FY 2020 to reflect the new financial restructure.			
Title: Obscuration Technologies for Active Protection Systems ***Description:*** Research, develop, test, evaluate, and demonstrate obscurant soft-kill vehicle protection technologies to defeat the observer/gunner, anti-tank guided missiles (ATGMs), and other guided threats. Design and evaluate systems that are Modular Active Protection System (MAPS) compliant. ***FY 2020 Plans:*** Will conduct prototype field experiments and characterization of the Improved Rapid Obscuration System that provides short range coverage for indirect defeat (obscuring the gunner?s view). ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603462A (NGCV Advanced Technology) / Project BG7 (Ground System Active Defense Advanced Technology) was previously PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 Combat Veh Survivability),	-	-	0.850

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
PE 0603270A (EW Technology)/ Project K16 (Non-Commo ECM Tech Demo), PE 0603313A (Missile and Rocket Advanced Technology) / Project 263 (Future MSL Tech Integr), and PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology) in FY 2019. Funding has been realigned in FY 2020 to reflect the financial restructure.			
Title: Active Protection Technologies ***Description:*** This effort demonstrates protection for light armored combat vehicles from anti-armor threat weapons such as rocket-propelled grenades (RPG), anti-tank guided missiles (ATGM), and recoilless rifle projectiles (RR) that cannot be defeated by other means. ***FY 2020 Plans:*** Will continue maturation and adaptation of a hard-kill countermeasure and fire control sensor to provide protection for Next Generation Combat Vehicles from guided missile, recoilless rifle, and rocket propelled grenade attacks. Will validate the lethal mechanism design through laboratory testing. Design and develop countermeasure and fire control subsystems that are MAPS compliant. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603462A (NGCV Advanced Technology) / Project BG7 (Ground System Active Defense Advanced Technology) was previously PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 Combat Veh Survivability), PE 0603270A (EW Technology) / Project K16 (Non-Commo ECM Tech Demo), PE 0603313A (Missile and Rocket Advanced Technology) / Project 263 (Future MSL Tech Integr), and PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology) in FY 2019. Funding has been realigned in FY 2020 to reflect the new financial restructure.	-	-	3.570
Title: Advanced Radar and Soft-Kill (A-RASK) suite ***Description:*** This effort matures next generation vehicle radar technologies and holistic electronic warning and soft-kill countermeasure techniques to support a layered modular active protection suite and ensure the survivability of ground combat platforms in all-weather day or night conditions with 360 degree situational awareness and threat defeat. ***FY 2020 Plans:*** For Combat Operations Battlefield Radar: Will conduct capability/tradeoff analysis based on demonstrated technology to mature active protection systems for 360 degree situational awareness. Will improve resource management and processing algorithms that supports multi-mission capabilities. Improve radar simulation models to support HWIL evaluation of emerging threats and future sensor improvements and technologies.	-	-	9.713

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG7 / *Ground Systems Active Defense (GSAD) Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
For Advanced Soft Kill Countermeasures (ASKCM): Will mature the soft-kill countermeasure system and hardware components and integrate techniques to address multiple types of anti-tank threats by optimizing hardware performance. Begin demonstrations of ASKCM capabilities to validate system performance against multiple threat classes, launch profiles and distances. Soft Kill Techniques and Effects: Will mature methodologies for countermeasure sources to be characterized, assessed and optimized against the priority threats of interest. Will demonstrate countermeasure capabilities against a variety of threats and guidance types. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** PE 0603462A (NGCV Advanced Technology) / Project BG7 (Ground System Active Defense Advanced Technology) was previously PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 Combat Veh Survivability), PE 0603270A (EW Technology) / Project K16 (Non-Commo ECM Tech Demo), PE 0603313A (Missile and Rocket Advanced Technology) / Project 263 (Future MSL Tech Integr), and PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology) in FY 2019. Funding has been realigned in FY 2020 to reflect the financial restructure.			
Accomplishments/Planned Programs Subtotals	-	-	23.387

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BG9 / *Obscuration Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BG9: *Obscuration Advanced Technology*	-	0.000	0.000	3.085	-	3.085	3.147	3.210	3.275	3.312	0.000	16.029

Note

In FY 2020 this Project is realigned from PE 0603004A (Weapons and Munitions Advanced Technology) / Project L97 (Smoke and Obscurants Advanced Technology).

A. Mission Description and Budget Item Justification

The Project matures and demonstrates obscurant technologies with potential to enhance personnel and platform survivability by degrading threat force surveillance sensors and defeating the enemy's target acquisition devices, missile guidance, and directed energy weapons. Dissemination systems for new and improved obscurants are developed with the goal of providing efficient and safe screening of deployed forces.

Work in this Project is related to, and fully coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Obscuration	-	-	3.085
Description: This effort investigates, designs and demonstrates the dissemination of new and advanced obscurants. This effort will support PE 0603462 Project (Ground Systems Active Defense Advanced Technology). ***FY 2020 Plans:*** Will continue to mature particulate infrared and bispectral obscurant dissemination in the screening obscuration module. Investigate obscurant cloud interaction for vehicle protection applications. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously performed in PE 0603004A (Weapons and Munitions Advanced technology) / Project L97 (Smoke and Obscurants Advanced Technology).			
Accomplishments/Planned Programs Subtotals	-	-	3.085

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BG9 / *Obscuration Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH1 / *Survivability Systems Controls Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BH1: *Survivability Systems Controls Advanced Technology*	-	0.000	0.000	13.022	-	13.022	13.693	14.107	14.022	13.786	0.000	68.630

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Veh Survivability).

A. Mission Description and Budget Item Justification

This Project advances the design and capability of the Modular Active Protection System (MAPS) framework and controller to enable integrating emerging survivability technologies into safe and secure configurations and demonstrating them in a representative operational environment. The effort will verify compliance of component sensors and effectors with the modular active protection architecture. This effort ultimately feeds demonstrations of active defense subsystems for demonstration as holistic (vehicle level) solutions. This Project is a key enabler for insertion of current and future active survivability technologies onto ground platforms in order to combat current and emerging threats.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

This work is performed by the U.S. Army Futures Command.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Survivability System Control	-	-	13.022
Description: This effort focuses on maturing and demonstrating a common and open survivability architecture and core implementation to ensure its operational effectiveness. Specifically, this effort includes extending the MAPS architecture across a broader set of active survivability capabilities and increasing the portfolio of Modular APS Framework (MAF) compliant technologies. In addition, this project will enhance the government-developed controller subsystem for performance and integration effectiveness with high speed digital signal processing and embedded systems/firmware/software which will be required due to the expanded active defense suite of sensors (e.g., electro-optic, infrared, radio frequency, magnetic, acoustic), sensor fusion, and explore synthesizing sensor data beyond situational awareness to situational understanding with context that can greatly enhance operational effectiveness and vehicle survivability. The activities under this effort provide incremental growth			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH1 / *Survivability Systems Controls Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
for broader threat spectrum defeat relevant to vehicle protection systems and will be aligned to capability gaps for transition to the acquisition community. ***FY 2020 Plans:*** Will build upon foundation of the MAPS controller and artifacts by analyzing latest stakeholder requirements and conducting functional analysis in preparation for an update to the MAF. Will optimize and enhance the Modular APS (MAPS) controller subsystem to begin accepting new technologies identified through design analysis activities. Will continue to advance modeling and simulation (M&S) and verification capabilities in the system integration lab. Will maintain configuration management of delivered MAPS-compliant systems. Will certify and demonstrate survivability components for MAPS-compliant active defense subsystems through use of hardware-in-the-loop and M&S. Will assess available artificial intelligence algorithms and technology that can synthesize sensor input data to paint contextual threat picture for optimized response. Will explore adaptability for tactical fleet integration with focus on SWAP constraints and affordability. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is a continuation of work performed in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Veh Survivability), and has been realigned in FY 2020 to reflect the Army?s new Science and Technology financial structure.			
Accomplishments/Planned Programs Subtotals	-	-	13.022

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH3 / *C4ISR Modular Autonomy Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BH3: *C4ISR Modular Autonomy Advanced Technology*	-	0.000	0.000	3.926	-	3.926	3.972	4.100	4.347	4.396	0.000	20.741

Note

In FY 2020 this Project is realigned from PE 0603772A (Advanced Tactical Computer Science & Sensor Technology) / Project 101 (Tactical Command and Control).

A. Mission Description and Budget Item Justification

This Project matures and develops software and algorithms to integrate ground and aerial Robotics and Autonomous Systems (RAS) with mission command information systems enabling commanders to more effectively plan, monitor and incorporate RAS into unit formations and missions, and assist the development of doctrine.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

Work in this PE complements PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Command of Autonomous Teams (COAT)	-	-	3.926
Description: This effort designs, fabricates, evaluates, and integrates RAS and Manned Unmanned Teaming (MUM-T) concepts with mission command information systems and doctrine allowing commanders? the ability to plan, monitor and incorporate RAS into formations while reducing Soldier burden. This work will provide an integrated mission planning and execution capability for NGCV, and allow RAS platforms to be quickly incorporated into mission formations and complete complex tactical tasks.			
FY 2020 Plans: Will implement the computational situation awareness engine, which consumes the data feeds from RAS and produces a model of the mission to display to the user; will complete interfaces to the mission model that allows soldiers to create alerts based on mission data and priority; will complete implementation of tactical service language that allows soldiers to define behaviors for RAS platforms in the mission model.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH3 / *C4ISR Modular Autonomy Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort was previously funded in PE 0603772A (Advanced Tactical Computer Science & Sensor Technology) / Project 101 (Tactical Command and Control).			
Accomplishments/Planned Programs Subtotals	-	-	3.926

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BH6 / *Platform Electrification and Mobility Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BH6: *Platform Electrification and Mobility Adv Tech*	-	0.000	0.000	5.198	-	5.198	15.469	18.006	22.872	22.768	0.000	84.313

Note

This Project is a new start in FY 2020.

A. Mission Description and Budget Item Justification

This Project matures, integrates and demonstrates technologies to electrify both manned and unmanned Next Generation Combat Vehicle platforms. Electrification of these platforms will enable advanced onboard electrified payloads such as directed energy weapons, reduce battlefield fuel consumption, and provide new capabilities such as burst acceleration, extended silent mobility and silent watch. The effort will mature, integrate and demonstrate technologies to increase electric power such as a high voltage/temperature generator and high power/ temperature power electronics as well as technologies to reduce power demands including composite rubber band track and adaptive hydro-strut suspension.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work is performed by the U.S. Army Futures Command.

This work complements PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: NGCV Platform Electrification & Mobility Advanced Technology	-	-	5.198
Description: This effort develops and demonstrates scalable electrification architecture, electronics and mobility components required to electrify both manned and unmanned Next Generation Combat Vehicle platforms. ***FY 2020 Plans:*** Will develop electrified mobility demonstrator design. Will develop composite rubber track and hydro strut suspension with track tensioner required to lower power demands for the electrified mobility demonstrator. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a new start in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	5.198

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH6 / *Platform Electrification and Mobility Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BH8 / *Enhanced VETRONICS Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BH8: *Enhanced VETRONICS Advanced Technology*	-	0.000	0.000	12.960	-	12.960	12.409	10.122	10.768	10.156	0.000	56.415

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 497 (Combat Vehicle Electro).

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates vehicle electronics hardware such as computers, sensors, communications systems, displays, and vehicle command/control/driving mechanisms as well as vehicle software to enhance crew performance, increase vehicle fuel efficiency, reduced Size, Weight, and Power (SWaP) burdens and reduce vehicle maintenance costs. This Project also advances open system architectures (power and data) for military ground vehicles to enable common interfaces, standards and hardware implementations. The overall vehicle system architecture is known as the Vehicle Integration for Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance / Electronic Warfare (C4ISR/EW) Interoperability (VICTORY), that provides an open architecture to allow platforms to accept future technologies without the need for significant re-design as new technologies are developed and integrated. Additionally this Project matures autonomy architectures that enable the ease of integration of autonomous subsystem technologies into future and existing tactical and combat vehicle architectures. Technical challenges include: software and algorithm development for increased levels of automation for both manned and unmanned systems, secure vehicle data networks, interoperability of intra-vehicle and inter-vehicle systems, and implementation of advanced user interfaces. Overcoming these technical challenges enables improved and increased span of collaborative vehicle operations, efficient workload management, commander's decision aids, embedded simulation for battlefield visualization and fully integrated virtual test/evaluation.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project is performed by the U.S. Army Futures Command.

Work is also coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Enhanced ? Vehicle Electronics (E-Vetronics)	-	-	12.960
Description: This effort addresses technical and integration challenges in the areas of vehicle architecture and systems integration. Specifically, this effort focuses on maturing and demonstrating a common ground vehicle open architecture with distributed display processing architecture, adaptable and flexible computing and Input/output (I/O), advanced video network			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BH8 / *Enhanced VETRONICS Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
distribution, advancements in slip ring technology, tactical situational awareness (SA), cooperative engagement and mission package integration through open architecture components and software. These efforts will enable future vehicle capabilities, reduce dependencies on proprietary solutions, and support increased market competition through open architecture components and software. ***FY 2020 Plans:*** Will mature open systems architecture defining capabilities for flexible computing, I/O, advanced video network distribution, advancements in slip ring technology, tactical SA, cooperative engagement. Will define the standards and performance for flexible computing and I/O component. Defines the open system standards for integrating tactical SA capabilities into ground vehicles. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a continuation of work conducted in PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 497 (Combat Vehicle Electro) in FY 2019.			
Accomplishments/Planned Programs Subtotals	-	-	12.960

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BI1 / *Protection for Autonomous Systems Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BI1: *Protection for Autonomous Systems Adv Tech*	-	0.000	0.000	4.100	-	4.100	3.705	5.282	5.371	5.431	0.000	23.889

Note

In FY 2020 this Project is realigned from:
PE 0603004A (Weapons and Munitions Advanced Technology) / Project 232 (Advanced Lethality & Survivability Demo)
PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Veh Survivability).

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates protection and survivability components such as novel ballistic and sensor protection to address both current and emerging advanced threats to autonomous ground vehicles. This Project integrates complimentary survivability technologies to enable advanced protection suites, providing greater survivability and protection against emerging threats. This Project develops a holistic set of protection technologies that specifically target the autonomous subsystems integrated on a robotic platform.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

In FY 2020 this Project will develop efforts that were successfully funded in PE 0602601A (Combat Vehicle and Automotive Technology) / Project C05 (Armor Applied Research) during FY 2019.

Work in this Project supports the Army Science and Technology Next Generation Combat Vehicle Portfolio.

Work is performed by the U.S. Army Futures Command.

Work in this Project complements PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Protection for Autonomous Systems	-	-	2.800
Description: This effort focuses on maturing and demonstrating novel ballistic protection and sensor protection concepts to ensure autonomous ground vehicles can continue their mission in contested environments.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BI1 / *Protection for Autonomous Systems Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will determine potential vulnerabilities to an autonomous ground combat vehicle through modeling and simulation using physics-based tools. Will develop capabilities to validate vulnerabilities in a laboratory environment. Will matures protection technologies for autonomous sensors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort develops successful Applied Research funded in FY 2019 under PE 0602601A (Combat Vehicle and Automotive Technology) / Project C05 (Armor Applied Research).			
Title: Vehicle Anti-Personnel Protection Armament System ***Description:*** This effort matures and demonstrates capabilities to provide protection of manned and unmanned platforms against threats, non-combatants, civilian belligerents, and other potentially hostile actors. ***FY 2020 Plans:*** Will optimize and improve developmental technologies such as kinetic energy weapons/munitions and millimeter Wave energy sources for employment on unmanned platforms to deliver effects (repel, suppress, move) that enable freedom of platform movement and maneuver. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort develops successful Applied Research funded in FY 2019 under PE 0602601A (Combat Vehicle and Automotive Technology) / Project C05 (Armor Applied Research).	-	-	1.300
Accomplishments/Planned Programs Subtotals	-	-	4.100

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*				Project (Number/Name) BI3 / *Sensor Protection Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
BI3: *Sensor Protection Advanced Technology*	-	0.000	0.000	1.500	-	1.500	2.000	2.000	2.000	2.022	0.000	9.522

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603710A Night Vision Advanced Technology, Project:
* K70 Night Vision Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates novel sensor protection capabilities which dramatically reduce the susceptibility of our thermal electro-optic/infrared (EO/IR) sensors to ever increasing threats on the battlefield. This effort enables continuation of the mission despite potential threat laser engagements. Low cost modular solutions will be demonstrated that can be applied across current and planned EO/IR targeting, surveillance, and situational awareness sensor systems against existing and emerging threats in support of combined arms maneuver.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle, Soldier Lethality, and Future Vertical Lift modernization priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

Work in this Project is coordinated with PE 0602145A (NGCV Technology), 0602143A (Soldier Lethality Technology), and 0603118A (Soldier Lethality Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Sensor Protection Advanced Technology	-	-	1.500
Description: This effort will mature and demonstrate sensor protection and signature reduction capabilities which better ensure sensors are difficult to detect, dazzle, and damage by current and future laser threats. This effort is coordinated with PE 0602145A (NGCV Technology), 0602143A (Soldier Lethality Technology), and 0603118A (Soldier Lethality Advanced Technology).			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BI3 / *Sensor Protection Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature novel approaches for protecting optics from energetic threats on multiple types of vehicle platforms and soldier sensors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603710A (Night Vision Advanced Technology) / Project K70 (Night Vision Advanced Technology).			
Accomplishments/Planned Programs Subtotals	-	-	1.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BI5 / *Materials Application and Integration Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BI5: *Materials Application and Integration Adv Tech*	-	0.000	0.000	3.625	-	3.625	3.628	3.729	3.804	3.846	0.000	18.632

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Veh Survivability).

A. Mission Description and Budget Item Justification

This Project matures, integrates, and demonstrates lightweight novel materials, and new manufacturing processes and methodologies. These materials and technologies will enable the Army to address critical areas within survivability, mobility, and transportability.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work is performed by the U.S. Army Futures Command.

Work in this Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: System Design Optimization for Lightweighting	-	-	3.625
Description: This effort matures technologies, tools, and advanced manufacturing techniques in support of the Army?s mission to increase mobility, protection, and transportability while reducing weight. This effort focuses on maturing and demonstrating technologies to decrease ground vehicle weight while optimizing performances and enabling the Army trade space for enhanced capabilities. The technologies being demonstrated are in the fields of material maturation, design optimization, operational metrics, joining technologies, and additive manufacturing. This effort is coordinated with PE 0602145A (NGCV Technology).			
FY 2020 Plans: Will mature and demonstrate advanced materials for weight optimization. Will demonstrate an optimization design which will result in meeting/exceeding required performance while reducing weight and increasing system robustness. Will validate the operational metrics on a combat platform established for light weighting to include freedom of movement, freedom and maneuver, and enhanced transportability and supportability. Will demonstrate the integration of a hybrid joint design of dissimilar materials.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BI5 / *Materials Application and Integration Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Exploit the capabilities of Additive Manufacturing by demonstrating performance requirements on a combat platform that are enabled by the unique geometries and design options that are not possible with traditional manufacturing techniques. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort was previously funded in PE 0603005 (Combat Vehicle and Automotive Advanced Technology) / Project 221 (Combat Veh Survivability) in FY19. Funding has been realigned to reflect the new financial structure.			
Accomplishments/Planned Programs Subtotals	-	-	3.625

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BJ1 / *Vehicle System Security Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BJ1: *Vehicle System Security Advanced Technology*	-	0.000	0.000	1.250	-	1.250	1.750	3.250	4.476	4.953	0.000	15.679

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Technology) / Project 441 (Combat Vehicle Mobility).

A. Mission Description and Budget Item Justification

This Project matures and demonstrates ground vehicle cyber protection and resilience technologies to increase the cybersecurity of ground vehicles and ensure their continued operation in near-peer cyber contested environments. This Project will mature cybersecurity technologies at the platform level to defeat cybersecurity threats and maintain assured vehicle functionality and freedom of maneuver in the cyber warfighting domain.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project will be coordinated with and transitioned to Projects identified by the RDECOM Cyber Community of Practice (CCoP).

Work is performed by the U.S. Army Futures Command.

This Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Vehicle System Security Advanced Technology	-	-	1.250
Description: This effort matures and demonstrates technologies required to maintain operating tempo and overmatch capability during offensive digital attacks to military ground vehicle systems. Additionally, the effort will maintain critical vehicle functionality in peer and near-peer cyber-contested environments. The effort will also mature and demonstrate technologies to mitigate risk of future and emerging cyber vulnerabilities by designing highly assured systems with cybersecurity designed from the beginning.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BJ1 / *Vehicle System Security Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate quantifiable security & resiliency metrics to inform digital protection requirements for future capabilities. Will develop and mature embedded cyber-resilient technologies to protect against offensive and malicious attacks. Will mature and demonstrate resilient runtime technologies for real-time threat detection and operation in near-peer cyber-contested environments. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort develops successful Applied Research previously performed in PE 0602601A (Combat Vehicle and Automotive Technology) / Project H77 (National Automotive Center) in FY 2019. Research of this type would previously have transitioned to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility). Under the new S&T financial structure, this type of work will now transition to Project BJ1.			
Accomplishments/Planned Programs Subtotals	-	-	1.250

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BJ6 / *Hydrogen Based Combat System Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BJ6: *Hydrogen Based Combat System Advanced Technology*	-	0.000	0.000	4.485	-	4.485	6.299	6.686	8.116	7.712	0.000	33.298

Note

In FY 2020 this Project is realigned from PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility).

A. Mission Description and Budget Item Justification

This Project matures, integrates and demonstrates the technologies required to enable combat systems to be powered by fuel cells to enable increased operational endurance, silent operations and improved mobility. This effort demonstrates the integration of multiple fuel cell stacks to achieve necessary power levels for tracked combat systems. The efforts in this Project analyze hydrogen generation and distribution approaches to validate operational relevance of hydrogen on the battlefield. This effort also develops and demonstrates in a relevant environment the required hydrogen generation technologies in order to quantify reliability, durability and efficiency.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work is performed by the U.S. Army Futures Command.

This Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Hydrogen Based Combat System Advanced Technology	-	-	4.485
Description: This effort matures, integrates and demonstrates the technologies required to enable combat systems to be powered by fuel cells.			
FY 2020 Plans: Will conduct performance evaluation of both reusable solid hydrogen storage tanks and liquid hydrogen for battlefield operations. Will demonstrate the physical integration of multiple fuel cell stacks into a larger module to reduce volume and increase power density.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BJ6 / *Hydrogen Based Combat System Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort develops successful fuel cell Applied Research previously performed in PE 0602601A (Combat Vehicle and Automotive Technology) / Project H77 (National Automotive Center) in FY 2019. This type of work would typically transition from H77 to PE 0603005A (Combat Vehicle and Automotive Advanced Technology) / Project 441 (Combat Vehicle Mobility). Under the new S&T financial structure, this type of work will transition to Project BJ6.			
Accomplishments/Planned Programs Subtotals	-	-	4.485

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BJ8 / *Detection of Explosive Hazards Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BJ8: *Detection of Explosive Hazards Advanced Technology*	-	0.000	0.000	5.130	-	5.130	5.480	5.156	3.680	3.721	0.000	23.167

Note

In FY 2020 this Project is realigned from PE 0603606A (Landmine Warfare and Barrier Advanced Technology) / Project 608 (Countermine & Bar Dev).

A. Mission Description and Budget Item Justification

This Project matures, optimizes and demonstrates leap ahead capabilities for manned and unmanned detection and neutralization of peer, near peer and other threat mines, minefields and improvised explosive devices in all environments.

Work in this Project supports Army Modernization Priorities Next Generation Combat Vehicle, and Soldier Lethality modernization priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command.

This Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Detection of Explosive Hazards Advanced Technology	-	-	5.130
Description: This effort matures and demonstrates an integrated, standoff, modular sensor processing capability that will enable remote, rapid autonomous detection of mines, other explosive hazards (EHs) and indicators of emplacement from manned and unmanned ground vehicles and unmanned aerial systems (UASs). This effort is coordinated with PE 0602145A (NGCV Technology), and 0602143A (Soldier Lethality Technology), and 0603118A (Soldier Lethality Advanced Technology).			
FY 2020 Plans: Will mature an EH detection payload for a manned or unmanned ground vehicle and validate performance in multiple environments. Will mature EH threat detection payload for small fixed wing and rotary wing UASs.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BJ8 / *Detection of Explosive Hazards Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This effort was previously funded in PE 0603606A (Landmine Warfare and Barrier Advanced Technology) / Project 608 (Countermine & Bar Dev).			
Accomplishments/Planned Programs Subtotals	-	-	5.130

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK1 / *Autonomous Mobility Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BK1: *Autonomous Mobility Adv Tech*	-	0.000	0.000	7.140	-	7.140	9.800	8.100	7.200	6.741	0.000	38.981

Note

This Project is a new start in Fiscal Year (FY) 2020.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates Artificial Intelligence and Machine Learning (AI/ML) technologies to increase autonomy and mobility to perform teamed operations with manned and unmanned air and ground vehicles in a military relevant environment through data collection on relevant platforms. Data collection will involve both simulation and live collection. Simulation will provide a baseline to correctly collect, clean, and analyze data that meets the need for improving algorithms for both formation control and unmanned aerial vehicle map input for unmanned ground vehicle mobility. Live data will start with Surrogate platforms in local areas. This will allow proper collection techniques, tools, and data to maximize embedded autonomy using Machine Learning and other Artificial Intelligent methods before utilizing live data collection. The Project will use AI/ML techniques to mature and demonstrate intelligent formation control to be used on maintained roads and in complex terrain without the need for GPS. Data will be collected from mounted platforms utilizing special internal and external sensors to improve algorithms for exact positioning, undistributed formation control, and increased speeds of unmanned platforms. Also, the Project will use AI/ML techniques to optimize intelligent autonomous ground platform planning through the use of UAV mapped areas. Data collected from air vehicle will be converted to maneuverable information for unmanned ground platform with the identification of enemy positions, go/no-go areas, terrain classification, and optimal suggested paths.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work is performed by the U.S. Army Futures Command.

This Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Machine Learning Data Collection	-	-	2.940
Description: This effort matures and demonstrates techniques and technologies for mass data collection to be used towards Army research in mobility with AI/ML efforts.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK1 / *Autonomous Mobility Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature data collection system to include multiple sensing modalities and proper computation requirements. Will develop and conduct collection plans leveraging both simulation and live data collection across multiple vehicles. Will develop and conduct test and validation plans to understand proper data to collect from training exercises. Will develop collection, analysis, and validation tools. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a new start in FY 2020.			
Title: Formation Control ***Description:*** This effort uses AI/ML techniques to develop intelligent formation control to be used on maintained roads and in complex terrain without the need for GPS. Data will be collected from mounted platforms utilizing special internal and external sensors to develop algorithms for exact positioning, undistributed formation control, and increased speeds of unmanned platforms. ***FY 2020 Plans:*** Will develop and mature simulation tools that will be used to research coordination and collaboration between vehicles and show usability of collected data from above. Will develop algorithms to determine position/orientation of vehicle within formation utilizing AI/ML that has been trained with Army relevant platform data. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a new start in FY 2020.	-	-	4.200
Accomplishments/Planned Programs Subtotals	-	-	7.140

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK4 / *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BK4: *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*	-	0.000	0.000	0.450	-	0.450	3.450	2.850	4.130	3.569	0.000	14.449

Note

This Project is a new start in Fiscal Year (FY) 2020.

A. Mission Description and Budget Item Justification

This Project will mature and deliver armament specific hardware, algorithms and architectures to support the Next Generation Combat Vehicle with the necessary fire control on future manned and unmanned platforms.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project is performed by the U.S. Army Futures Command.

Work in this Project is related to and fully integrated with the efforts funded in PE 0602145A (Next Generation Combat Vehicle Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation Intelligent Fire Control	-	-	0.450
Description: This effort will deliver armament specific hardware, algorithms and architectures to support the Next Generation Combat Vehicle with the necessary fire control on future manned and unmanned platforms. ***FY 2020 Plans:*** Will optimize the fire control auto-tracking algorithms capability for advanced weapons systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a new start in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.450

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK4 / *Next Gen Intelligent Fire Control(NG-IFC) Adv Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	Project (Number/Name) BK6 / *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BK6: *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*	-	0.000	0.000	0.510	-	0.510	0.912	10.935	11.741	12.018	0.000	36.116

Note

This Project is a new start in Fiscal Year (FY) 2020.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for large caliber direct fire light-weight armament systems that will exceed the current capability of 120mm direct fire cannons and be optimized for future operational environment with cross-domain engagement capability. Specifically this effort integrates and demonstrates technologies for rapid fire on-the-move at all elevations (direct & indirect), compact ammunition design with advanced ignition, advanced recoil mitigation to reduce impulse and allow integration onto lighter platforms, automated ammunition handling and reloading. This Project supports open architecture to enable supervised autonomy and remote operation and integrates intelligent fire control to address multi-domain targets from manned and unmanned platforms.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project supports the Army Modernization Priority Next Generation Combat Vehicle.

Work in this Project is performed by the U.S. Army Futures Command.

Work in this Project is related to and fully integrated with the efforts funded in Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) and PE 0604115A (Technology Maturation Initiative).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Direct In-Direct Armament System (ADIDAS)	-	-	0.510
Description: This effort matures and demonstrates technologies for large caliber direct fire light-weight armament systems that will exceed the current capability of 120mm direct fire cannons and be optimized for future operational environment with cross-domain engagement capability.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603462A / *Next Generation Combat Vehicle Advanced Technology*	**Project (Number/Name)** BK6 / *Adv Direct InDirect Armament Sys (ADIDAS) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will optimize the armament system configurations for high elevations and advanced recoil mitigation to reduce impulse. Will mature system level designs through modeling and simulation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is a new start in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.510

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603463A *I Network C3I Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	106.899	-	106.899	129.790	135.791	146.246	144.512	0.000	663.238
AM7: *Modular RF Communications Advanced Technology*	-	0.000	0.000	15.820	-	15.820	9.427	5.200	6.100	8.922	0.000	45.469
AM9: *Protected SATCOM Advanced Technology**	-	0.000	0.000	0.000	-	0.000	7.545	16.000	19.000	18.835	0.000	61.380
AN2: *Narrowband SATCOM Advanced Technology**	-	0.000	0.000	0.000	-	0.000	5.000	10.000	16.000	0.000	0.000	31.000
AN4: *Non Traditional Waveforms Advanced Technology*	-	0.000	0.000	5.500	-	5.500	11.178	8.000	4.464	9.534	0.000	38.676
AN6: *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*	-	0.000	0.000	2.000	-	2.000	2.000	0.000	0.000	0.000	0.000	4.000
AN8: *COE - Every Receiver is a Sensor Advanced Tech*	-	0.000	0.000	5.978	-	5.978	6.118	6.240	6.365	6.436	0.000	31.137
AO1: *UNT - Every Receiver is a Sensor Advanced Tech*	-	0.000	0.000	6.700	-	6.700	8.700	8.860	10.908	5.013	0.000	40.181
AO3: *Stand-In Advanced RF Effects (STARE) Adv Tech*	-	0.000	0.000	2.000	-	2.000	5.000	7.500	5.560	6.603	0.000	26.663
AO6: *Tag Track and Locate Small Satellites Adv Tech*	-	0.000	0.000	13.986	-	13.986	16.675	16.956	17.501	17.696	0.000	82.814
AO7: *EW for Maneuver Operations (EMO) Adv Tech*	-	0.000	0.000	4.265	-	4.265	2.919	3.045	3.116	3.150	0.000	16.495
AP6: *C4ISR Integrated Demonstrations Advanced Tech*	-	0.000	0.000	4.542	-	4.542	2.474	4.890	5.042	5.153	0.000	22.101
AP8: *Comms/Horiz Int for Army Mod Priorities Adv Tech*	-	0.000	0.000	0.680	-	0.680	4.097	8.628	8.086	18.538	0.000	40.029
AP9: *Next Generation HF Advanced Technology*	-	0.000	0.000	6.000	-	6.000	4.000	0.000	0.000	0.000	0.000	10.000

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603463A *I Network C3I Advanced Technology*							
AQ1: *Spectrum Obfuscation Advanced Technology*	-	0.000	0.000	6.000	-	6.000	0.000	0.000	0.000	0.000	0.000	6.000
AQ5: *Sensor CE-Integrated Sensor Architecture Adv Tech*	-	0.000	0.000	1.508	-	1.508	2.000	2.050	1.500	2.022	0.000	9.080
AQ8: *High Tempo Data Driven Decision Tools Adv Tech**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	1.336	0.957	0.000	2.293
AR2: *Energy Informed Operations Advanced Technology*	-	0.000	0.000	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	2.000
AR4: *Intelligent Env Battlefield Awareness Adv Tech*	-	0.000	0.000	0.659	-	0.659	2.380	3.607	4.188	5.206	0.000	16.040
AR6: *Understanding the Environment as a Threat Adv Tech*	-	0.000	0.000	2.310	-	2.310	2.812	2.557	3.304	3.659	0.000	14.642
AR8: *Sensing in Contested Environments Adv Tech**	-	0.000	0.000	0.000	-	0.000	1.672	1.632	1.800	1.820	0.000	6.924
AS9: *Persistent Geophysical Sensing-Infrasound Adv Tech*	-	0.000	0.000	2.583	-	2.583	3.588	2.481	2.483	2.776	0.000	13.911
AT3: *Subterranean Detection and Monitoring Adv Tech*	-	0.000	0.000	1.090	-	1.090	2.741	1.047	0.908	1.434	0.000	7.220
AT5: *GeoINT - OPS Merge Advanced Technology**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	6.543	0.000	6.543
AT8: *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	-	0.000	0.000	3.992	-	3.992	3.000	3.100	3.526	0.000	0.000	13.618
AU1: *Tactical GeoSpatial Information Capabilities ATech*	-	0.000	0.000	2.070	-	2.070	3.743	4.263	5.120	0.000	0.000	15.196
AU2: *Optimization of Geospatial Data for Visualization**	-	0.000	0.000	0.000	-	0.000	2.100	2.200	1.800	1.784	0.000	7.884
AU4: *Geospatially Enabled Operational Design Adv Tech*	-	0.000	0.000	4.958	-	4.958	6.213	6.261	6.470	0.000	0.000	23.902

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*								
AU6: *Automated Analytics for Operational Environment AT*	-	0.000	0.000	1.709	-	1.709	1.622	2.835	2.900	0.000	0.000	9.066
AU8: *GEOInt/Ops Integration for Multi-echelon Orders**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	4.553	0.000	4.553
AV1: *GEOInt/Ops Logistics Integration-Planning Adv Tech**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	4.953	0.000	4.953
AV2: *LEO Advanced Technology*	-	0.000	0.000	1.983	-	1.983	1.981	0.000	0.000	0.000	0.000	3.964
AV4: *Foundational S&T for Network C3I Advanced Tech**	-	0.000	0.000	0.000	-	0.000	2.128	2.648	2.862	2.952	0.000	10.590
AV8: *Navigation Warfare (NAVWAR) Advanced Technology*	-	0.000	0.000	5.266	-	5.266	4.977	5.191	0.000	0.000	0.000	15.434
AW2: *Autonomous Navigation Advanced Technology*	-	0.000	0.000	0.300	-	0.300	0.700	0.600	0.600	0.607	0.000	2.807
AW4: *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*	-	0.000	0.000	3.000	-	3.000	3.000	0.000	0.000	0.000	0.000	6.000
AW6: *Modular GPS Independent Sensors Advanced Tech**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	5.307	5.366	0.000	10.673

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

In Fiscal Year (FY) 2020 this Program Element (PE) was previously funded, with continuity of effort realigned from the following PEs:

* PE 0603006A Space Application Advanced Technology
* PE 0603270A Electronic Warfare Technology
* PE 0603710A Night Vision Advanced Technology
* PE 0603728A Environmental Quality Technology Demonstrations
* PE 0603734A Military Engineering Advanced Technology
* PE 0603772A Advanced Tactical Computer Science and Sensor Technology
* PE 0603794A C3 Advanced Technology

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603463A *I Network C3I Advanced Technology*

A. Mission Description and Budget Item Justification

This PE matures and demonstrates technologies to provide an Army tactical network and enabling infrastructure that support operations in any environment, to include where the electromagnetic spectrum is denied or degraded. This is accomplished through the exploitation and optimization of components and systems for robust, low signature communications and data networks; assured positioning, navigation, and timing in contested environments; converged and coordinated cyber and electronic warfare activities; resilient mission command on the move; and the collection, processing, and dissemination of information for intelligence, surveillance, and reconnaissance.

AM7 optimizes autonomous networking protocols to automate the Primary, Alternate, Contingency, and Emergency (PACE) communication plan to initialize, adapt, and continue operations under changing environments and threats. AN4 demonstrates non-traditional waveforms and technologies for resilient communications in contested environments providing anti-jam, low probability of intercept, and low probability of detection for the dismounted and vehicular user. AN6 matures technologies providing increased resiliency for Wideband Satellite Communications (SATCOM) through the use of technologies including adaptive interference mitigation and diversity through multiple paths. AN8 and AN01 demonstrates high fidelity Cyber-Electromagnetic Activity (CEMA) situational understanding by exploiting tactical receivers with sufficient capabilities as sensors. AO3 matures and demonstrates technologies and capabilities to provide a robust and reliable communications capabilities by leveraging commercial technologies and enhancing their operation to maintain network connectivity in contested and congested environments. AO6 matures and demonstrates networked and integrated surveillance, communications, and command and control capabilities for high altitude and tactically responsive space payloads to enable information superiority, enhanced situational awareness, and support global assured access enabling distributed tactical operations. AO7 matures and demonstrates technologies that understand contested spectrum points, sense, locate, and cue fires missions to create windows of opportunity in A2/AD environments, restore network capabilities, and enable maneuver and fires. AO9 demonstrates enhanced awareness of the information's "provenance" from originator to consumer (e.g. sensor to shooter) in the presence of cyber attacks, such as an attempt to manipulate data traversing the network. AP2 demonstrates disruption of enemy cyber attack through the use of cyber decoy applications with realistic user behavior algorithms, such as software that creates fake users, applications, systems, documents, networks, and communication traffic. AP6 provides System of Systems (SoS) engineering rigor on Science & Technology (S&T) projects by providing field-based risk reduction processes, quantifiable technology performance in a SoS context, data-driven programmatic decision support, and field-based performance data to supplement Technology Readiness Level (TRL) assessments. AP8 provides unified communications for the Army's modernization priorities through operationally-relevant, end-to-end network demonstrations which leverage Science & Technology (S&T) and commercial technology adapted to mitigate performance gaps in the presence of electronic warfare (EW) systems and reduce network complexity. AP9 improves performance of technologies to provide assured and resilient reach-back communications in satellite denied or degraded environments. AQ1 validates and demonstrates technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities. AQ4 matures and demonstrates advanced mission management tools and workflows, to promote efficient selection and sequencing of effects to support the agile deployment and execution of Offensive Cyber Operations (OCO)/RF Enabled capabilities. AQ5 matures and demonstrates an interoperability architecture consisting of standards, interfaces, and service; the application managers will have added artificial intelligence and functionality that allows for improved collaboration, survivability and recoverability, security, and adaptability to a dynamic network. AR2 matures and demonstrates software, algorithms, communication and control methodologies that allow more expedient, efficient, and informed use of energy resources across the battlefield. AR4 demonstrates and optimizes technologies to allow Soldiers to maneuver faster around or through existing environmental (urban/industrial) conditions and physical landscape constraints. AR6 matures and demonstrates tools that provide capability to inform the Solider of different routes through a complex urban landscape. AS9 matures and demonstrates kitted hardware and software solutions to enable near-real-time battlespace awareness to persistently monitor and update COE regarding critical infrastructure conditions. AT3 matures and demonstrates an integrated suite of subterranean threat detection and vulnerability assessment/

decision technologies that enhance survivability and threat awareness for the soldier operating in urban, complex, and varied environments with subterranean domains. AT8 integrates and demonstrates geo-registration, feature extraction, change detection, data visualization and transmission capabilities. AU1 matures and demonstrates next generation geospatial analytical tools for 3D complex environments applicable to low echelon and tactical edge exploitation. AU4 designs, demonstrates, integrates and transitions to the Army Command Post Computing Environment, a geospatially enabled collaborative planning environment, accessible across echelons. AU6 designs and demonstrates advanced technologies to understand and visualize threat patterns and operational environment changes and support mission planning. AV2 matures and demonstrates Low Earth Orbit Constellation Management architectures and protocols. AV8 matures and demonstrates capabilities allowing the Army to monitor, understand, and control the Navigation Warfare (NAVWAR) environment. AW2 improves localization and decision making of Robotic/Autonomous Systems by optimizing use of sensors on the platform and taking advantage of all available navigation signals; leverages Assured Positioning, Navigation, and Timing (PNT) efforts. AW4 matures, demonstrates and performs modeling and simulation of PNT technologies to provide access to trusted PNT information in global positioning system (GPS) denied or degraded environments.

Work in this PE complements PE 0602146A (Network C3I Technology), PE 0602782A (Command, Control, Communications Technology), PE 0602143A (Soldier Lethality Technology), PE 0602145A (Next Generation Combat Vehicle Technology), PE 0602146A (Network C3I Technology), PE 0602147A (Long Range Precision Fires Technology), PE 0602148A (Future Vertical Lift Technology), PE 0602150A (Air and Missile Defense Technology), PE 0603118A (Soldier Lethality Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0603464A (Long Range Precision Fires Advanced Technology), PE 0603465A (Future Vertical Lift Advanced Technology), and PE 0603466A (Air and Missile Defense Advanced Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work is performed by the U.S. Army Futures Command (AFC), the U.S. Army Space and Missile Defense Command (SMDC) and U.S. Army Engineer Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	106.899	-	106.899
Total Adjustments	0.000	0.000	106.899	-	106.899
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	106.899	-	106.899

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603463A *I Network C3I Advanced Technology*

Change Summary Explanation

FY20 adjustments realign program funding from other Program Elements in the Science and Technology (S&T) portfolio in support of the Army Modernization Priorities and National Defense Strategy.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AM7 / *Modular RF Communications Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AM7: *Modular RF Communications Advanced Technology*	-	0.000	0.000	15.820	-	15.820	9.427	5.200	6.100	8.922	0.000	45.469

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This Project optimizes autonomous networking protocols to automate the Primary, Alternate, Contingency, and Emergency (PACE) communication plan to initialize, adapt, and continue operations under changing environments and threats. Work in this Project complements PE 06022146A/\Project AM6 (Modular RF Communications Technology).

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Modular RF Communications Advanced Technology	-	-	15.820
Description: This project optimizes autonomous networking protocols to automate the Primary, Alternate, Contingency, and Emergency (PACE) communication plan to initialize, adapt, and continue operations under changing environments and threats. ***FY 2020 Plans:*** Will optimize autonomous techniques and algorithms for network initialization, detection, and/or adaption; optimize the architecture design to enable validation of algorithms for network and networking technology initialization from initial start-up condition and/or initial contact with an autonomous networking algorithm; demonstrate multiple approaches to autonomous networking by providing algorithms to detect available networks and networking technologies available to a single node or user, initialize network technology, and/or adapt the changing environmental conditions, such as hostile electronic warfare emitters; mature shared interfaces between network technologies and an autonomous networking algorithms to enable initialization, detection, selection, and/or control of networks and demonstrate the interfaces enabling the autonomous network operation in a relevant laboratory			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AM7 / *Modular RF Communications Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
environment; validate initial instantiation of the network routing algorithms are able to optimally select and switch among the available networks to traverse data from originator to consumer across the overall tactical network in congested and electronic warfare contested environments; deliver initial routing and switching software code and documentation for demonstration in program of record systems; publish the first version of an interface standard between network technologies and an autonomous network detection and adaptation algorithms. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	15.820

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AN4 / *Non Traditional Waveforms Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AN4: *Non Traditional Waveforms Advanced Technology*	-	0.000	0.000	5.500	-	5.500	11.178	8.000	4.464	9.534	0.000	38.676

Note

In Fiscal Year (FY) 2020 this project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This Project demonstrates non-traditional waveforms and technologies for resilient communications in contested environments providing anti-jam, low probability of intercept, and low probability of detection for the dismounted and vehicular user. This Project optimizes technologies not typically applied to the tactical environment, such as millimeter wave communications and directional networking with coherent combining of radio frequency signals, to maintain networked communications in and under contested and congested electromagnetic spectrum environments. Work in this Project complements PE 06022146A/Project AN3 (Non Traditional Waveforms Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Non Traditional Waveforms Advanced Technology	-	-	5.500
Description: This project demonstrates non-traditional waveforms and technologies for resilient communications in contested environments providing anti-jam, low probability of intercept, and low probability of detection for the dismounted and vehicular user. This project optimizes technologies not typically applied to the tactical environment, such as millimeter wave communications and directional networking with coherent combining of radio frequency signals, to maintain networked communications in and under contested and congested electromagnetic spectrum environments.			
FY 2020 Plans: Will mature cooperative beamforming technology to support dismounted or mounted operations; provide increased capacity in a contested environment to dismounted and mounted communications using cooperative technology, such as the dismount distributed tactical beamforming system, to support additional number of users and data throughput; demonstrate dismounted			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN4 / *Non Traditional Waveforms Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
network technology providing local networking among dismounted unit in support of low probability of detection/intercept communication to distant nodes, using technology such as distributed cooperative beamforming; demonstrate millimeter wave communications systems in a relevant field environments to validate performance characteristics of the delivered technology. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	5.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AN6 / *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AN6: *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*	-	0.000	0.000	2.000	-	2.000	2.000	0.000	0.000	0.000	0.000	4.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This Project matures technologies providing increased resiliency for Wideband Satellite Communications (SATCOM) from contested and congested electromagnetics through the use of technologies including adaptive interference mitigation and diversity through multiple paths. Wideband SATCOM is the primary high-bandwidth Beyond Line of Sight (BLOS) Communications used by the tactical Army and this project demonstrates protection of this valuable communication link. Work in this Project complements PE 06022146A/Project AN5 (Protected SATCOM-WB Global SATCOM Inter Canc Tech).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech	-	-	2.000
Description: This project matures technologies providing increased resiliency for Wideband Satellite Communications (SATCOM) from contested and congested electromagnetics through the use of technologies including adaptive interference mitigation and diversity through multiple paths. Wideband SATCOM is the primary high-bandwidth Beyond Line of Sight (BLOS) Communications used by the tactical Army and this project demonstrates protection of this valuable communication link.			
FY 2020 Plans: Will optimize Wideband Global Satellite (WGS) Ka-band interference cancelling technology modem algorithms based on lessons learned from previous over the air demonstrations; validate the Ka-band interference cancelling technology planning tool predicted			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN6 / *Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
performance matches actual field demonstration performance against Warfare (EW) threats; provide modem enhancements to validate Ka-band interference cancelling technology for field based demonstrations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AN8 / *COE - Every Receiver is a Sensor Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AN8: *COE - Every Receiver is a Sensor Advanced Tech*	-	0.000	0.000	5.978	-	5.978	6.118	6.240	6.365	6.436	0.000	31.137

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 243 Sensors and Signals Processing

A. Mission Description and Budget Item Justification

This Project investigates, designs, and codes advanced automated exploitation and fusion analysis tools, applications, and software services that harvest, correlate and fuse tactical receiver sources with new and emerging data sources to improve understanding of the threat picture and more efficiently support near-real time Situational Understanding of the battlefield.

Work in this Project complements PE 06033463A (Network C3I Advanced Technology) \ Project AO1 (UNT - Every Receiver is a Sensor Advanced Tech).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Data Analytics for Situational Awareness	-	-	5.978
Description: This effort develops software technologies for intelligence/mission command (MC) mission collaboration to provide faster and higher quality decision making support for the commander and his key staff. Specific efforts focus on integrating intelligence, surveillance and reconnaissance (ISR) planning and execution at the Task Force/Battalion through troop-level, as well as efforts that provide the capability to identify, fuse, and trace/track specific targets in an asymmetric environment. Work accomplished under Program Element (PE) 0602146A/Project AN7 complements this effort.			
FY 2020 Plans: Will evaluate open source and commercial-off-the-shelf (COTS) technologies to support the creation of a converged data platform which will unify tactical data silos across the warfighting functions (such as: Intel and Operations data sets), resolve data access limitations, and prioritize critical data sharing. Integrate selected data management and information sharing technologies to create			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AN8 / *COE - Every Receiver is a Sensor Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
initial converged data platform and demonstrate the improvement to tactical situational awareness in both timeliness and accuracy by maturing initial analytic capabilities, leveraging these aggregated data sources, to the converged data platform. Will evaluate and define communication pathways between current Mission Command, Fires, and Intelligence systems and scope potential deficiencies and latencies. Map current Army and Joint targeting protocols to proposed data flows and identify potential for algorithmic support. Mature system platforms capable of managing cross-domain, multi-INT, multi-platform data flows, and evaluate on the basis of speed, accuracy, and data integrity. Develop and demonstrate initial multi-INT algorithms capable of facilitating timely creation of intelligence to support long range fires missions. Will mature and demonstrate algorithms that can support distributed processing, exploitation, and dissemination (PED) workflows, increase automation, and augment analyst?s capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is realigned from PE 0603772A/243 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	5.978

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AO1 / *UNT - Every Receiver is a Sensor Advanced Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AO1: *UNT - Every Receiver is a Sensor Advanced Tech*	-	0.000	0.000	6.700	-	6.700	8.700	8.860	10.908	5.013	0.000	40.181

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int
PE 0603772A Electronic Warfare Technology, Projects:
* K15 Advanced Comm ECM Demo
* K16 Non-Commo ECM Tech Dem

A. Mission Description and Budget Item Justification

This Project demonstrates high fidelity Cyber-Electromagnetic Activity (CEMA) situational understanding by exploiting tactical receivers with sufficient capabilities as sensors. This Project optimizes real-time radio frequency mapping of the tactical environment in support of network operation and decision making. Work in this Project complements PE 06022146A (Network C3I Technology) \ Project AN9 (UNT - Every Receiver is a Sensor Technology).

Work in this Project complements PE 06033463A (Network C3I Advanced Technology) \ Project AN8 (COE Every Receiver is a Sensor Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Unified Network Transport (UNT) - Every Receiver is a Sensor Advanced Tech	-	-	2.000
Description: This project demonstrates high fidelity Cyber-Electromagnetic Activity (CEMA) situational understanding by exploiting tactical receivers with sufficient capabilities as sensors. This project optimizes real-time radio frequency mapping of the tactical environment in support of network operation and decision making.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO1 / *UNT - Every Receiver is a Sensor Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature software algorithms on a software defined radio and demonstrate advanced radio tasking capabilities; validate performance measures for dynamic spectrum sensing/advanced tasking algorithms in a relevant laboratory environment; optimize advanced tasking algorithms for use on legacy fielded systems to increase the number of sensors on the battlefield. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603794/EL4 and PE 0603772A/Project K15 and K16 in FY 2020.			
Title: Multi Intelligence Modernization supporting Multifunction Operations ***Description:*** This effort will leverage Intelligence Community investments in software frameworks and exploits against threat SOIs to develop a library of open, modular, and scalable software solutions to address identified capability gaps and to provide the commander with electronic situational awareness while at the same time protecting his assets from enemy deception and jamming. Work accomplished under PE 0602146/Project AN7 complement this effort. ***FY 2020 Plans:*** Will mature and demonstrate electronic support functions suitable for operation in a highly contested environment with enhanced techniques for geolocation. Will integrate techniques to harden and protect electronic support and attack assets from enemy electronic warfare. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603794/EL4 and PE 0603772A/Project K15 and K16 in FY 2020.	-	-	3.000
Title: Highly Distributable UGS ***Description:*** This effort will develop a small, low cost sensor capability that can be distributed in mass quantity and tailored to specific electro-magnetic signals or other modalities (i.e. seismic) to allow the tactical commander to obtain relevant situational awareness data within a signal dense and contested operational environment. ***FY 2020 Plans:*** Will mature and demonstrate advanced ultra-low cost disposable sensing capabilities suitable for operation in a highly contested environment and demonstrate distributed signal survey utilizing large quantities of such sensors. Demonstrate distributed sensor information feeding the larger electronic warfare framework for improved situational understanding. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603794/EL4 and PE 0603772A/Project K15 and K16 in FY 2020.	-	-	1.700
Accomplishments/Planned Programs Subtotals	-	-	6.700

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO1 / *UNT - Every Receiver is a Sensor Advanced Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO3 / *Stand-In Advanced RF Effects (STARE) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AO3: *Stand-In Advanced RF Effects (STARE) Adv Tech*	-	0.000	0.000	2.000	-	2.000	5.000	7.500	5.560	6.603	0.000	26.663

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int
PE 0603270A Electronic Warfare Technology, Project:
* K15 Advanced Comm ECM Demo

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies and capabilities to provide a robust and reliable communications capabilities by leveraging commercial technologies and enhancing their operation to maintain network connectivity in contested and congested environments. Work in this Project complements PE 06022146A (Network C3I Technology) \ Project AO2 (Robust Grey C3I Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Robust Grey C3I Advanced Technology	-	-	2.000
Description: This project matures and demonstrates technologies and capabilities to provide a robust and reliable communications capabilities by leveraging commercial technologies and enhancing their operation to maintain network connectivity in contested and congested environments.			
FY 2020 Plans: Will optimize enhancements to commercial off-the-shelf technologies, such as cellular and/or narrowband communications, to provide dismount and mounted operators with long-range connectivity in a hostile electromagnetic spectrum environment; will			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO3 / *Stand-In Advanced RF Effects (STARE) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
demonstrate low probability of detection/intercept and/or anti-jam enhancements, such as radio frequency directionality and/or frequency/modulation coding, in a relevant field environment. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE06032701/Project K15 and PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AO6 / *Tag Track and Locate Small Satellites Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AO6: *Tag Track and Locate Small Satellites Adv Tech*	-	0.000	0.000	13.986	-	13.986	16.675	16.956	17.501	17.696	0.000	82.814

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603006A Space Application Advanced Technology, Project:
* 592 Space Application Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates payloads, sensors, and data down link systems for tactically responsive space and high altitude platforms supporting Army ground forces. This Project matures, demonstrates, and integrates lightweight materials, hardware components with reduced power consumption, and advanced data collection, processing, and dissemination capabilities. This Project also develops algorithms that process space and near space sensor data in real and near real time for integration into battlefield operating systems. These efforts support the Army's ability to control and exploit space assets that contribute to current and future military operations as defined in the national, Department of Defense (DoD), and Army space policies. Work supports the Army Modernization Priorities.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Tag, Track, and Locate Small Satellites	-	-	13.986
Description: This effort matures and demonstrates technologies required for smaller, warfighter-responsive sensor and communication Low Earth Orbit small satellite constellations. Work will augment, improve, exploit and optimize existing commercial and DoD technologies and networks. Work supports the Army Modernization Priorities. This effort will fund research and validate software, hardware, and algorithms used to enable space-based capabilities in support of the Army?s Modernization Priorities. This effort will also investigate the maturity and feasibility of commercial advances and opportunities in small satellite constellation and payload management for apply to future Army concepts.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO6 / *Tag Track and Locate Small Satellites Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
The work cited is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology (S&T) priority focus areas and the Army Modernization Strategy. This work is performed by the Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) in Huntsville, AL. ***FY 2020 Plans:*** Will optimize and demonstrate technologies, and validate software/algorithms, for tracking and locating objects of interest to improve performance of space-based signal detection, processing, and dissemination; will exploit existing commercial technologies to improve warfighter capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, this effort is realigned from PE 0603006A (C3 Advanced Technology Development).			
Accomplishments/Planned Programs Subtotals	-	-	13.986

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AO7 / *EW for Maneuver Operations (EMO) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AO7: *EW for Maneuver Operations (EMO) Adv Tech*	-	0.000	0.000	4.265	-	4.265	2.919	3.045	3.116	3.150	0.000	16.495

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603270A Electronic Warfare Technology, Project:
* K15 Advanced Comm Ecm Demo

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies that understand contested spectrum points, sense, locate, and cue fires missions to create windows of opportunity in A2/AD environments, restore network capabilities, and enable maneuver and fires.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Stand-Off ISR Technologies	-	-	3.000
Description: This effort matures and demonstrates hardware and software to conduct electronic warfare (EW) for intelligence, surveillance reconnaissance in support of Army tactical operations. ***FY 2020 Plans:*** Will mature stand-in capabilities to find, fix, and locate adversary signals of interest that impact the Army?s ability to use the Electromagnetic Spectrum. Mature and demonstrate the capability for distributed platform sensing that efficiently collaborate to convey spectrum Situational Understanding (SU) to the Commander. Demonstrate and validate critical technologies for distributed Electronic Warfare Support (ES) at the Brigade and Below tactical engagement. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE060270/Project K15 in FY 2020.			
Title: EW Techniques Maturation and Modeling & Simulation	-	-	1.265

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AO7 / *EW for Maneuver Operations (EMO) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates Electronic Warfare capabilities leveraging hardware-in-the-loop and modeling and simulation (M&S) of threat Intelligence, Surveillance, and Reconnaissance (ISR) systems to validate coordinated and collaborative non-kinetic effects. ***FY 2020 Plans:*** Will mature simultaneous Electronic Warfare (EW) techniques against adversarial Intelligence Surveillance and Reconnaissance (ISR) capabilities. Perform laboratory risk reduction experiments in modeling, simulation, and hardware-in-the-loop to validate EW techniques prior to the kinetic engagement. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE060270/Project K15 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	4.265

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP6 / *C4ISR Integrated Demonstrations Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AP6: *C4ISR Integrated Demonstrations Advanced Tech*	-	0.000	0.000	4.542	-	4.542	2.474	4.890	5.042	5.153	0.000	22.101

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

Provides System of Systems (SoS) engineering rigor on Science & Technology (S&T) projects by providing field-based risk reduction processes, quantifiable technology performance in a SoS context, data-driven programmatic decision support, and field-based performance data to supplement Technology Readiness Level (TRL) assessments.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: C4ISR Integrated Demonstrations Advanced Tech	-	-	4.542
Description: This project provides appropriate System of Systems (SoS) engineering rigor on Science & Technology (S&T) projects by providing field-based risk reduction processes, quantifiable technology performance in a SoS context, data-driven programmatic decision support, and field-based performance data to supplement Technology Readiness Level (TRL) assessments. This project provides network automation, resiliency, and situational understanding through science & technology advancements.			
FY 2020 Plans: Will demonstrate commercial and government off-the-shelf and research and development advanced technologies in themed field-based risk reduction events that informs the Army's Modernization Priorities, including Network/C3I, Future Vertical Lift, Next Generation Combat Vehicle, and Soldier Lethality; provide technology assessments of science & technology efforts, such as millimeter wave communication systems and/or spectrum decoying, in a field relevant environment to demonstrate technology			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP6 / *C4ISR Integrated Demonstrations Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
maturation; Exploit virtualization to increased venue capabilities by incrementally building a more scalable tactical network; mature and demonstrate advancement of spectrum collection, injection, and management capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	4.542

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP8 / *Comms/Horiz Int for Army Mod Priorities Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AP8: *Comms/Horiz Int for Army Mod Priorities Adv Tech*	-	0.000	0.000	0.680	-	0.680	4.097	8.628	8.086	18.538	0.000	40.029

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This Project provides unified communications for the Army's modernization priorities through operationally-relevant, end-to-end network demonstrations which leverage Science & Technology (S&T) and commercial technology adapted to mitigate performance gaps in the presence of electronic warfare (EW) systems and reduce network complexity. Work in this Project complements PE 06022146A (Network C3I Technology) / Project AP7 (Comms Support to CSA / Horizontal Integ Fields Tech).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Communications Support to Army Modernization Priorities/Horizontal Integration Fields Advance Technology	-	-	0.680
Description: This Project provides unified communications for the Army's modernization priorities through operationally-relevant, end-to-end network demonstrations which leverage Science & Technology (S&T) and commercial technology adapted to mitigate performance gaps in the presence of electronic warfare (EW) systems and reduce network complexity. ***FY 2020 Plans:*** Will demonstrate commercial and/or government off-the-shelf technologies which can fulfill interim network requirements for Long Range Precision Fires (LRPF), Next Generation Combat Vehicle (NGCV), Future Vertical Lift (FVL), Air and Missile Defense (AMD), and/or Soldier Lethality (SL), while other network science and technology projects develop future network capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.680

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP8 / *Comms/Horiz Int for Army Mod Priorities Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AP9 / *Next Generation HF Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AP9: *Next Generation HF Advanced Technology*	-	0.000	0.000	6.000	-	6.000	4.000	0.000	0.000	0.000	0.000	10.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This Project improves performance of technologies to provide assured and resilient reach-back communications in satellite denied or degraded environments. This Project optimizes performance of new high frequency (HF) technology to provide low probability of detection and anti-jam capabilities to overcome emerging electronic warfare threats.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation HF Advanced Technology	-	-	6.000
Description: This Project improves performance of technologies to provide assured and resilient reach-back communications in satellite denied or degraded environments. This project optimizes performance of new high frequency (HF) technology to provide low probability of detection and anti-jam capabilities to overcome emerging electronic warfare threats.			
FY 2020 Plans: Will optimize software code modifications to the High Frequency (HF) communications waveform to meet the Army?s HF requirements, such as anti-jam and low probability of detection/intercept, and modernization goals to provide resilient long-range reach-back in satellite denied environments; demonstrate the modified software code in a waveform emulator to validate the code?s functionality; demonstrate the modified HF software to validate the enhancements, such as anti-jam and low probability			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AP9 / *Next Generation HF Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
of detection/intercept performance, against pacing threats, such as simulated enemy systems; optimize software code based on waveform emulator demonstration results; provide waveform code for porting to communications hardware for demonstrations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is realigned from PE0603794/Project EL4 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	6.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AQ1 / *Spectrum Obfuscation Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AQ1: *Spectrum Obfuscation Advanced Technology*	-	0.000	0.000	6.000	-	6.000	0.000	0.000	0.000	0.000	0.000	6.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603794A C3 Advanced Technology, Project:
* EL4 Tactical Comms and Networking Technology Int

A. Mission Description and Budget Item Justification

This project validates and demonstrates technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Spectrum Obfuscation Advanced Technology	-	-	6.000
Description: This Project validates and demonstrates technologies that provide obfuscation of radio frequency (RF) spectrum signature in order to counter enemy electronic surveillance capabilities. ***FY 2020 Plans:*** Will optimize the design of a proof-of-concept wideband alluring signal projection (WASP) system to provide electromagnetic spectrum protection through the use of multichannel signal emissions capability to project high-value assets, such as Battalion and Brigade-level command post electromagnetic signatures, on the battlespace; mature and demonstrate a proof-of-concept WASP system in a relevant field environment; validate improved network communications through the operation of WASP systems to decoy high value targets and attract simulated enemy systems on the battlespace away from high-value assets. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Project is realigned from PE0603794/Project EL4 in FY20.			
Accomplishments/Planned Programs Subtotals	-	-	6.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AQ1 / *Spectrum Obfuscation Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AQ5 / *Sensor CE-Integrated Sensor Architecture Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AQ5: *Sensor CE-Integrated Sensor Architecture Adv Tech*	-	0.000	0.000	1.508	-	1.508	2.000	2.050	1.500	2.022	0.000	9.080

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603710A Night Vision Advanced Technology, Project:
* K70 Night Vision Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates an interoperability architecture consisting of standards, interfaces, and services. The application managers will have added artificial intelligence and functionality that allows for improved collaboration, survivability and recoverability, security, and adaptability to a dynamic network. Work in this Project supports the Army Science and Technology Network, Next Generation Combat Vehicle, Soldier Lethality, Air and Missile Defense, Long Range Precision Fires and Future Vertical Lift modernization priorities.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Sensor CE - Integrated Sensor Architecture	-	-	1.508
Description: This effort matures and demonstrates an agile and adaptive interoperability sensor architecture that allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge across limited, heterogeneous resources and against a peer adversary. The goal of this effort is to develop standards, models, and protocols that provide a common language for sensor systems to connect, publish their capabilities and needs, and interact with other systems, even on disadvantaged networks. The benefits of this effort are increased sensor collaboration, reduced decision timelines, reduced soldier load, and reduced integration costs.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AQ5 / *Sensor CE-Integrated Sensor Architecture Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will demonstrate interoperability on limited-bandwidth communication networks with capability to recover from communication network denial. Will mature tasking capability to dynamically fulfill mission objections while reducing operator knowledge burden. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603710A / Project K70 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	1.508

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR2 / *Energy Informed Operations Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AR2: *Energy Informed Operations Advanced Technology*	-	0.000	0.000	2.000	-	2.000	0.000	0.000	0.000	0.000	0.000	2.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 101 Tactical Command and Control

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software, algorithms, communication and control methodologies that allow more expedient, efficient, and informed use of energy resources across the battlefield. It provides Commanders at all echelons with situational awareness (SA) that allows them to understand and control their power and energy resources to ensure continuous operations of mission equipment and maintain overmatch of adversaries.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Expeditionary Energy Informed Operations	-	-	2.000
Description: This effort matures and demonstrates advanced power and thermal management and distribution technologies for command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) applications as well as validates and integrates designs in power generation, hybrid energy storage, and assessments.			
FY 2020 Plans: Will demonstrate and validate intelligent power system technologies at user events targeting Multi-Domain Operations and joint applications. Will develop and demonstrate predictive power and use algorithms in multi-power source configurations in support of ad-hoc, mobile arrangements of power equipment for expeditionary Command, Control, Communications, computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems; will demonstrate multiple-master control methodologies in intelligent power systems integrated into C4ISR platforms like vehicles, airframes or other platforms with critical power loads that must join together			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR2 / *Energy Informed Operations Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
in an ad-hoc power network with competing prioritizations; and will validate and demonstrate universal translation and mixed grid control capabilities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603772A / Project 101 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AR4 / *Intelligent Env Battlefield Awareness Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AR4: *Intelligent Env Battlefield Awareness Adv Tech*	-	0.000	0.000	0.659	-	0.659	2.380	3.607	4.188	5.206	0.000	16.040

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603728A Environmental Quality Technology Demonstrations, Project:
* 03E Environmental Restoration Technology

A. Mission Description and Budget Item Justification

This Project demonstrates and optimizes technologies to allow Soldiers to maneuver faster around or through existing environmental (urban/industrial) conditions and physical landscape constraints. This effort matures and demonstrates web modules/software tools delivering crucial geo-chemical resources and advanced knowledge of geo-environmental infrastructure to mission planners. This effort supports the Common Operating Environment LOE.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Geo-Forensics for Reconnaissance Exploitation	-	-	0.659
Description: This effort provides unique terrestrial ?fingerprints? to describe and predict the geological, biological, and overall ecological information associated with A2/AD sites from CONUS analogs. ***FY 2020 Plans:*** Will develop of a software tool that predicts soil behavior, including ability to retain or alter chemical threats, at locations where access and knowledge are limited. Will mature and demonstrate tools to allow incorporating this data onto geospatial maps to enable mission planning and forensics applications for predicting chemical movement in the soil. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603728A/03E in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.659

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR4 / *Intelligent Env Battlefield Awareness Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army					Date: March 2019							
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AR6 / *Understanding the Environment as a Threat Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AR6: *Understanding the Environment as a Threat Adv Tech*	-	0.000	0.000	2.310	-	2.310	2.812	2.557	3.304	3.659	0.000	14.642

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603728A Environmental Quality Technology Demonstrations, Project:
* 03E Environmental Restoration Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates tools that provide capability to inform the Solider of different routes through a complex urban landscape. Optimizes tools that balance exposure to environmental threats with mission constraints to provide a risk versus reward capability of operating in different areas of the urban theater. This Project matures and demonstrates predictive software accurately integrating the risks of physical, chemical, and biological threats in an urban environment into route planning tools.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Environmental Threat Technology Demonstrations for route planning	-	-	2.310
Description: This effort matures and demonstrates a software tool informing and balancing the risk of exposure to environmental threats with maneuver constraints along potential routes. The software integrates the risks associated with different environmental matrices in complex urban environments and includes the capability for routing in off-road scenarios.			
FY 2020 Plans: Will demonstrate a new route planning capability for off-road options through the complex urban environment. Will mature and optimize products that will inform the Soldier of risks to personnel and equipment expected along various routes, to weigh Soldier exposure and probability of mission success.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AR6 / *Understanding the Environment as a Threat Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Effort is realigned from PE0603728A/03E in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.310

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AS9 / *Persistent Geophysical Sensing-Infrasound Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AS9: *Persistent Geophysical Sensing-Infrasound Adv Tech*	-	0.000	0.000	2.583	-	2.583	3.588	2.481	2.483	2.776	0.000	13.911

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates kitted hardware and software solutions that persistently monitor (through non-line-of-sight sensing including infrasound) critical infrastructure conditions and threat activities in dynamic battlefields. These technologies provide near real time data collection, processing, and alerts of infrastructure go/no-go condition required for maneuver planning. This Project also matures and demonstrates methodologies to assign maneuver relevant engineering attributes to geospatial feature data such as bridge load classification, road condition, and bathymetry. Work supports the Common Operating Environment LOE.

Work in this Project supports the Army Science and Technology Network/C3I Portfolio.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project conducted at Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Remote Assessment of Infrastructure for Ensured Maneuver (RAFTER) Demonstrations	-	-	2.583
Description: This effort matures and demonstrates a light-weight, low-power, persistent monitoring system that is capable of integration with mission command platforms with associated software for processing geophysical data in near-real-time (with no SME in the loop) to provide actionable intelligence concerning critical transportation assets. This effort complements PE 0602146A (Network C3I Technology) / Project AR9 (Persistent Geophysical Sensing-Infrasound Tech).			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AS9 / *Persistent Geophysical Sensing-Infrasound Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will optimize and validate the persistent monitoring system and associated software for near-real-time geophysical data processing through multiple field demonstrations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603734A/T08 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.583

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AT3 / *Subterranean Detection and Monitoring Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AT3: *Subterranean Detection and Monitoring Adv Tech*	-	0.000	0.000	1.090	-	1.090	2.741	1.047	0.908	1.434	0.000	7.220

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project validates and demonstrates advanced subterranean monitoring and vulnerability assessment technologies providing mobile and man-portable solutions to enhance survivability and threat awareness during urban operations and negate enemy subterranean operation advantage. This Project also optimizes and demonstrates enhanced technologies to detect tunnels and tunneling activity in complex and varied environments. This effort supports a Common Operating Environment.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project conducted at Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Subterranean Threat Assessment by Real-time Sensing Demonstrations	-	-	1.090
Description: This effort validates and demonstrates integrated suite of tunnel detection and persistent surveillance technologies, mobile and man-portable solutions to detect underground municipal infrastructure, voids, and other subterranean vulnerabilities in urban and complex domains. This effort complements PE 0602146A (Network C3I Technology) / Project AT2 (Subterranean Detection and Monitoring Technology).			
FY 2020 Plans: Will optimize seismic acquisition hardware and software components to speed up data acquisition and transfer rates, validate sensor coupling models, and demonstrate full waveform inversion data processing algorithms.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AT3 / *Subterranean Detection and Monitoring Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Effort is realigned from PE 0603734A/T08 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	1.090

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AT8 / *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AT8: *Network-Enabled GeoSpatial-GEOINT Services AdvTech*	-	0.000	0.000	3.992	-	3.992	3.000	3.100	3.526	0.000	0.000	13.618

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project integrates and demonstrates the geo-registration, feature extraction, change detection, data visualization and transmission capabilities developed in the applied research portion of this effort. Tools developed for the exploitation of 3D datasets will be integrated into a streamlined workflow requiring low levels of expertise, putting advanced processing capabilities in the hands of the Soldier. This effort includes demonstrations of tactical enhancements and the integrated ability to rapidly share mission critical 3D information in support of planning and execution. This effort supports a Common Operating Environment.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Integration and Demonstration of 3D Data Model Feature Extraction, Geo-registration, Analytical Tool Development and Visualization	-	-	3.992
Description: This effort matures, integrates and demonstrates the design and formulation of new urban terrain data models, frameworks and processes to automate the transformation of tactical unit generated source data (e.g. LiDAR, imagery, and full motion video derived data) to new model constructs for rapid and accurate geo-registration of features (manmade infrastructure).			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AT8 / *Network-Enabled GeoSpatial-GEOINT Services AdvTech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will review, compare, and document through experiments and demonstrations baseline of industry and government technologies in 3D data processing, and data models, in terms of adaptation to modernization of mission command network. Will compare suitability for automated feature extraction and resources required for accurate Geo-registration and display. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603734A/T08 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	3.992

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU1 / *Tactical GeoSpatial Information Capabilities ATech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AU1: *Tactical GeoSpatial Information Capabilities ATech*	-	0.000	0.000	2.070	-	2.070	3.743	4.263	5.120	0.000	0.000	15.196

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates next generation geospatial analytical tools for 3D complex environments applicable to low echelon and tactical edge exploitation. These new capabilities will allow deployed units to enhance/update provisioned (baseline) standard, sharable, geospatial foundation (SSGF) data through automated analytics on multi-sourced spatial data resulting in streamlined, high fidelity terrain analysis products. Reducing data gaps and processing timelines will greatly increase Soldier situational awareness and support faster decision making in complex terrain. This effort supports the Common Operating Environment LOE.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: 3D Terrain Analysis	-	-	1.320
Description: This effort integrates and demonstrates software models and workflows provisioned on the geospatial and GEOINT workstations for improved capabilities to generate, process and exploit terrain products enabling situational awareness and rapid decision making at the tactical edge. ***FY 2020 Plans:*** Will conduct testing of preliminary compatible framework and workflow for remotely sensed tactical data exploitation that provisions an enhanced terrain analysis capability to the geospatial engineer toolkit. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603734A/T08 in FY 2020.			
Title: Advanced Airborne LiDAR	-	-	0.750

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU1 / *Tactical GeoSpatial Information Capabilities ATech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort integrates and demonstrates enhanced Geiger-mode LiDAR hardware/software, for advanced testing of protocols, equipment, and products for enhanced high-altitude/wide area terrain data collection, to support tactical operations. ***FY 2020 Plans:*** Will mature new Geiger-mode LiDAR sensor payload components, for increasing performance and speed of collection and processing, for more realistic portrayal of multi-domain environments. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603734A/T08 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	2.070

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU4 / *Geospatially Enabled Operational Design Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AU4: *Geospatially Enabled Operational Design Adv Tech*	-	0.000	0.000	4.958	-	4.958	6.213	6.261	6.470	0.000	0.000	23.902

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project designs, demonstrates, integrates and transitions to the Army Command Post Computing Environment, a geospatially enabled collaborative planning environment, accessible across echelons, with capabilities that support Army Design Methodology (ADM) by providing the ability to perform conceptual planning and problem framing, supporting a greater understanding and visualization of the dynamic operational environment, a shared understanding of the operations purpose across echelons, and enhanced products to drive detailed budget planning and operational assessment processes, enhancing the collaborative interaction between commanders, staffs, and unified action partners. Work supports the Common Operating Environment LOE.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Engineer Research and Development Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Virtual Collaborative Operational Design Demonstrations	-	-	2.400
Description: This effort integrates and demonstrates automation technologies to digitally visualize, create and assess critical elements of the Operational Environment required to inform the Operational Design functions, including collaborative conceptual framing of the problem.			
FY 2020 Plans: Will design and demonstrate tools to support Army Design Methodology (ADM) to frame the problem and visualize the desired end state in a geospatial context.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU4 / *Geospatially Enabled Operational Design Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Effort is realigned from PE 0603734A/T08 in FY 2020.			
Title: Tactical Data Analysis and Visualization Demonstration ***Description:*** This effort integrates and demonstrates a suite of automated data aggregation analysis and visualization capabilities allowing commanders and staffs the capability to bridge conceptual planning (ADM) to deliberate planning at echelons down to battalion. ***FY 2020 Plans:*** Will design and conduct demonstrations to geospatially enable strategic guidance inputs to operational design, in a digital, integrated, collaborative planning environment. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603734A/T08 in FY 2020.	-	-	2.558
Accomplishments/Planned Programs Subtotals	-	-	4.958

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AU6 / *Automated Analytics for Operational Environment AT*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AU6: *Automated Analytics for Operational Environment AT*	-	0.000	0.000	1.709	-	1.709	1.622	2.835	2.900	0.000	0.000	9.066

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project designs and demonstrates advanced technologies to understand and visualize threat patterns and operational environment changes and support mission planning by contextualizing results based on battlefield conditions and on hidden patterns discovered and merged from textual reporting. Work supports the Common Operating Environment LOE.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Simultaneous Multi-Domain Data Representation	-	-	0.624
Description: This effort designs, demonstrates and integrates advanced capabilities to provide commanders and staffs with the ability to understand and operate in multiple domains simultaneously, utilizing data representations and algorithms to seamlessly track the enemy, determine patterns of behavior or actions, identify operational environment changes, and support mission planning by contextualizing results from textual data analysis based upon battlefield conditions. ***FY 2020 Plans:*** Will exploit available advanced spatio-temporally coherent multi-domain data representations that capture explicit and implicit relationships between threat actors, and operational environment changes, distilled from raw data. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603734A/T08 in FY 2020.			
Title: Automated Analysis of Multi-Domain Data	-	-	1.085

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AU6 / *Automated Analytics for Operational Environment AT*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort designs and demonstrates data models to support automated sense making and analysis and advanced relevancy ranking approaches to identify and prioritize knowledge gaps and contextualized results. ***FY 2020 Plans:*** Will exploit available multi-domain data fusion capabilities for geospatial data processing, analytics and representations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE0603734A/T08 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	1.709

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV2 / *LEO Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AV2: *LEO Advanced Technology*	-	0.000	0.000	1.983	-	1.983	1.981	0.000	0.000	0.000	0.000	3.964

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603006A Space Application Advanced Technology, Project:
* 592 Space Application Tech

A. Mission Description and Budget Item Justification

Project AV2 will mature and develop Low Earth Orbit (LEO) constellation management for space order-of-battle architectures and protocols. The advanced technology development will involve using two spacecraft and will leverage commercial LEO mega-constellation investments to develop capabilities which support direct sensor-to-shooter data links while under control by a maneuver battalion commander. Technology will be developed to enable communications and deep strikes in contested environments. This Project supports the Army's efforts to proliferate and control space assets to support the tactical ground commander. It includes exploration efforts to augment missile warning, GPS, and global communications. Work aligns with development underway in Network, Assured Positioning Navigation and Timing (APNT), and Long-Range Precision Fires (LRPF) Cross Functional Teams (CFT).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) Technical Center in Huntsville, AL and the Defense Advanced Research Projects Agency (DARPA), Arlington, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Payload Technology Development	-	-	1.983
Description: Mature the technology for Low Earth Orbit satellites. Payload integration will be validated as well as the architectureand design of two LEO satellites for support to an Army tactical commander. The work cited is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology (S&T) priority focus areas and the Army Modernization Strategy. This work is performed by the Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) in Huntsville, AL.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV2 / *LEO Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will design and develop space payloads to operate in a LEO constellation and augment missile warning/defense, GPS, and provide global communications with tactical timelines. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort was realigned from PE 0603006A / Project 592 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	1.983

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AV8 / *Navigation Warfare (NAVWAR) Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AV8: *Navigation Warfare (NAVWAR) Advanced Technology*	-	0.000	0.000	5.266	-	5.266	4.977	5.191	0.000	0.000	0.000	15.434

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 101 Tactical Command and Control

A. Mission Description and Budget Item Justification

This Project matures and demonstrates capabilities allowing the Army to monitor, understand, and control the Navigation Warfare (NAVWAR) environment. This requires an integrated approach to Electronic Protection (EP), Electronic Support (ES), and Electronic Attack (EA) to rapidly characterize the NAVWAR environment, deny Positioning, Navigation, and Timing (PNT) based capabilities to our adversaries, and maintain Army capabilities.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: NAVWAR for Ground Soldiers	-	-	5.266
Description: This effort matures and demonstrates capabilities allowing the Army to monitor, understand, and control the NAVWAR environment. This requires an integrated approach to Electronic Protection (EP), Electronic Support (ES), and Electronic Attack (EA) to rapidly characterize the NAVWAR environment, deny PNT based capabilities to our adversaries, and maintain Army capabilities.			
FY 2020 Plans: Will improve the performance of a Navigation Warfare (NAVWAR) breadboard that will enable continued military operations in hostile, GPS denied environments by integrating electronic attack, electronic protection and electronic support hardware and software; incorporate the new Military Code (M-Code) GPS signal for offensive and defensive NAVWAR operations into the breadboard; will mature and code a PNT situational awareness software tool utilizing existing sensors and GPS receivers; will mature and demonstrate a hardware solution using multi-GNSS signals for integrity monitoring; will integrate PNT technologies			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AV8 / *Navigation Warfare (NAVWAR) Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
such as radio frequency (RF) ranging beacons for in-building navigation to augment PNT solutions for mounted and dismounted platforms; will mature and demonstrate two way time transfer hardware that will provide accurate time to users and systems in the absence of GPS. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603772A / Project 101 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	5.266

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*				Project (Number/Name) AW2 / *Autonomous Navigation Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AW2: *Autonomous Navigation Advanced Technology*	-	0.000	0.000	0.300	-	0.300	0.700	0.600	0.600	0.607	0.000	2.807

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 101 Tactical Command and Control

A. Mission Description and Budget Item Justification

This Project will leverage Assured Positioning, Navigation, and Timing (PNT) efforts. It improves localization and decision making of Robotic/Autonomous Systems by optimizing use of sensors on the platform and taking advantage of all available navigation signals.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Autonomous Navigation	-	-	0.300
Description: This effort leverages Assured PNT efforts and improves localization and decision making of Robotic/Autonomous Systems by optimizing use of sensors on the platform and taking advantage of all available navigation signals. Work accomplished under Program Element (PE) 0602146/Project AW1 (Autonomous Navigation Technology) complements this effort. ***FY 2020 Plans:*** Will perform a candidate component demonstration on a Mounted platform for Assured Autonomous PNT, leveraging previous sensor and component work integrated with autonomous obstacle avoidance sensors (potential sensors include inertial measurement units, vision navigation sensors, RF ranging, etc.). ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This Effort is realigned from PE 0603772A / Project 101 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	0.300

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AW2 / *Autonomous Navigation Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603463A / *Network C3I Advanced Technology*	Project (Number/Name) AW4 / *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AW4: *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*	-	0.000	0.000	3.000	-	3.000	3.000	0.000	0.000	0.000	0.000	6.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 101 Tactical Command and Control

A. Mission Description and Budget Item Justification

This Project matures, demonstrates and performs modeling and simulation (M&S) of Positioning, Navigation, and Timing (PNT) technologies to provide access to trusted PNT information in global positioning system (GPS) denied or degraded environments.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: DoD PNT M&S Collaborative Initiative (CI)	-	-	3.000
Description: This effort matures, demonstrates and performs modeling and simulation (M&S) of PNT technologies to provide access to trusted PNT information in global positioning system (GPS) denied or degraded environments. Work accomplished under Program Element (PE) 0602146/Project AW3 (DoD PNT M&S Collaborative Initiative (CI) Technology) complements this effort.			
FY 2020 Plans: Will conduct operational Tri-Service PNT M&S Analysis for a more comprehensive analysis of PNT in the battlespace. Will adopt and adapt operational mission/campaign level simulations. Will demonstrate a PNT M&S capability in performing force effectiveness analysis of candidate PNT technologies.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603463A / *Network C3I Advanced Technology*	**Project (Number/Name)** AW4 / *DoD PNT M&S Collaborative Initiative (CI) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This Effort is realigned from PE 0603772A / Project 101 in FY 2020.			
Accomplishments/Planned Programs Subtotals	-	-	3.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603464A *I Long Range Precision Fires Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	174.386	-	174.386	118.682	85.471	72.670	97.524	0.000	548.733
AE6: *Strategic Long Range Cannon Advanced Technology*	-	0.000	0.000	77.000	-	77.000	0.000	0.000	0.000	0.000	0.000	77.000
AE8: *Land-Based Anti-Ship Missile (LBASM) Advanced Tech*	-	0.000	0.000	6.761	-	6.761	10.067	15.908	11.800	0.000	0.000	44.536
AE9: *Low-Cost Tact Ext Range Missile (LC-TERM) Adv Tech*	-	0.000	0.000	14.149	-	14.149	10.087	0.000	0.000	0.000	0.000	24.236
AF2: *Long Range Maneuverable Fires (LRMF) Advanced Tech**	-	0.000	0.000	0.000	-	0.000	0.000	0.000	0.000	11.210	0.000	11.210
AF4: *Missile Simulation Advanced Technology*	-	0.000	0.000	0.273	-	0.273	2.623	2.678	2.731	2.762	0.000	11.067
AG3: *Extended Range Cannon Artillery (ERCA) Adv Tech*	-	0.000	0.000	19.992	-	19.992	15.319	0.000	0.000	0.000	0.000	35.311
AG5: *Extended Range Artillery Munition Suite Adv Tech*	-	0.000	0.000	35.600	-	35.600	45.275	34.246	23.651	23.915	0.000	162.687
AG7: *Energetic Materials and Adv Processing Adv Tech*	-	0.000	0.000	2.040	-	2.040	2.081	2.123	2.165	2.189	0.000	10.598
AH1: *Multiple Simul Engagement Technologies Adv Tech**	-	0.000	0.000	0.000	-	0.000	0.000	6.416	10.520	8.347	0.000	25.283
AH3: *Single Multi-mission Attack Missile Adv Tech*	-	0.000	0.000	5.683	-	5.683	3.000	0.000	0.000	0.000	0.000	8.683
BS3: *Strategic Missile Advanced Technology*	-	0.000	0.000	12.888	-	12.888	30.230	24.100	21.803	49.101	0.000	138.122

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

All other efforts in this Program Element (PE) were previously funded, with continuity of effort realigned from the following PEs:
* 0603004A (Weapons and Munitions Advanced Technology)
* 0603313A (Missile and Rocket Advanced Technology)

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603464A *I Long Range Precision Fires Advanced Technology*

A. Mission Description and Budget Item Justification

This PE matures and demonstrates Long Range Precision Fires (LRPF) technologies to destroy, neutralize, or suppress the enemy by cannon artillery and missile fire and enable integration of fire support assets into combined arms operations. Major Focus Areas for LRPF Science and Technology include: Missiles, Cannon Artillery, and Supporting LRPF Technologies. LRPF Missiles Advanced Development matures and demonstrates a broad range of Missile technologies to enhance Army integrated LRPF capabilities at extended range. Cannon Artillery Advanced Development matures and demonstrates critical technologies to increase range, precision, and both point and area effects for cannon artillery. Supporting LRPF Technologies Advanced Development matures and demonstrates a broad range of component technologies to address weapon cost drivers and enhance performance of future LRPF munitions and systems.

Work in this PE complements PE 0602147A Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work is performed by the U.S. Army Futures Command (AFC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	174.386	-	174.386
Total Adjustments	0.000	0.000	174.386	-	174.386
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	174.386	-	174.386

Change Summary Explanation

Beginning in FY20, this PE realigns ongoing efforts from other PEs within the Science and Technology portfolio related to Long Range Precision Fires Advanced Technology.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AE6 / *Strategic Long Range Cannon Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AE6: *Strategic Long Range Cannon Advanced Technology*	-	0.000	0.000	77.000	-	77.000	0.000	0.000	0.000	0.000	0.000	77.000

Note

Was previously funded in PE 0603004A / 232: Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by maturing and demonstrating technologies for a long range cannon capability to deliver lethal effects at strategic ranges while providing lethality overmatch.

Work in this Project complements PE 0602147 Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Strategic Long Range Cannon Advanced Technology	-	-	77.000
Description: This effort will mature and demonstrate subsystem technologies to further enhance range, lethality, and precision enablers for extended range cannon and munition systems. ***FY 2020 Plans:*** Will mature and optimize long range armament technologies for both weapons and munitions to support potential deep strike objective capabilities from future cannon artillery systems; will enhance component level technologies for novel cannon, munition, and fire control, including guidance and propulsion systems, for artillery fired projectiles. Will provide revolutionary performance for Long Range Fires by developing enhanced lethality and range extension technologies for integrated system level performance with maximum effects from cannons. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Was previously funded in PE 0603004A / 232: Advanced Lethality & Survivability Demo			
Accomplishments/Planned Programs Subtotals	-	-	77.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AE6 / *Strategic Long Range Cannon Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AE8 / *Land-Based Anti-Ship Missile (LBASM) Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AE8: *Land-Based Anti-Ship Missile (LBASM) Advanced Tech*	-	0.000	0.000	6.761	-	6.761	10.067	15.908	11.800	0.000	0.000	44.536

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 263 Future Msl Tech Integr (FMTI)

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by maturing and demonstrating critical technologies to detect, engage, and defeat moving land or maritime surface targets under all conditions.

Work in this Project complements PE 0602147A Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Land Based Anti-Ship Missile (LBASM) Advanced Technology	-	-	6.761
Description: Matures and demonstrates technologies that enable high-mobility artillery rocket system (HIMARS) and multiple-launch rocket system (MLRS) rocket/missile artillery systems to destroy enemy air defenses in the land and the maritime domains. ***FY 2020 Plans:*** Will continue component integration/demonstration of multi-mode seeker that provides target classification/discrimination and aim-point selection on critical target features and lethal payload that provides maximum effects against multi-domain target sets. Will also continue to validate components and optimize concepts for system integration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs..			
Accomplishments/Planned Programs Subtotals	-	-	6.761

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AE8 / *Land-Based Anti-Ship Missile (LBASM) Advanced Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AE9 / *Low-Cost Tact Ext Range Missile (LC-TERM) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AE9: *Low-Cost Tact Ext Range Missile (LC-TERM) Adv Tech*	-	0.000	0.000	14.149	-	14.149	10.087	0.000	0.000	0.000	0.000	24.236

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 263 Future Msl Tech Integr (FMTI)

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by maturing and demonstrating propulsion technologies that enables extended range target engagements and navigation component technologies that reduce dependence on Global Positioning System (GPS) for precision effects.

Work in this Project complements PE 0602147A Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Low-Cost Tactical Extended Range Missile (LC-TERM) Advanced Technology	-	-	14.149
Description: Mature and demonstrate propulsion technologies that enables extended range target engagement and navigation component technologies that reduce dependence on GPS for precision. ***FY 2020 Plans:*** Will integrate enhanced long-range fires navigation components and demonstrate performance in high fidelity hardware-in-the-loop simulation environment validating improved precision guidance in GPS degrade environments. Will also integrate high temperature fiber, resin, nozzle, and structures propulsion component technologies and demonstrate performance through static solid rocket motor firing validating improved energy output in the same form factor. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs.			
Accomplishments/Planned Programs Subtotals	-	-	14.149

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AE9 / *Low-Cost Tact Ext Range Missile (LC-TERM) Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AF4 / *Missile Simulation Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AF4: *Missile Simulation Advanced Technology*	-	0.000	0.000	0.273	-	0.273	2.623	2.678	2.731	2.762	0.000	11.067

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 206 Missile Simulation

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by maturing and demonstrating enhanced analysis and high fidelity modeling and simulation technologies for advanced missiles and interceptor design and analysis.

Work in this Project complements PE 0602147A Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Missile Simulation Advanced Technology	-	-	0.273
Description: Mature and demonstrate enhanced analysis and high fidelity modeling and simulation technologies for advanced missiles and interceptor design and analysis. ***FY 2020 Plans:*** Will mature the development of very high speed missile simulation architectures for rapid performance predictions; inform technology requirements; and reduce technology development timelines. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs for this effort.			
Accomplishments/Planned Programs Subtotals	-	-	0.273

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AF4 / *Missile Simulation Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AG3 / *Extended Range Cannon Artillery (ERCA) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AG3: *Extended Range Cannon Artillery (ERCA) Adv Tech*	-	0.000	0.000	19.992	-	19.992	15.319	0.000	0.000	0.000	0.000	35.311

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities. This effort matures and demonstrates artillery technologies including light weight cannon and mount structures, high efficiency recoil cylinders, common lower power fire control hardware, improved fire control software, and improved sensor to shooter communications which will increase range and accuracy without an increase in platform weight.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Extended Range Cannon Artillery Advanced Technology	-	-	19.992
Description: This effort matures and demonstrates extended range Armament technologies including Cannons and Gun Mounts, novel integration for automation, improved fire control, ammunition handling, and improved sensor to shooter communications which will maximize range increases and enable increase precision with next generation munition and target acquisition technology.			
FY 2020 Plans: Will continue maturation of integration and automation technologies for ammunition handling and weapon control, initial prototype and demonstration of advanced precision technologies from fire control sensors and systems; Will optimize cannon, mount, and weapon system components to maximize weight reduction and automation adaptability			
FY 2019 to FY 2020 Increase/Decrease Statement: In FY 2020, ongoing work is transferred from other PEs for this effort.			
Accomplishments/Planned Programs Subtotals	-	-	19.992

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AG3 / *Extended Range Cannon Artillery (ERCA) Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*				Project (Number/Name) AG5 / *Extended Range Artillery Munition Suite Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AG5: *Extended Range Artillery Munition Suite Adv Tech*	-	0.000	0.000	35.600	-	35.600	45.275	34.246	23.651	23.915	0.000	162.687

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities. This effort matures and demonstrates extended range artillery technologies including advanced projectile propulsion and guidance technologies to increase range and accuracy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Extended Range Artillery Munition Suite Advanced Technology	-	-	35.600
Description: Matures and optimizes long range unitary artillery projectile systems in the areas of range, precision, counter-measure, and payload technologies.			
FY 2020 Plans: Effort will validate system modeling and simulation to improve projectile performance by integrating the optimal configurations of technologies; will develop and demonstrate integrated concepts for Extended Range Artillery Projectiles (e.g. XM1155) in the areas of increased range, sensor optimization and integration, improved algorithms and refined concepts at extended ranges in Integrated Air Defense Systems (IADS) contested and GPS-denied environments for armor and counter-battery defeat; will optimize system development for extended range cargo munitions for advanced area effects munition compatible with legacy and ERCA in the following areas: 1) dispensing techniques and sensor optimization for improved area effects to service imprecisely located targets ; 2) optimal formulations and characteristics for smoke and illumination payloads that maximize effectiveness ; and 3) survivability of cannon-launched terrain shaping munition for maximum area denial effects; will conduct critical design review			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AG5 / *Extended Range Artillery Munition Suite Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
of component technologies; will perform demonstration to validate key enabling component technologies; optimize concepts for system integration; and will mature modeling and simulation concepts for subsequent validation. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs for this effort.			
Accomplishments/Planned Programs Subtotals	-	-	35.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AG7 / *Energetic Materials and Adv Processing Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AG7: *Energetic Materials and Adv Processing Adv Tech*	-	0.000	0.000	2.040	-	2.040	2.081	2.123	2.165	2.189	0.000	10.598

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities. This effort matures and demonstrates the performance of energetic materials ranging from medium caliber through large caliber weapons.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Energetic Materials and Advanced Processing Advanced Technology	-	-	2.040
Description: This effort matures and demonstrates the performance and insensitivity of energetic materials ranging from 25mm medium caliber (direct fire) through 155mm large caliber (indirect fire) weapons. ***FY 2020 Plans:*** Will continue to qualify energetic materials for complete material characterization; demonstrate high-energy, reduced sensitivity, metalized formulations for dual purpose representative munitions; will demonstrate high-energy, reduced sensitivity formulations for shaped charge representative munitions; will demonstrate high energy propellant in representative applications; will continue to optimize and demonstrate advanced processing methods of novel materials. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs for this effort.			
Accomplishments/Planned Programs Subtotals	-	-	2.040

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AG7 / *Energetic Materials and Adv Processing Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) AH3 / *Single Multi-mission Attack Missile Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AH3: *Single Multi-mission Attack Missile Adv Tech*	-	0.000	0.000	5.683	-	5.683	3.000	0.000	0.000	0.000	0.000	8.683

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 263 Future Msl Tech Integr (FMTI)

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities. Matures and demonstrate technologies for an expeditionary short-to-medium range loitering missile with man-in-the-loop capability for situational awareness, targeting, and lethal effects against hard and soft targets.

Work in this Project complements PE 0602147A Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Single Multi-mission Attack Missile (SMAM) Advanced Technology	-	-	5.683
Description: Matures and demonstrate technologies for an expeditionary short-to- medium range loitering missile with man-in-the-loop capability for situational awareness, targeting, and lethal effects against hard and soft targets. ***FY 2020 Plans:*** Will integrate certified mini-crypto module in an extended range missile digital datalink for secure missions. Develop and integrate inertial navigation aiding sensors and algorithms to provide suitable target accuracy for terminal engagement in GPS degraded/ denied environments. Perform static testing of multi-effects warhead technologies optimized to defeat future mechanized threats. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, ongoing work is transferred from other PEs for this effort.			
Accomplishments/Planned Programs Subtotals	-	-	5.683

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** AH3 / *Single Multi-mission Attack Missile Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603464A / *Long Range Precision Fires Advanced Technology*	Project (Number/Name) BS3 / *Strategic Missile Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
BS3: *Strategic Missile Advanced Technology*	-	0.000	0.000	12.888	-	12.888	30.230	24.100	21.803	49.101	0.000	138.122

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Projects:
* 263 Future Msl Tech Integr (FMTI)
* 704 Advanced Missile Demo
PE 0603004A Weapons and Munitions Advanced Technology, Projects:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by developing and maturing critical technologies for ground-based strategic missiles. Technology development includes critical technologies to improve strategic missile components such as advanced structures and materials, thermal protection systems, guidance/seekers, navigation systems, electronic controls, improve/miniaturize avionics and automated fight termination systems.

Work in this Project complements PE 0602147 Long Range Precision Fires Technology.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy. All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC) and the U. S. Army Space and Missile Defense Command (SMDC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Strategic Missile Advanced Technology	-	-	12.888
Description: This effort develops and matures critical technologies for ground-based strategic missiles.			
FY 2020 Plans: Will continue to develop and mature critical technologies to improve strategic missile components such as advanced structures and materials, thermal protection systems, guidance/seekers, navigation systems, electronic controls, improve/miniaturize avionics and automated flight termination systems.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603464A / *Long Range Precision Fires Advanced Technology*	**Project (Number/Name)** BS3 / *Strategic Missile Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Ongoing work transferred from other PEs due to S&T financial restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	12.888

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	151.640	-	151.640	145.543	173.019	196.348	188.723	0.000	855.273
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	0.000	0.000	10.000	-	10.000	0.000	0.000	0.000	0.000	0.000	10.000
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	0.000	0.000	21.748	-	21.748	25.583	25.094	23.536	22.788	0.000	118.749
AI8: *Alternative Concept Engine Advanced Technology*	-	0.000	0.000	2.929	-	2.929	2.604	1.737	1.772	1.791	0.000	10.833
AJ1: *Future UAS Engine Advanced Technology*	-	0.000	0.000	1.730	-	1.730	2.830	4.424	4.512	4.517	0.000	18.013
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	0.000	0.000	1.098	-	1.098	1.394	1.422	1.450	1.466	0.000	6.830
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	0.000	0.000	1.153	-	1.153	1.538	1.569	1.600	1.618	0.000	7.478
AJ7: *Advanced Rotors Advanced Technology*	-	0.000	0.000	2.500	-	2.500	2.500	2.510	2.560	2.577	0.000	12.647
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	0.000	0.000	15.820	-	15.820	22.402	24.383	26.021	21.589	0.000	110.215
AK3: *Aviation Survivability Advanced Technology*	-	0.000	0.000	20.836	-	20.836	10.331	10.696	12.532	13.034	0.000	67.429
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	0.000	0.000	2.426	-	2.426	0.000	4.000	10.384	12.489	0.000	29.299
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	0.000	0.000	3.139	-	3.139	3.931	11.931	12.170	12.306	0.000	43.477
AK8: *Air Launched Effects Advanced Technology*	-	0.000	0.000	3.215	-	3.215	3.865	4.196	4.635	4.394	0.000	20.305
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	0.000	0.000	20.964	-	20.964	41.368	40.618	40.322	46.814	0.000	190.086

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army													Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*								
AL3: *HPC for Rotorcraft Applications Adv Tech*	-	0.000	0.000	4.958	-	4.958	5.051	5.141	5.306	5.365	0.000	25.821
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	0.000	0.000	29.151	-	29.151	0.000	0.000	0.000	0.000	0.000	29.151
AL7: *Full Spectrum Targeting Advanced Technology*	-	0.000	0.000	5.425	-	5.425	9.917	10.124	10.326	10.442	0.000	46.234
AL9: *Holistic Sit Awareness and Dec Making Adv Tech**	-	0.000	0.000	0.000	-	0.000	5.000	17.800	31.700	19.926	0.000	74.426
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	0.000	0.000	4.548	-	4.548	5.229	5.334	5.441	5.502	0.000	26.054
AM5: *Opt Energy Stg & Therm Mgmt for FVL Surv Adv Tech**	-	0.000	0.000	0.000	-	0.000	2.000	2.040	2.081	2.105	0.000	8.226

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

In Fiscal Year (FY) 2020 this Program Element (PE) continues efforts previously funded in the following PEs:
* PE 0603003A (Aviation Advanced Technology)
* PE 0603004A (Weapons and Munitions Advanced Technology)
* PE 0603270A (Electronic Warfare Technology)
* PE 0603313A (Missile and Rocket Advanced Technology)
* PE 0603710A (Night Vision Advanced Technology)
* PE 0603734A (Military Engineering Advanced Technology)
* PE 0603772 (Advanced Tactical Computer Science and Sensor Technology)

A. Mission Description and Budget Item Justification

This PE matures and demonstrates manned and unmanned air vehicle and mission system technologies as well as advanced teaming capabilities to enable Army Future Vertical Lift. Emphasis is on platform and mission system technologies to enhance manned and unmanned air vehicle combat and combat support operations for attack, reconnaissance, air assault, survivability, logistics, and command and control missions. Within this PE, aviation technologies are advanced and integrated into realistic and robust demonstrations.

Work in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0602148A (Future Vertical Lift Advanced Technology Development)

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603465A *I Future Vertical Lift Advanced Technology*

The cited work is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this PE is performed by the United States Army Futures Command (AFC) and the Army Engineering Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	151.640	-	151.640
Total Adjustments	0.000	0.000	151.640	-	151.640
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	151.640	-	151.640

Change Summary Explanation

FY20 funding realigns activities from other PEs to consolidate Future Vertical Lift efforts.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI4 / *Joint Multi-Role (JMR) Demonstration Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AI4: *Joint Multi-Role (JMR) Demonstration Advanced Tech*	-	0.000	0.000	10.000	-	10.000	0.000	0.000	0.000	0.000	0.000	10.000

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project demonstrates transformational advanced rotary-wing configurations and open systems architectures to prepare the Department of Defense (DoD) for decisions regarding Future Vertical Lift (FVL).

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Joint Multi-Role (JMR) Technology Demonstration	-	-	10.000
Description: Provide demonstration of Future Vertical Lift (FVL) platform configurations that address multi domain battle capability needs. Determine optimum vehicle attributes that meet future force capability needs for increased system speed, range, payload, and reduced operating costs in order to inform and reduce future aviation materiel acquisitions. Flight demonstrate operational capabilities of technology demonstrators.			
FY 2020 Plans: Will complete the Mission Systems Architecture Capstone Demonstration, which includes development of processes, tools, and standards necessary to specify, analyze, design, implement and qualify a Mission Systems Architecture for future programs using a Model-Based development approach. Will continue development of the Joint Common Architecture (JCA), including a functional model, data model, supporting documentation, and tools. Will continue final design, integration, and assessment of a notional Open Systems Architecture (OSA) that implements the Future Airborne Capability Environment (FACE) Technical Standard and			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI4 / *Joint Multi-Role (JMR) Demonstration Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Hardware Open Systems Technologies (HOST). Will deliver architectural models and technical reports from vendors participating in the demonstration of the architectures. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313. Overall decrease in funding from FY 2019 to FY 2020 for this effort due to completion of JMR TD flight demonstration.			
Accomplishments/Planned Programs Subtotals	-	-	10.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI6 / *Next Gen Tactical UAS TD Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AI6: *Next Gen Tactical UAS TD Advanced Technology*	-	0.000	0.000	21.748	-	21.748	25.583	25.094	23.536	22.788	0.000	118.749

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates conceptual designs and enabling technologies to support the development of technically feasible and achievable requirements for the Future Unmanned Aircraft Systems (FUAS) Program of Record. The Project will also reduce the developmental risk of critical technologies for FUAS.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Gen Tactical UAS Technology Demonstration	-	-	21.748
Description: This Project will develop and demonstrate conceptual designs and enabling technologies to support the development of technically feasible and achievable requirements for the Future Unmanned Aircraft Systems (FUAS) Program of Record.			
FY 2020 Plans: Air vehicle conceptual designs will be assessed against refined requirements for continuation to detailed design, fabrication, and demonstration in 2023. Proposed technology insertions will be prioritized to enable advanced UAS. Experiments will inform concepts of operation for future vertical lift family of systems within the ecosystem. Will incrementally demonstrate implementation of experiential learning-based algorithms for autonomous navigation, including strategies for perception, state estimation, vehicle			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI6 / *Next Gen Tactical UAS TD Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
control, and exploration. Flight demonstration will be conducted to validate government in-house UA-scale airfoil and air vehicle design methodologies. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	21.748

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AI8 / *Alternative Concept Engine Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AI8: *Alternative Concept Engine Advanced Technology*	-	0.000	0.000	2.929	-	2.929	2.604	1.737	1.772	1.791	0.000	10.833

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 447 ACFT Demo Engines

A. Mission Description and Budget Item Justification

This Project provides demonstration of adaptable, fuel efficient and high power to weight engine technologies for potential application to Future Vertical Lift platforms. Efforts include development of alternative, adaptive and smart engine technologies to provide improved performance, readiness and affordability across the engine operating envelope for increased operational capability.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Alternative Concept Engine (ACE)	-	-	2.929
Description: This effort demonstrates alternative, adaptive, and intelligent engine technologies to provide improved / mission-optimized performance, readiness and affordability across an expanding engine envelope for increased operational capability for Future Vertical Lift (FVL) platforms. The alternative concept engine technology demonstrations planned for this effort are applicable to current and future platforms.			
FY 2020 Plans: Alternative concept engine component fabrication and component validation testing will be completed and engine testing will be initiated.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AI8 / *Alternative Concept Engine Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 447.			
Accomplishments/Planned Programs Subtotals	-	-	2.929

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*				Project (Number/Name) AJ1 / *Future UAS Engine Advanced Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AJ1: *Future UAS Engine Advanced Technology*	-	0.000	0.000	1.730	-	1.730	2.830	4.424	4.512	4.517	0.000	18.013

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 447 ACFT Demo Engines

A. Mission Description and Budget Item Justification

This Project provides full system demonstration of a JP8-fueled, reliable, fuel-efficient and high power-to-weight engine concept for Future Unmanned Aircraft Systems (FUAS).

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Reliable Advanced Small Power Systems	-	-	1.730
Description: This effort demonstrates adaptive and intelligent engine technologies to provide improved / mission- optimized performance, readiness and affordability across an expanding engine envelope for increased operational capability for group 3 and 4 FUAS platforms. ***FY 2020 Plans:*** Reliable Advanced Small Power System component fabrication and component validation testing will be completed and engine testing will be initiated. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 447.			
Accomplishments/Planned Programs Subtotals	-	-	1.730

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ1 / *Future UAS Engine Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ3 / *Next Generation Rotorcraft Transmission Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AJ3: *Next Generation Rotorcraft Transmission Adv Tech*	-	0.000	0.000	1.098	-	1.098	1.394	1.422	1.450	1.466	0.000	6.830

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and ground demonstrates variable-speed transmission technologies that can be matured and integrated into the development of Future Vertical Lift (FVL) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation Rotorcraft Transmission	-	-	1.098
Description: This effort demonstrates advanced rotorcraft drive technologies with the potential to increase the horsepower-to-weight ratio; reduce drive system noise; reduce production, operating and support costs; and provide automatic component impending-failure detection. The drive system demonstrators for this effort will be applicable to Future Vertical Lift (FVL) platforms.			
FY 2020 Plans: Variable speed transmission hardware fabrication and full scale transmission stand testing will be completed. Integration into ground test aircraft will be initiated.			
FY 2019 to FY 2020 Increase/Decrease Statement: This work was previously performed in PE 0603003A / Project 313			
Accomplishments/Planned Programs Subtotals	-	-	1.098

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ3 / *Next Generation Rotorcraft Transmission Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ5 / *Digital Vehicle Management & Control Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AJ5: *Digital Vehicle Management & Control Advanced Tech*	-	0.000	0.000	1.153	-	1.153	1.538	1.569	1.600	1.618	0.000	7.478

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project designs, integrates and demonstrates Future Vertical Lift (FVL) flight control and Vehicle Management Systems (VMS) technologies. Technologies demonstrated include: advanced flight control laws and autonomy; automatic reconfiguration for speed/damage; coupled cockpit symbology and haptic cueing; and handling qualities requirements for new platform concepts.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Digital Vehicle Management and Control	-	-	1.153
Description: This effort demonstrates integrated Future Vertical Lift (FVL) capable flight controls and advanced sensors to satisfy future capability needs to fly in any visual environment, adapt to degradation and damage to complete the mission and support autonomous operations and manned-unmanned teaming (MUM-T). Technologies demonstrated include: advanced flight control laws and autonomy; automatic reconfiguration for speed/damage; coupled cockpit symbology and haptic cueing; and handling qualities requirements for new platform concepts.			
FY 2020 Plans: Will complete North Atlantic Treaty Organization (NATO) working group research on rotorcraft simulation modeling fidelity assessment and improvement and publish lessons learned. Will develop unmanned FVL handling quality testing methods and requirements for flying in mission-relevant turbulent environments; Will validate and publish new response types for high-speed			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ5 / *Digital Vehicle Management & Control Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
and mission task elements for a FVL design standard. Will analyze Joint Multi-Role Technology Demonstrator (JMR-TD) handling qualities flight test results for validation of simulation models and inclusion of new JMR-relevant requirements in a FVL design standard. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	1.153

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AJ7 / *Advanced Rotors Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AJ7: *Advanced Rotors Advanced Technology*	-	0.000	0.000	2.500	-	2.500	2.500	2.510	2.560	2.577	0.000	12.647

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project demonstrates and integrates new technologies that enable global and highly efficient/reliable operations for Future Vertical Lift (FVL) aircraft and Future Unmanned Aircraft Systems(FUAS) throughout the flight envelope.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Rotors Technology	-	-	2.500
Description: This effort demonstrates full scale, integrated rotor system technologies through the assessment of alternative designs aimed to satisfy future capability needs for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) increased system durability, efficiency, speed, range, and payload. Technologies include: integrated high speed, low drag rotor technologies for high speed configurations; interactional aero tailoring between rotor and body & auxiliary lift/ propulsors; light weight, low volume, efficient and high authority electro- mechanical actuators (EMAs); reliable and safety critical actuators/hubs/ controls for Independent Blade Control (IBC)/swash plateless rotors; damage compensation/load alleviation; active/passive flow control; and automated track and balance.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ7 / *Advanced Rotors Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will conduct advanced low drag rotor wind tunnel testing. Will conduct individual blade control actuator testing. Will conduct design and testing of robust, efficient UAS rotors and propulsion systems for FUAS platforms. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	2.500

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*				Project (Number/Name) AJ9 / *Integ Mission Equip for Vert Lift Systems Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AJ9: *Integ Mission Equip for Vert Lift Systems Adv Tech*	-	0.000	0.000	15.820	-	15.820	22.402	24.383	26.021	21.589	0.000	110.215

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and demonstrates a mission systems architecture to support Future Vertical Lift (FVL) through utilization of a reconfigurable and flexible tiered architectural approach.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Integrated Mission Equipment for Vertical Lift Systems	-	-	15.820
Description: Develops and demonstrates a mission systems architecture to support Future Vertical Lift (FVL) through utilization of a reconfigurable and flexible tiered architectural approach. The tired approach will consist of the following: Maturing and implementing Model Based Engineering methods and Modular Open Systems Architecture strategies; instantiating an architecture verification environment and developing an agile and resilient digital backbone to support the rapidly changing threat environment including the digital battleground.			
FY 2020 Plans: Publish baseline requirements for both a representative mission package and instrumented architecture laboratory. Document detailed design of the Architecture Verification Environment (AVE). Instantiate initial AVE capabilities which will include architecture requirements validation processes, methods and tools for validating Future Attack Reconnaissance Aircraft (FARA) and Future Long Range Assault Aircraft (FLRAA) architecture requirements. Establish AVE experimental framework to collect the body of knowledge necessary to effectively verify architecture implementations			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AJ9 / *Integ Mission Equip for Vert Lift Systems Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
against specifications. Conduct initial development and testing of the IME software infrastructure to support representative mission packages. Document the Digital Backbone (DBB) specification for power, mechanical, thermal, hardware, software and data. Publish specific guidance documentation to assist the Government and Industry partners in the development of open architecture capabilities. Create a model based specification for documentation of the flying testbed mission system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	15.820

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK3 / *Aviation Survivability Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AK3: *Aviation Survivability Advanced Technology*	-	0.000	0.000	20.836	-	20.836	10.331	10.696	12.532	13.034	0.000	67.429

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech
PE 0603270A Electronic Warfare Technology, Project:
* K16 Non-Commo Ecm Tech Dem
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project matures and demonstrates increased Future Vertical Lift (FVL) survivability through the integration and demonstration of technologies that reduce platform signatures, improve threat warning and countermeasures against integrated networked air and ground threat systems.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Survivability Against Integrated Networked Threats	-	-	4.802
Description: This effort increases rotorcraft survivability by reducing platform signatures, providing the means to more efficiently counter enemy detection and tracking systems			
FY 2020 Plans: Will mature and demonstrate Aircraft Survivability Correlator algorithms. Will improve and validate own-ship and team based survivability behaviors. Will mature and demonstrate holistic survivability technologies to enhanced FVL survivability.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK3 / *Aviation Survivability Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 313.			
Title: Digital Dual Use Sensors (DDUS) ***Description:*** This effort will mature and demonstrate dual band infrared sensor technologies to enable future multi-function sensing concepts suitable for both manned and unmanned aviation platforms. Effort will combine recent advances in digital readout technologies and large (megapixel) infrared detector fabrication to develop a dual band infrared proof-of-principle demonstrator and assess the feasibility of the sensor to support both pilotage and aircraft survivability functions. ***FY 2020 Plans:*** Will mature sensor optics; will complete fabrication of focal plane array (FPA) packages into cooled assemblies. Will integrate components into proof-of principle camera system; will demonstrate camera systems in laboratory and airborne field environments; will validate sensor to enable both pilotage and aircraft survivability functions. Will complete final technical report capturing lessons learned and recommendations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603710A / Project K86.	-	-	9.500
Title: Multispectral Threat Detection and Countermeasure Technologies ***Description:*** This effort matures and demonstrates countermeasure technologies that provide platform protection and integrated cueing against electro-optical (EO), infrared (IR) and radio frequency (RF) guided threats. ***FY 2020 Plans:*** Will continue sensor system development and perform unit testing on sensor components; will document and publish sensor component and subsystem performance results; will collect and analyze clutter and threat data in a relevant environment with sensor subsystem and incorporate that data into modeling and simulation infrastructure; will perform an assessment of the sensor subsystem architectural approaches and the viability of each approach to operate against unknown/unexploited and emerging threats; will demonstrate agile radio frequency (RF) components in a relevant environment and assess the viability of meeting RF countermeasure requirements using those components; will characterize RF components and produce models for modeling and simulation integration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603270A / Project K16.	-	-	6.534
Accomplishments/Planned Programs Subtotals	-	-	20.836

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK3 / *Aviation Survivability Advanced Technology*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK5 / *Multi-Role Small Guided Missile Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AK5: *Multi-Role Small Guided Missile Advanced Tech*	-	0.000	0.000	2.426	-	2.426	0.000	4.000	10.384	12.489	0.000	29.299

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 704 Advanced Missile Demo

A. Mission Description and Budget Item Justification

This Project investigates and demonstrates a holistic lethality solution for current Army Aviation and Future Vertical Lift (FVL) offensive and defensive multi-role armament technologies for fire control, armament systems, munitions and integration of threat agnostic countermeasures.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Modular Missile Advanced Technology	-	-	2.426
Description: This effort matures and demonstrates armament solutions adaptable to current aviation and Future Vertical Lift (FVL) applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems.			
FY 2020 Plans: Will complete the integration of modular missile technology subsystems into the guided forward firing missile configuration and perform laboratory testing and simulation evaluations. Will demonstrate in a ground-launched flight test series, which includes guidance and control performance of the guided forward firing missile configuration, payload, guidance electronics unit, control actuation subsystem, propulsion subsystem and subsystem interface bus.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK5 / *Multi-Role Small Guided Missile Advanced Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603313A / Project 704.			
Accomplishments/Planned Programs Subtotals	-	-	2.426

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK7 / *Adv Rotorcraft Armaments Protection Sys Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AK7: *Adv Rotorcraft Armaments Protection Sys Adv Tech*	-	0.000	0.000	3.139	-	3.139	3.931	11.931	12.170	12.306	0.000	43.477

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A, Project:
* 232 Advanced Lethality & Survivability Demo

A. Mission Description and Budget Item Justification

This Project investigates and demonstrates a holistic lethality solution for Future Vertical Lift (FVL) offensive and defensive applications. Develop components for use in multi-role armament solutions for fire control, armament systems, munitions and integration of threat agnostic countermeasures.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Aviation Armament System Technologies	-	-	3.139
Description: This effort matures and demonstrates armament solutions adaptable to current aviation and future vertical lift applications in small caliber, medium caliber, counter measure technologies with a focus on light lethal aerodynamic systems. ***FY 2020 Plans:*** Will improve performance of medium caliber ammunition in 20mm and 30mm for a multi-role armaments solution on the Future Vertical Lift aircraft system. Effort will optimize lightweight 20mm and 30mm munitions for air combat systems and provide multi-purpose fuze and warhead functionalities. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603004A / Project 232.			
Accomplishments/Planned Programs Subtotals	-	-	3.139

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK7 / *Adv Rotorcraft Armaments Protection Sys Adv Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AK8 / *Air Launched Effects Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AK8: *Air Launched Effects Advanced Technology*	-	0.000	0.000	3.215	-	3.215	3.865	4.196	4.635	4.394	0.000	20.305

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603303A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This Project develops and demonstrates the ability to launch a UAS from a manned or unmanned future vertical lift aircraft at tactical altitudes and to control the UAS from the cockpit or a crew station. This Project will assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Air Launched Effects	-	-	3.215
Description: Develop and demonstrate the ability to launch a Future Unmanned Aircraft System (FUAS) from a Future Vertical Lift (FVL) platform at tactical altitudes, and to control the UAS from the cockpit or a crew station. Assess the enabled capabilities and determine their relevance to current Army Aviation engagement and survivability portfolios. These air-launched FUAS will employ a variety of non-lethal effects including: electronic attack, decoy, communications relay.			
FY 2020 Plans: Will demonstrate the ability to launch a UAS from a manned rotorcraft at tactical altitudes, and to control the UAS from an onboard crew station; integrate reconnaissance, surveillance, targeting, and communications relay payloads into the UAS; evaluate the mission effectiveness of organic UAS assets in support of the manned aircraft?s mission.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AK8 / *Air Launched Effects Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE 0603003A / Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	3.215

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL1 / *Adv Teaming for Tactical Aviation Oper Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AL1: *Adv Teaming for Tactical Aviation Oper Adv Tech*	-	0.000	0.000	20.964	-	20.964	41.368	40.618	40.322	46.814	0.000	190.086

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 436 Rotarywing MEP Integ
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project develops, demonstrates and drafts frameworks for certifiable autonomy of teaming behaviors and autonomous decision making for Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platform formations in combined arms operations.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Advanced Teaming Demonstration	-	-	20.964
Description: Develop and demonstrate teaming behaviors and autonomous decision making for mixed Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platform formations in combined arms operations that are beyond Manned-Unmanned Teaming (MUM-T) technologies. Focus areas include: resilient autonomous algorithms; self-organizing unmanned formations; distributed command and control; and navigation. This effort will also demonstrate multi-platform distributed apertures of multispectral sensors for threat detection and awareness and improved reliability through adaptation in autonomous systems.			
FY 2020 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL1 / *Adv Teaming for Tactical Aviation Oper Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Will mature and integrate advanced teaming technologies into mission systems packages for test and evaluation; simulate autonomous teaming behaviors and operations in foundational mission based vignettes; draft frameworks for certifiable autonomy. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 436 and part of PE 0603710 / Project K86.			
Accomplishments/Planned Programs Subtotals	-	-	20.964

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*				Project (Number/Name) AL3 / *HPC for Rotorcraft Applications Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AL3: *HPC for Rotorcraft Applications Adv Tech*	-	0.000	0.000	4.958	-	4.958	5.051	5.141	5.306	5.365	0.000	25.821

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project develops and demonstrates the use of high-fidelity computational modeling for Future Vertical Lift platforms through the utilization of DoD High Performance Computing (HPC) and software tools for cutting-edge modeling and simulation, as well as adding software capabilities for workflow automation and design space exploration. Efforts in this project are also applicable to the family of Future Vertical Lift (FVL) and Advanced Unmanned Aircraft System (AUAS) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Engineered Resilient Systems for Future Vertical Lift	-	-	4.958
Description: This effort matures and demonstrates capabilities (tools and methodologies) to rapidly create high-fidelity computational modeling to support the simulation of system performance for different Army missions with relevant environmental physics in various geographic settings worldwide; provide input to and obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. This effort focuses on Future Vertical Lift and Advanced Unmanned Aircraft System platforms.			
FY 2020 Plans: Will support Future Vertical Lift through the advancement of workflow automation processes for rotorcraft platforms; will integrate mission effectiveness into the resulting trade spaces; will leverage emerging data analytics techniques and machine learning			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL3 / *HPC for Rotorcraft Applications Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
algorithms to optimize insight prior to acquisition decision points; and mature novel methodologies that incorporate the use of high-fidelity, physics-based simulations to enable multi-disciplinary design and optimization. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603734A / Project T08.			
Accomplishments/Planned Programs Subtotals	-	-	4.958

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL6 / *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AL6: *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*	-	0.000	0.000	29.151	-	29.151	0.000	0.000	0.000	0.000	0.000	29.151

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech
PE 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project develops, matures, and demonstrates advanced sensors, cueing, and flight controls to provide the ability to maintain terrain and obstacle situational awareness during all Degraded Visual Environment Mitigation (DVE-M) environments on current Army Aviation and Future Vertical Lift (FVL) platforms. The program provides an opportunity for DoD, North Atlantic Treaty Organization (NATO) nations, global industry, and academia to participate with their own assets in order to foster information exchange and collaboration.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Degraded Visual Environment Mitigation (DVE-M)	-	-	16.855
Description: Develop and mature advanced sensor cueing and flight controls to provide ability to maintain terrain and obstacle situational awareness during all DVEs both aircraft induced (brown-out & white-out) and environmentally induced (fog, rain, snow etc.). Flight testing on fleet aircraft is an integral component of the demonstration.			
FY 2020 Plans: Will develop and demonstrate integrated cutting-edge sensors, advanced flight controls, and refined cueing schemes to provide the ability to maintain terrain and obstacle situational awareness during Degraded Visual Environments (DVEs) such as aircraft-induced (brown-out & white-out) and environmentally-induced (fog, rain, snow etc.). Will flight test a mission adaptive autonomy			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL6 / *Degraded Vis Environ Mitigation (DVE-M) Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
system adapted for use on a partial-authority helicopter. Efforts include flight trials in various climates and environments which also presents an opportunity for DoD, North Atlantic Treaty Organization (NATO) nations, industry, and academia to participate with their own assets to foster information exchange and collaboration. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A / Project 313.			
Title: Sensors for DVE-M ***Description:*** This effort will mature and demonstrate combinations of sensors (radar and infrared) and sensor fusion technologies to assess their degree of effectiveness to improve safety of flight under degraded visual conditions. Effort includes development of 3 dimensional (3D) local area maps derived/refined by data from onboard sensors. 3D maps will be utilized to generate two dimensional (2D) views of the environment for presentation to pilots/crew and also support demonstration of autonomous behaviors including flight guidance and safe landing zone determination. Effort will result in an improved understanding of the complex sensor/fusion trade space to improve development of requirements and acquisition strategies for Future Vertical Lift (FVL) and the current fleet. ***FY 2020 Plans:*** Will complete initial flight testing and optimize DVE sensor subsystem; will integrate sensor subsystem with cueing and flight guidance/control subsystems onto single testbed aircraft. Will demonstrate combined DVE system in three DVEs. Will complete final technical report capturing lessons learned and recommendations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603710A / Project K86.	-	-	12.296
Accomplishments/Planned Programs Subtotals	-	-	29.151

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AL7 / *Full Spectrum Targeting Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AL7: *Full Spectrum Targeting Advanced Technology*	-	0.000	0.000	5.425	-	5.425	9.917	10.124	10.326	10.442	0.000	46.234

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603710A Night Vision Advanced Technology, Project:
* K86 Night Vision, Abn Sys

A. Mission Description and Budget Item Justification

This Project demonstrates next generation targeting concepts for Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) platforms.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Full Spectrum Targeting	-	-	5.425
Description: This effort will mature and demonstrate key targeting sensor system and automation (i.e. Artificial Intelligence / Machine Learning (AI/ML)) technologies essential to enable the Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS) modernization priorities. Effort will leverage advancements in laser, infrared imaging focal plane arrays, and multi/ hyperspectral system technologies to develop a stabilized, turreted payload that can actively and/or passively image in multiple spectral bands simultaneously providing robust targeting and situational awareness capabilities for the prevailing battlefield conditions. Effort will demonstrate the ability of multi/hyperspectral sensing to autonomously identify tactical threats and reduce cognitive workloads through sensor fusion and automated spectral selection.			
FY 2020 Plans: Will mature laser imaging and automation components; will collect broadband and multi / hyperspectral data and optimize for increased automation; will complete initial payload design consistent with FVL size, weight, and power constraints.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AL7 / *Full Spectrum Targeting Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
This work was previously performed in PE0603710A / Project K86.			
Accomplishments/Planned Programs Subtotals	-	-	5.425

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603465A / *Future Vertical Lift Advanced Technology*	Project (Number/Name) AM3 / *Aircraft and Aircrew Protection Advanced Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AM3: *Aircraft and Aircrew Protection Advanced Tech*	-	0.000	0.000	4.548	-	4.548	5.229	5.334	5.441	5.502	0.000	26.054

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603003A Aviation Advanced Technology, Project:
* 313 Adv Rotarywing Veh Tech

A. Mission Description and Budget Item Justification

This project demonstrates integrated, scalable, and structural platform solutions for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) platforms that improves crashworthiness, damage tolerance, sustainment, survivability and break-through weight efficiency while maintaining mission performance requirements.

Work in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Advanced Technology Development).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Science and Technology focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Aircraft and Aircrew Protection	-	-	4.548
Description: Demonstrate integrated, scalable, and structural platform solutions for Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) platforms that improves crashworthiness, damage tolerance, sustainment, survivability and break-through weight efficiency while maintaining mission performance requirements. ***FY 2020 Plans:*** Will mature and demonstrate integrated, advanced structural assemblies that enable FVL and FUAS platform improved crashworthiness, damage tolerance, weight efficiency, sustainment, and survivability. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This work was previously performed in PE 0603003A Project 313.			
Accomplishments/Planned Programs Subtotals	-	-	4.548

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603465A / *Future Vertical Lift Advanced Technology*	**Project (Number/Name)** AM3 / *Aircraft and Aircrew Protection Advanced Tech*

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603466A *I Air and Missile Defense Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	0.000	0.000	60.613	-	60.613	60.980	61.628	64.445	54.616	0.000	302.282
AC8: *Low Cost Extended Range Air Defense Adv Tech*	-	0.000	0.000	21.050	-	21.050	20.150	0.000	0.000	0.000	0.000	41.200
AD1: *High Energy Laser Tactical Vehicle Demo Adv Tech*	-	0.000	0.000	29.914	-	29.914	27.268	27.706	0.000	0.000	0.000	84.888
AD4: *Maneuver Air Defense Advanced Technology**	-	0.000	0.000	0.000	-	0.000	0.000	20.000	22.692	12.392	0.000	55.084
AD6: *Next Generation Fires Radar Advanced Technology*	-	0.000	0.000	7.729	-	7.729	7.884	8.042	8.203	8.294	0.000	40.152
AE1: *Close Combat High Energy Laser Advanced Technology**	-	0.000	0.000	0.000	-	0.000	2.500	2.700	31.350	31.700	0.000	68.250
AE3: *Unconventional Countermeasures-Survivability ATech*	-	0.000	0.000	1.920	-	1.920	3.178	3.180	2.200	2.230	0.000	12.708

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2020

Note

In Fiscal Year (FY) 2020 this Program Element (PE) continues efforts previously funded in the following PEs:
* PE 0603004A Weapons and Munitions Advanced Technology
* PE 0603313A Missile and Rocket Advanced Technology
* PE 0603734A Military Engineering Advanced Technology
* PE 0603772A Advanced Tactical Computer Science and Sensor Technology

A. Mission Description and Budget Item Justification

Work in this Program Element (PE) matures demonstrates technology in support of Army Modernization Priority Air and Missile Defense by maturating, demonstrating and conducting system level experimentation for the development of advanced air defense technologies that reduce the cost curve of missile defense, restore overmatch, survive volley-fire attacks, and operate within sophisticated Anti-Access/Area Denial (A2/AD) and contested domains.

Work in this PE complements PE 0602147A (Air and Missile Defense Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603466A *I Air and Missile Defense Advanced Technology*

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work is performed by the U.S. Army Futures Command (AFC), the United States Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT), and the Engineer Research and Development Center (ERDC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	0.000	0.000	0.000	-	0.000
Current President's Budget	0.000	0.000	60.613	-	60.613
Total Adjustments	0.000	0.000	60.613	-	60.613
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	60.613	-	60.613

Change Summary Explanation

FY20 increase represents a realignment of efforts previously funded in other PEs.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AC8 / *Low Cost Extended Range Air Defense Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AC8: *Low Cost Extended Range Air Defense Adv Tech*	-	0.000	0.000	21.050	-	21.050	20.150	0.000	0.000	0.000	0.000	41.200

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603313A Missile and Rocket Advanced Technology, Project:
* 704 Advanced Missile Demo

A. Mission Description and Budget Item Justification

This Project directly supports Army Modernization Priority Air and Missile Defense capabilities. Matures and demonstrates key missile technologies for a lower-cost interceptor system to address advanced air defense threats such as medium to large unmanned aerial systems (UAS) and sub-sonic cruise missile systems.

Work in this Project complements PE 0602150A (Air and Missile Defense Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Low Cost Extended Range Air Defense (LowER AD) Advanced Technology	-	-	21.050
Description: Mature and demonstrate key missile technologies for a lower-cost interceptor system to address advanced air defense threats such as medium to large unmanned aerial systems (UAS) and sub-sonic cruise missile systems			
FY 2020 Plans: Will integrate motor, airframe, mission computer, power supply, telemetry, and data link as an interceptor for demonstrating initial capability in two Ballistic Test Vehicle (BTV) flight tests. These tests will provide verification of component operation and aerodynamic parameters in a relevant environment. The control actuation system (CAS) and inertial measurement unit (IMU) will be integrated with the interceptor to demonstrate control authority and aerodynamic characterization in a Control Test Vehicle (CTV). Will continue maturation of guidance and fuzing algorithms, and verify Guidance Electronic Unit (GEU) performance from pre-flight predictions for CTV and guided test vehicle (GTV) in the Hardware-in the-Loop (HWIL).			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AC8 / *Low Cost Extended Range Air Defense Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Ongoing work transferred from other PEs due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	21.050

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*				Project (Number/Name) AD1 / *High Energy Laser Tactical Vehicle Demo Adv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
AD1: *High Energy Laser Tactical Vehicle Demo Adv Tech*	-	0.000	0.000	29.914	-	29.914	27.268	27.706	0.000	0.000	0.000	84.888

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603004A Weapons and Munitions Advanced Technology, Project:
* L96 High Energy Laser Technology Demo

A. Mission Description and Budget Item Justification

This Project matures and demonstrates a 100 kW-class mobile HEL weapon system on a tactical platform to protect fixed and semi-fixed sites from rocket, artillery, mortar (RAM) and unmanned aerial system (UAS) threats. The major effort under this Project is the phased approach for mobile high power solid state laser (SSL) technology demonstrations that are traceable to the form, fit, and function requirements for a HEL weapon. This effort utilizes open systems architecture to ensure growth, interoperability, and opportunity for technology insertions for maturation of laser, beam control, sensor/radar, integration of power and thermal management subsystems, as well as Battle Management Command, Control, and Computers (BMC3).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy as well as supports the Army's future capability opportunities for leap-ahead technology for directed energy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work is performed by the U.S. Army Space and Missile Defense Command/Amy Forces Strategic Command (USASMDC/ARSTRAT).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: High Energy Laser Tactical Vehicle Demonstrator (HEL TVD) Advanced Technology	-	-	29.914
Description: This effort integrates and demonstrates HEL technologies on an Army tactical platform for transition to the future Indirect Fire Protection Capability Increment 2-Intercept Program of Record. Effort includes integrating technologies developed under PE 0602307A/AC9 into HEL TVD and demonstrating the system against an array of RAM and UAS targets in FY 2022. Technology and knowledge gained from demonstration will be transitioned to Program Executive Office Missiles and Space for material development.			
FY 2020 Plans: Will begin integration and laboratory checkout of the HEL TVD subsystems. Will integrate the electrical and thermal management subsystems into the HEL TVD platform, a family of medium tactical vehicles (FMTV). Will begin integration of system software			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AD1 / *High Energy Laser Tactical Vehicle Demo Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
to control all subsystems that will validate software functionality. Will begin test range coordination for HEL TVD FY 2022 demonstration to include range and non-range truth data sensors and purchase first RAM and UAS targets for system demonstrations and knowledge points. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Ongoing work transferred from other PEs due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	29.914

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AD6 / *Next Generation Fires Radar Advanced Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AD6: *Next Generation Fires Radar Advanced Technology*	-	0.000	0.000	7.729	-	7.729	7.884	8.042	8.203	8.294	0.000	40.152

Note

In Fiscal Year (FY) 2020 this Project is realigned from:
Program Element (PE) 0603772A Advanced Tactical Computer Science and Sensor Technology, Project:
* 243 Sensors and Signals Processing

A. Mission Description and Budget Item Justification

This Project directly supports Army Modernization Priority Air and Missile Defense capabilities by demonstrating scalable radar open systems architecture software allowing the insertion of modular software components.

Work in this Project complements PE 0602150A (Air and Missile Defense Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Next Generation Fires Radar Advanced Technology	-	-	7.729
Description: This effort matures and demonstrates the architectures, processing and components necessary to deliver next generation capability, flexibility and supportability to the fires family of radar systems. Efforts focus on development of a modular and scalable open architecture that is extensible to multiple radar systems technologies in support of air defense and area/base camp protection.			
FY 2020 Plans: Will demonstrate Fires Radar Open System Technology architecture and back- end processing on the first version of Digital Array Radar Technology as well as other front end antenna configurations, as available, to verify scalability and modularity; Leverage the mode development efforts in FY 2019 (multi-mission, target identification, and multi-static) to complete a Mode Development Kit (MDK) that will be used to mature the interfaces of the open architecture backend; Continue development of the modes from FY 2019 to improve performance and optimize the multi-mission capability for future Fires radars; and Demonstrate additional			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AD6 / *Next Generation Fires Radar Advanced Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Fires radar technology on different class (medium and light-weight) systems to provide multi-mode and multi-mission capabilities relevant to current and future radar systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work transferred from other PEs due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	7.729

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603466A / *Air and Missile Defense Advanced Technology*	Project (Number/Name) AE3 / *Unconventional Countermeasures-Survivability ATech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
AE3: *Unconventional Countermeasures-Survivability ATech*	-	0.000	0.000	1.920	-	1.920	3.178	3.180	2.200	2.230	0.000	12.708

Note

In Fiscal Year (FY) 2020 this Project was realigned from:
Program Element (PE) 0603734A Military Engineering Advanced Technology, Project:
* T08 Combat Eng Systems

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies to increase survivability of personnel and critical assets using integrated unconventional countermeasures. These countermeasures include tonedown concepts for signature management using novel materials, rapidly deployable, low-cost, multisprectral survivability enhancers as well as intuitive decision support technologies to select and assess non-kinetic protective measures.

Work in this Project supports the Army Science and Technology AMD Portfolio.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project conducted at Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Development of Unconventional Countermeasures for Enhanced Survivability (DeUCES) Demonstrations	-	-	1.920
Description: This effort matures and demonstrates countermeasures to detect and defeat near-peer advanced weapons through computational simulations and physical countermeasures and enhanced tonedown measures. This effort is coordinated with PE 0602150A Air and Missile Defense Technology.			
FY 2020 Plans: Will demonstrate novel tonedown techniques for critical fixed and semi-fixed assets to include novel application of commercial off the shelf materials.			
FY 2019 to FY 2020 Increase/Decrease Statement:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603466A / *Air and Missile Defense Advanced Technology*	**Project (Number/Name)** AE3 / *Unconventional Countermeasures-Survivability ATech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
In FY 2020, work in this PE transferred from other PEs due to S&T Financial Restructuring.			
Accomplishments/Planned Programs Subtotals	-	-	1.920

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603606A *I Landmine Warfare and Barrier Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	18.473	17.097	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	35.570
608: *Countermine & Bar Dev*	-	15.529	11.097	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.626
64C: *COUNTERMINE DEMONSTRATIONS (CA)*	-	1.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.000
683: *Area Denial Sensors*	-	1.944	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.944

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
* PE 0603118A Soldier Lethality Advanced Technology
* PE 0603462A NGCV Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates sensors, subsystems, and neutralization technologies that can be used by dismounted forces as well as ground and air platforms to detect, identify and mitigate the effects of landmines, improvised explosive devices, minefields, and other explosive hazards. This PE also conducts modeling and simulation activities to assess the effectiveness of detection and neutralization concepts. Project 608 (Countermine and Bar Dev)supports the maturation and demonstration of enabling component and subsystems for counter explosive hazards and countermine technologies in the areas of countermine and barrier development and Project 683 (Area Denial Sensors) funds efforts on area denial sensors.

Work in this PE is fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602622A (Chemical, Smoke and Equipment Defeating Technology), PE 0602624A (Weapons and Munitions Technology), PE 0602712A (Countermine Systems), PE 0602784A (Military Engineering Technology), PE 0603004 (Weapons and Munitions Advances Technologies), PE 0603270 (Electronic Warfare Technology), and PE 0603710A (Night Vision Advanced Technology).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by the U.S. Army Futures Command.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603606A *I Landmine Warfare and Barrier Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	17.948	11.104	11.238	-	11.238
Current President's Budget	18.473	17.097	0.000	-	0.000
Total Adjustments	0.525	5.993	-11.238	-	-11.238
• Congressional General Reductions	-0.010	-0.007			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	1.000	6.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.465	-			
• Adjustments to Budget Years	-	-	-11.238	-	-11.238

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 64C: *COUNTERMINE DEMONSTRATIONS (CA)*		
Congressional Add: *Countermine*	1.000	6.000
Congressional Add Subtotals for Project: 64C	1.000	6.000
Congressional Add Totals for all Projects	1.000	6.000

Change Summary Explanation

FY19 congressional add ($6.000 million) for multi-sensor drone swarms for explosive hazard detection.
This PE is being terminated in FY20, with continuity of effort realigned to other PEs.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	Project (Number/Name) 608 / *Countermine & Bar Dev*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
608: *Countermine & Bar Dev*	-	15.529	11.097	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	26.626

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603118A Soldier Lethality Advanced Technology, Project:
* BC9 Advanced Soldier Sensors/Displays Advanced Technology for Dismounts
PE 0603462A NGCV Advanced Technology, Project:
* BJ8 Detection of Explosive Hazards Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies for finding and neutralizing explosive hazards in varying vegetation, soil, and weather conditions both day and night. Activities include maturation and demonstration of modular, semi-autonomous, and autonomous air, ground, and Soldier borne technologies to enable standoff and close-in detection and neutralization of explosive threats. Efforts are supported by modeling and simulation assessments to define potential system effectiveness.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering Science and Technology priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Ground Vehicle Explosive Hazard Detection ***Description:*** This effort improves detection, marking, and defeat of low metal/low contrast explosive threats buried in the road and along the sides of roads, Improvised Explosive Devices (IEDs), and antitank landmines. This effort also matures technologies to increase standoff detection and defeat distances, both in roads and off routes, enabling faster rates of advance and safer operations for early entry and route clearance missions.	15.529	-	-
Title: Autonomous Explosive Hazard Detection ***Description:*** This effort demonstrates an integrated modular sensor and sensor data processing capability to enable remote and semi-autonomous detection of mines, other explosive hazards, and indicators of emplacement, such as command wires and initiation devices from a safe standoff distance using small unmanned ground and air platforms. This effort also matures and demonstrates explosive hazard (EH) detection technologies that can be adapted to address near-peer threats in multiple environments.	-	10.860	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 608 / *Countermine & Bar Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Mature sensors to detect wire components from standoff distances and sensor configurations for implementation on unmanned platforms; exploit novel sensor phenomenologies for optimization of explosive threat detection approaches; improve threat detection algorithms and signal processing techniques for the detection of buried explosive hazards using data collected in near-peer environments; mature low contrast target marking schemas and approaches; improve performance of close-in explosive threat confirmation sensors. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort will be funded in PE 0603118A (Soldier Lethality Advanced Technology) / Project BC9 (Advanced Soldier Sensors/ Displays Advanced Technology for Dismounts) and PE 0603462A (NGCV Advanced Technology) / Project BJ8 (Detection of Explosive Hazards Advanced Technology) for FY 2020.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.237	-
Accomplishments/Planned Programs Subtotals	15.529	11.097	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*				Project (Number/Name) 64C / *COUNTERMINE DEMONSTRATIONS (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
64C: *COUNTERMINE DEMONSTRATIONS (CA)*	-	1.000	6.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	7.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Countermine Advanced Technology and Demonstrations.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Countermine	1.000	6.000
FY 2018 Accomplishments: Countermine		
FY 2019 Plans: Countermine		
Congressional Adds Subtotals	1.000	6.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*				Project (Number/Name) 683 / *Area Denial Sensors*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
683: *Area Denial Sensors*	-	1.944	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.944

Note

In Fiscal Year (FY) 2020 funding for Area Denial Sensors is realigned to:
Program Element (PE) 0603462A Next Generation Combat Vehicle Advanced Tech, Project:
* BG1 Sensors for Auto Oper and Survivability Adv Tech

A. Mission Description and Budget Item Justification

This Project matures and demonstrates surveillance and command and control technology components for anti-access area denial systems that inform maneuver elements and minimize the risk to non-combatants from exposure to anti-personnel landmines and related maneuver barriers. The technology includes distributed personnel surveillance systems and command and control systems to be used with human-in-the-loop threat confirmation. This Project uses modeling and simulation to evaluate new concepts and doctrine. This Project also matures and optimizes components and system architectures, and it validates components in field settings.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Area Denial Sensors	1.944	-	-
Description: This effort matures and demonstrates networked sensor and sensor fusion technology efforts to provide detection, identification, and classification in support of remotely delivered sensor systems and area denial munitions. Key technologies to be matured and demonstrated include deployable multi-mode sensors, fused sensor information, and local area network communications to meet requirements for human-in-the-loop command and control.			
Accomplishments/Planned Programs Subtotals	1.944	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603606A / *Landmine Warfare and Barrier Advanced Technology*	**Project (Number/Name)** 683 / *Area Denial Sensors*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603607A *I Joint Service Small Arms Program*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	5.628	22.799	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	28.427
627: *Jt Svc Sa Prog (JSSAP)*	-	5.628	5.879	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.507
62D: *SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)*	-	0.000	16.920	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.920

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
* PE 0603118A Soldier Lethality Advanced Technology

A. Mission Description and Budget Item Justification

This Program Element (PE) matures and demonstrates advanced technologies that provide greater lethality, target acquisition, fire control, and range at a significantly reduced weight. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden while maintaining or improving current levels of performance.

Efforts in this PE support the Army Science and Technology Lethality Portfolio.

In FY18/FY19, work in this PE was related to and fully integrated with the efforts funded in PE 0602623A (Joint Service Small Arms Program), PE 0602624A (Weapons and Munitions Technology) and PE 0602618A (Ballistic Technology). Beginning in FY20, work in this PE is related to, and fully coordinated with PE 0603118A (Soldier Lethality Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy. All FY20 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The work in this PE is performed by the U.S. Army Futures Command (AFC)

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603607A *I Joint Service Small Arms Program*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	5.796	5.885	4.604	-	4.604
Current President's Budget	5.628	22.799	0.000	-	0.000
Total Adjustments	-0.168	16.914	-4.604	-	-4.604
• Congressional General Reductions	-0.003	-0.006			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	16.920			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.165	-			
• Adjustments to Budget Years	-	-	-4.604	-	-4.604

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 62D: *SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)*		
Congressional Add: *Next Generation Squad Weapon - Carbine*	-	8.800
Congressional Add: *Next Generation Squad Weapon Ammunition*	-	8.120
Congressional Add Subtotals for Project: 62D	-	16.920
Congressional Add Totals for all Projects	-	16.920

Change Summary Explanation

FY19 congressional add ($16.920 million) for soldier lethality.
In FY20, this PE is eliminated due to Science & Technology portfolio financial restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603607A / *Joint Service Small Arms Program*	Project (Number/Name) 627 / *Jt Svc Sa Prog (JSSAP)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
627: *Jt Svc Sa Prog (JSSAP)*	-	5.628	5.879	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	11.507

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603118A Soldier Lethality Advanced Technology, Project:
* AY5 Soldier Squad Small Arms Armaments Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates advanced technologies that provide greater lethality, target acquisition, fire control, training effectiveness and range at a significantly reduced weight. These technologies lighten the Soldier's load, provide improved battlefield mobility, and reduce logistics burden while maintaining or improving current levels of performance.

Efforts in this Project support the Army Science and Technology Lethality Portfolio.

In FY 2018/FY 2019 work in this Project is related to, and fully integrated with the efforts funded in Program Element (PE) 0602623A (Joint Service Small Arms Program) and PE 0602624A (Weapons and Munitions Technology). Beginning in FY 2020, work in this PE is related to, and fully coordinated with PE 0603118A (Soldier Lethality Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Volume Effects	2.205	1.900	-
Description: This effort addresses the maturation and demonstration of emerging small arms technologies from PE 0602623A efforts into current and next generation weapon systems to address Volume (sustained suppressive and lethal fires for area targets) capability gaps for improved effectiveness at extended ranges.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*	**Project (Number/Name)** 627 / *Jt Svc Sa Prog (JSSAP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Mature technology concepts to inform NGSAR requirements and optimize designs for the next generation carbines and Squad Designated Marksman (SDM) weapon systems; mature weapon system, fire control, and ammunition technologies to increase the current performance of the lightweight medium machine gun. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, this effort is realigned to PE 0603118A / Project AY5.			
Title: Precision Effects ***Description:*** This effort focuses on the maturation and demonstration of emerging small arms technologies from PE 0602623A efforts into current and next generation weapon systems to address precision fire (Precision fire is support fire in the offense during the assault and engagement of targets to the maximum effective range of the weapon), and fire control capability gaps for improved accuracy at extended ranges. ***FY 2019 Plans:*** Optimize and demonstrate anti-material, improved performance and subsonic precision ammunition in three different calibers to support requirements for extended range and increased accuracy and terminal effects required to meet those needs across multiple fielded or emerging weapon platforms. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, this effort is realigned to PE 0603118A / Project AY5.	1.428	1.008	-
Title: Small Arms Systems Integration and Demo ***Description:*** This effort addresses the maturation and demonstration of small arms component technologies resulting from PE 0602623A efforts and applied into advanced small arms technologies as to inform the user requirement process, address operational capability gaps and transition mature components and technology concepts. ***FY 2019 Plans:*** Demonstrate next Generation Small Arms Squad Technologies at the Army Expeditionary Warrior Experiment (AEWE) in support of increasing small unit effectiveness. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY 2020, this effort is realigned to PE 0603118A / Project AY5.	0.495	1.450	-
Title: Joint Service Small Arms Science and Technology Collaboration ***Description:*** This effort addresses the continued operations of the Joint Service Small Arms Program (JSSAP) office to coordinate and harmonize new Services' materiel requirements with potential joint applications, and to maintain awareness of the	1.500	1.350	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603607A / *Joint Service Small Arms Program*	**Project (Number/Name)** 627 / *Jt Svc Sa Prog (JSSAP)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Services' efforts to improve Small Arms capabilities thus reducing duplication of ongoing and planned technology, acquisition and sustainment activities. ***FY 2019 Plans:*** Continue to manage Joint Services Small Arms Programs; continue technology developmental efforts on material solutions for transitioning to small arms programs of record; continue to influence small arms technology maturation activities in collaboration with North Atlantic Treaty Organization (NATO) partners. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort ends in FY 2019.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.171	-
Accomplishments/Planned Programs Subtotals	5.628	5.879	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603607A / *Joint Service Small Arms Program*	Project (Number/Name) 62D / *SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
62D: *SMALL ARMS ADVANCED TECHNOLOGY DEV (CA)*	-	0.000	16.920	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	16.920

A. Mission Description and Budget Item Justification

Congressional Interest FY 2019 Program Increase for Soldier Lethality.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Next Generation Squad Weapon - Carbine ***FY 2019 Plans:*** Next Generation Squad Weapon - Carbine	-	8.800
Congressional Add: Next Generation Squad Weapon Ammunition ***FY 2019 Plans:*** Next Generation Squad Weapon Ammunition	-	8.120
Congressional Adds Subtotals	-	16.920

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603710A *I Night Vision Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	45.617	61.313	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	106.930
K70: *Night Vision Adv Tech*	-	20.867	32.717	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	53.584
K86: *Night Vision, Abn Sys*	-	24.750	28.596	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	53.346

Note

In Fiscal Year (FY) 2020 this Program Element is being eliminated, with continuity of effort realigned to the following PEs:
* PE 0603118A Soldier Lethality Advanced Technology
* PE 0603462A Next Generation Combat Vehicle Advanced Technology
* PE 0603463A Network C3I Advanced Technology
* PE 0603465A Future Vertical Lift Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates sensor technologies that increase Warfighter situational understanding, survivability, and lethality by providing sensor capabilities to acquire and engage targets at longer ranges in complex environments and operational conditions (e.g. day/night, obscured, smoke, adverse weather, and other degraded visual environments). Project K70 pursues technologies that provide our Warfighters with a Common Operating Picture (COP) to enable increased situational understanding and combat overmatch. Specific areas of maturation and demonstration include technologies that integrate disparate sensor architectures, perform multispectral aided target detection (AiTD), enable passive long range target identification (ID), improve day/night visualization systems, allow rapid wire area search, and facilitate augmented reality. Project K86 matures and validates airborne platform sensors and algorithms designed to detect targets (vehicles and personnel) in camouflage, concealment, and deception. This Project provides pilotage and situational understanding imagery to multiple pilots/crew members independently to enhanced operations in day/night/adverse weather conditions.

Work in this PE is fully coordinated with efforts in PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602709A (Night Vision and Electro-Optics Technology), PE 0602712A (Countermine Systems), PE 0603001A (Warfighter Advanced Technology), PE 0602211A (Aviation Technology), PE 0603003A (Aviation Advanced Technology), PE 0603005A (Combat Vehicle and Automotive Advanced Technology), PE 0603606A (Landmine Warfare and Barrier Advanced Technology), PE 0603774A (Night Vision Systems Advanced Development) and PE 0604710A (Night Vision Systems Engineering Development).

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army					Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603710A *I Night Vision Advanced Technology*		
B. Program Change Summary ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
Previous President's Budget	47.135	61.376	62.280	-	62.280
Current President's Budget	45.617	61.313	0.000	-	0.000
Total Adjustments	-1.518	-0.063	-62.280	-	-62.280
• Congressional General Reductions	-0.030	-0.063			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.488	-			
• Adjustments to Budget Years	-	-	-62.280	-	-62.280

Change Summary Explanation

FY20 reduction - PE eliminated due to financial restructure, with continuity of effort realigned to other PEs in Science and Technology portfolio.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / *Night Vision Advanced Technology*	Project (Number/Name) K70 / *Night Vision Adv Tech*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
K70: *Night Vision Adv Tech*	-	20.867	32.717	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	53.584

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Project:
* AQ5 Sensor CE-Integrated Sensor Architecture Adv Tech
PE 0603118A Soldier Lethality Advanced Technology, Projects
* AY7 Small Arms Fire Control Advanced Technology
* BC9 Adv Soldier Sensors/Displays AdvTech for Dismounts
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BG1 Sensors for Auto Oper and Survivability Adv Tech
* BI3 Sensor Protection Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates high-performance sensor technologies and architectures that enhance situational understanding, increase target detection and identification ranges, reduce target acquisition (TA) timelines, enable threat detection and mitigation, and support operations in degraded environments against threats that are partially obscured by terrain, weather, or other features. This Project provides improved capabilities and Common Operating Picture (COP) for mounted and dismounted Soldiers and tactical vehicles.

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Sensor Interoperability	2.342	2.904	-
Description: This effort matures and demonstrates an interoperability sensor architecture that allows a system to dynamically discover and leverage other systems on a network without any specific or prior knowledge. The goal of this effort is to develop standards, models, and protocols that provide a common language for sensor systems to connect, publish their capabilities and needs, and interact with other systems, even on disadvantaged networks. The benefits of this effort are increased sensor collaboration, reduced decision timelines, reduced soldier load, and reduced integration costs.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Improve methods for distributed interoperability management to support autonomous sensor data requesting, processing, and distribution decisions; improve methods for interoperability to optimize operation on limited-bandwidth communication networks and survive and recover from communication network denial; exploit internal interoperability management metadata to provide indicators of abnormal network behavior consistent with intrusion; mature and demonstrate methods allowing two-way interoperability across security domains; demonstrate interoperability integration and operation strategies across tactical and intelligence assets, to include joint and multinational assets. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603463A / Project AQ5.			
Title: Soldier System Architecture ***Description:*** This effort matures and optimizes interfaces for Soldier sensors, optics, displays, and electronic systems that will be incorporated into the larger Soldier system architecture to improve the individual Soldier's effectiveness and efficiency while reducing burden and total operational costs. This effort is coordinated with Program Element (PE) 0603001A/Project J50, PE 0602716A/Project H70, PE 0602786A/Project H98, PE 060315A/Project S28, and PE 0603004A/Project 232. This effort ends in FY 2018 and deliverables transition to Program Executive Office (PEO) Soldier and Research, Development, and Engineering Command (RDECOM).	1.001	-	-
Title: Ground Based Sensors and Integration for Degraded Visual Environments (DVE) ***Description:*** This effort provides uncooled infrared (UCIR) sensor technologies to improve survivability through increased Situational Awareness (SA) in all conditions and environments, to include Degraded Visual Environments (DVE), for manned and unmanned ground vehicle systems. Current uncooled IR requires improvement in sensitivity and development of signal processing techniques to penetrate obscurants. Integration of improved sensors, signal processing algorithms, and data fusion will maintain mission capabilities in DVE (e.g. smoke, dust, fog). Demonstration of scalable, multi-functional (360 degree SA, Hostile Fire Detection (HFD), Aided Driving), low cost SA systems with in-vehicle displays that can be tailored to the ground platform and mission requirements will bring timely and useful information to the vehicle crew and squad. This is a Joint effort with the Tank Automotive Research, Development and Engineering Center (TARDEC) under PE 0602601/Project C05 and PE 0603005/Project 221. This effort is fully coordinated with PE 0602709/Project H95. ***FY 2019 Plans:*** Conduct system validation of real time driving and maneuver capabilities in DVEs (dust, fog) on vehicle platforms with imaging sensors, an overlay of driving aids on sensor displays, and image enhancement algorithms; continue performance improvements	5.112	7.599	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
from fusing COTS active sensors including MMW/Radar and scene based terrain knowledge to supplement UCIR imagery and optimize low latency cues suitable for driving; incorporate advanced UCIR sensors and image processing into unmanned systems to enhance target detection performance of convoy operations under degraded environments; demonstrate stationary hostile fire detection/cueing capabilities in real time through use of dual band UCIR with high performance detection against subsonic vehicular threats; optimize HFD algorithms for both short/long range scenarios to demonstrate low false alarm rates and validate the potential for OTM applications. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort ends in FY 2019.			
Title: Soldier Maneuver and Lethality Sensors ***Description:*** This effort matures and demonstrates dismounted Soldier capabilities that improve Soldier mobility, maneuver, situational understanding, threat detection, targeting, and lethality. Innovative technologies for Soldier weapon or head mounted sensors, head mounted displays, and tactical lasers will be provided to users to gain feedback about performance and utility. The technologies provided through this effort address human factors/human dimension and provide lower weight, reduced cost, and improved performance for Soldier based sensor systems. In FY 2019, work in this effort are realigned to support the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army. ***FY 2019 Plans:*** Provide design approaches for a multi-band leader weapon sight with multifunction sensors and lasers for target handoff, threat detection, and facial identification; improve sensor resolution for threat discrimination; exploit existing biometrics databases to provide standoff tactical capabilities; mature existing target detection algorithms to recognize complex obstacles using data collected with prototype high resolution airborne detection sensor system to improve situational awareness for dismounted units. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603118A / Project AY7 and PE 0603462A / Project BG1.	2.892	3.808	-
Title: Augmented Reality for Tactical Operations ***Description:*** This effort will mature and demonstrate an integrated mounted and dismounted tactical Augmented Reality (AR) capability that provides a Common Operating Picture (COP) for mounted and dismounted elements, increased maneuverability and survivability, and enhanced situational understanding by integrating sensor imagery, geo-location information, accurate real time Situational Understanding (SU) and command and control information for all warfighter operational environments. Leverages work performed in PE 0602709A/Project H95, PE 0602784A/Project 855, and PE 0602784A/Project T42. ***FY 2019 Plans:***	2.002	2.904	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Provide vision based orientation sensors to support geo-registration of information; provide initial demonstration of Blue Force Tracking (BFT), threat icons, and Situational Awareness (SA) information display on existing vehicle displays; demonstrate video from vehicle imagers displayed on Soldier Helmet Mounted Display (HMD) via wireless connection. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603118A / Project BC9.			
Title: New Long Range Advanced Scout Surveillance System (LRAS3) ***Description:*** This effort matures and demonstrates sensor technologies that provide reconnaissance crews the ability to rapidly detect, identify, and respond to hybrid threats beyond their current tactical capability to include integration of third-generation forward looking infrared (FLIR) with low cost optics, multi-function laser module enabling range finding, marking and pointing, rapid detection of threat optical systems, precision target location, and advanced image processing and aided target recognition algorithms. ***FY 2019 Plans:*** Integrate 3rd Generation FLIR and mature high power multi-spectral laser technologies for advanced threat detection at tactical ranges; improve laser detector technology to increase range performance and range resolution; optimize optical assemblies to yield high throughput multi-wavelength designs, lowering overall system Size, Weight, and Power (SWAP); validate target handoff subsystem performance; demonstrate initial digital read-out integrated circuit (DROIC) and cooled long wave infrared (LWIR) camera under required environmental conditions. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603462A / Project BG1.	5.412	4.727	-
Title: Down Range Electro-Optical Wind Sensing ***Description:*** This effort will integrate crosswind sensing and range measurement with real time compensation of the aim-point offset for a shooter to rapidly and accurately engage targets from effective weapon ranges. The effort will mature and demonstrate sensing and imaging technologies to measure crosswinds and target range to provide an aim-point compensation of the bullet trajectory and increase the first round probability of hit. ***FY 2019 Plans:*** Mature and demonstrate a system brass board concept for a crew served electro-optical (EO) wind sensing system with weapon sight and reticle aim point adjustment; improve rifle display assembly to provide more direct optical flow of disturbed reticle. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	2.106	2.815	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Effort ends in FY 2019.			
Title: One Sensor for Fire Support/Scout Operations ***Description:*** This effort will optimize and demonstrate a modular and tailorable single sensor solution for both Scouts and Forward Observers integrating advanced sensor technologies with increased identification (ID) range and improved target location accuracy. The effort will enable a synchronized Situational Awareness (SA) picture to enhance overall lethality and survivability. A single sensor approach will increase human performance with common training, common materiel repair parts, and economy of scales to support expeditionary operations. ***FY 2019 Plans:*** Provide trade studies to optimize single sensor design approach for both Scouts and Forward Observers; improve design for increased range performance and reduced target location error; validate design approach via sensor range performance predictive modeling. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603118A / Project AY7.	-	2.012	-
Title: Asymmetric Vision / Decide Faster ***Description:*** This effort will mature and demonstrate sensing, image processing, display and mission decision aid capabilities to provide disaggregated mounted and dismounted teams with the ability to act autonomously, outmaneuver, and outthink the enemy in close combat with limited and intermittent access to higher echelon command and control systems. In FY 2019, this effort is developed from realigned funds in support of the Army science and technology (S&T) priorities as identified at the December 2016 S&T Army Requirements Oversight Council by the Chief of Staff of the Army. ***FY 2019 Plans:*** Demonstrate tactical augmented reality, 3-Dimensional enriched terrain and mission planning tools; validate initial system of systems level concepts in tactically relevant environments; optimize concept data management and interoperability approaches. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603118A / Project BC9.	-	4.937	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:***	-	1.011	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K70 / *Night Vision Adv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 SBIR / STTR Transfer			
FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	20.867	32.717	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603710A / *Night Vision Advanced Technology*	Project (Number/Name) K86 / *Night Vision, Abn Sys*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
K86: *Night Vision, Abn Sys*	-	24.750	28.596	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	53.346

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603465A Future Vertical Lift Advanced Technology, Projects:
* AK3 Aviation Survivability Advanced Technology
* AL6 Degraded Vis Environ Mitigation (DVE-M) Adv Tech
* AL7 Full Spectrum Targeting Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates intelligence, surveillance, reconnaissance, targeting, and pilotage technologies in support of the Army's aviation and networked systems. This effort focuses on improved reconnaissance, surveillance, and target acquisition, pilotage sensors, high-resolution heads-up displays, sensor fusion, and aided target recognition (AiTR) capabilities for Army vertical lift aircraft, utility helicopters, and unmanned aerial systems (UAS) in day/night, obscured, smoke, adverse weather, and other Degraded Visual Environments (DVE). UAS payload efforts mature and demonstrate small, lightweight, and modular payloads (e.g. electro-optical/ infrared, laser radar, designator) to support target detection, identification, location, tracking, and targeting of tactical targets for the Brigade Combat Team.

Work in this Project is fully coordinated with Program Element (PE) 0602211A (Aviation Technology) and PE 0603003A (Aviation Advanced Technology).

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Local Area Intelligence, Surveillance, and Reconnaissance (ISR) for Tactical Small Units	5.089	5.148	-
Description: This effort develops and demonstrates sensors enabling simultaneous display of wide and narrow field-of-view (FOV) infrared imagery for enhanced Situational Awareness (SA)/targeting. This effort optimizes multi-band image fusion and the ability to image battlefield laser spot locations for improved targeting accuracy and reduced fratricide caused by laser misalignment.			
FY 2019 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Demonstrate and validate CSP turret system performance/capability improvements from a surrogate manned airborne platform to include simultaneous wide/narrow field-of-view, imaging of battlefield lasers, and extended range performance under adverse weather conditions. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort ends in FY 2019.			
Title: Sensors and Sensor Fusion for Rotorcraft Degraded Visual Environment (DVE) Mitigation ***Description:*** This effort leverages work previously accomplished under the ?Multifunction Imagers for Rotary Wing? and ? Pilotage Sensor Fusion? efforts. This effort matures sensing and processing approaches to improve pilotage in DVEs. This effort optimizes Long Wave Infrared (LWIR) imaging sensors capable of providing actionable imagery over a wide range of DVEs. This effort also demonstrates a distributed aperture sensing (DAS) approach in which sensing modules are placed around the airframe to enable 360 degree coverage and provide information on potential threats and obstacles for increased Situational Awareness (SA). The effort provides DVE-specific multimodal fusion techniques to leverage the strengths and mitigate the weaknesses of multiple sensor modalities. Work in this effort is coordinated with DVE efforts in PE 060211A, Aviation Technology, Project 47A, and PE0603003A, Aviation Advanced Technology, Project 313. ***FY 2019 Plans:*** Mature real-time computing hardware and implement previously identified software approaches for sensor fusion, DAS and synthetic scene rendering, coherent 3D world model generation, and advanced navigation/location; integrate flight-worthy real-time computing hardware/software along with baseline sensor suite (high-sensitivity cooled LWIR, RADAR, active IR and wide field of view uncooled IR) onto airborne rotary wing testbed platform; conduct a series of airborne data collections to demonstrate the achieved system performance of the baseline and several alternate sensor/processing configurations; validate demonstrated performance of DVE sensor/processing configurations and identify modifications to improve performance; demonstrate operability of data interfaces to allow 3D world model queries from the flight control, guidance, and cueing systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603465A / Project AL6.	9.257	10.692	-
Title: Digital Dual Use Sensors (DDUS) ***Description:*** This effort will mature and demonstrate the core camera technology for a multi-spectral, multi-mode distributed aperture pilotage system while supporting aircraft survivability. This synergistic single sensor technology will support aircraft survivability by providing hostile fire and missile warning cues while simultaneously providing pilotage and situational understanding in Degraded Visual Environments (DVEs). This effort leverages technology from the Dual Band Infrared Focal	10.404	11.848	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603710A / *Night Vision Advanced Technology*	**Project (Number/Name)** K86 / *Night Vision, Abn Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Plane Arrays (IRFPA) ManTech as well as from the 3D Digital Read-Out Integrated Circuit (DROIC) Science and Technology Objective (STO) to fabricate the digital multi-function readout circuit to enable the multi-function capability. ***FY 2019 Plans:*** Mature multiple dual band DROIC designs; optimize DROICs based on the two most promising designs; electrically probe DROIC parts will be validated for functionality and performance in preparation to bond DROICs to the dual band Midwave/Longwave Infrared (MWIR/LWIR) detector material; mature the integrated dewar and cooler assemblies (IDCAs) required for DDUS FPAs; mature optical lenses to demonstrate and validate performance of DDUS sensor technology. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** For FY 2020, this effort is realigned to PE 0603465A / Project AK3.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.908	-
Accomplishments/Planned Programs Subtotals	24.750	28.596	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603728A *I Environmental Quality Technology Demonstrations*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	29.150	29.132	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	58.282
002: *Environmental Compliance Technology*	-	2.162	2.352	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.514
025: *Pollution Prevention Technology*	-	1.429	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.429
03E: *Environmental Restoration Technology*	-	6.559	6.780	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.339
03F: *Environmental Quality Tech Demonstrations (CA)*	-	19.000	20.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.000

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
* PE 0603119A Ground Advanced Technology
* PE 0603462A Next Generation Combat Vehicle Advanced Technology
* PE 0603463A Network C3I Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates technologies that assist the Army to reduce or eliminate environmental impacts both in the United States and abroad, and provide science and technology solutions to Army environmental challenges as a force multiplier in mission planning, material acquisition and soldier preparedness. Project 002 demonstrates tools and methods for compliance with environmental laws relevant to conservation of natural and cultural resources while providing a flexible realistic training environment for mission activities. The Army also requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This project matures and demonstrates tools for robotic and autonomous agile infrastructure modification and custom designed construction for expeditionary structures on demand. Project 025 demonstrates pollution prevention tools and methods to minimize the Army's use and generation of toxic chemicals and hazardous wastes. Project 03E focuses on technologies for advanced life cycle analysis, advanced sensing, and technologies to empower rapid fielding of next generation energetics, propellants and munitions.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army Strategy for the Environment.

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

This PE is fully coordinated and complementary to PE 0602720A (Environmental Quality Technology).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*

Work in this PE is performed by the Army Engineer Research and Development Center, Vicksburg, MS, and the Army Futures Command (AFC).

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	10.421	9.136	9.352	-	9.352
Current President's Budget	29.150	29.132	0.000	-	0.000
Total Adjustments	18.729	19.996	-9.352	-	-9.352
• Congressional General Reductions	-0.005	-0.004			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	19.000	20.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.266	-			
• Adjustments to Budget Years	-	-	-9.352	-	-9.352

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 03F: *Environmental Quality Tech Demonstrations (CA)*		
Congressional Add: *Autonomous Transport Innovation*	5.000	5.000
Congressional Add: *Depleted Uranium Cleanup*	4.000	-
Congressional Add: *Rapid Safe Carbon Nanotechnology Research*	10.000	8.000
Congressional Add: *Smart Bases*	-	5.000
Congressional Add: *Environmental Sensors for Explosives*	-	2.000
Congressional Add Subtotals for Project: 03F	19.000	20.000
Congressional Add Totals for all Projects	19.000	20.000

Change Summary Explanation

FY 2018 congressional adds ($19.000 million) for autonomous transport innovation; depleted uranium cleanup; and rapid safe carbon nanotechnology research
FY 2019 congressional adds ($20.000 million) for autonomous transport innovation; environmental sensors for explosives; rapid safe advanced carbon nanotechnology materials; and smart bases.
FY 2020 reduction - PE eliminated due to Science and Technology (S&T) portfolio Financial Restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 002 / *Environmental Compliance Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
002: *Environmental Compliance Technology*	-	2.162	2.352	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	4.514

Note

In FY 2020 this Project is being realigned to:
Program Element (PE) 0603462A Next Generation Combat Vehicle Advanced Technology, Project:
* BK8 Robotics for Engineer Operations Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from PE 0602720A (Environmental Quality Technology), Projects 048 and 896, and PE 0602784 (Military Engineering), Projects T41 and T45. This Project assists Army installations and operations in achieving environmental compliance. Army facilities are subject to fines and facility shutdowns for violations of federal, state, and local environmental regulations. Efforts under this Project enable the Army to reduce environmental constraints at installations while complying with the myriad of federal, state, local, and host country environmental regulations and policy. In addition, this project matures capabilities to assess, establish, upgrade, and construct infrastructure to project power and enable deployed force operations. Current and planned efforts enable the Army to perform additive and advanced manufacturing for deployed force infrastructure, support robotic and autonomous engineering during combat operations, and ensure infrastructure resiliency. Technologies demonstrated aim to reduce the cost of resolving compliance issues for the Army, sustain the viability of testing and training ranges, protect critical resources, and expand capacity to perform construction and supporting tasks in high risk/threat and dynamic environments.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, supports the Army Strategy for the Environment, and supports the Army Modernization Priority for Next Generation Combat Vehicle, Air Missile Defense and Network/C3I.

All FY 2020 adjustments align program financial structure to Army Modernization Priorities in support of the National Defense Strategy.

Work in this Project supports the Army Science and Technology Military Engineering and Environmental Technology, Simulation and Computing Portfolio.

Work in this Project is performed by the Army Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Sustainable Ranges and Lands	1.065	-	-
Description: This effort provides ecosystem vulnerability assessment and ecosystem analysis, monitoring, modeling, and mitigation technologies to support sustainable, unconstrained, realistic access and use of the Army's ranges and lands. This effort			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 002 / *Environmental Compliance Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
demonstrates environmentally safe and cost effective technologies to manage and reduce the increase in noise and pollution concerns associated with training ranges.			
Title: Infrastructure for Combat Operations (Previous Titled: Adaptive & Resilient Installations) ***Description:*** The Army requires the ability to assess, establish, upgrade, and secure infrastructure while in theatre to enable deployed force operations. This effort matures and demonstrates tools for the assessment of physical and ecological impacts on operations, agile infrastructure modification, and custom designed construction for expeditionary structures on demand.	1.097	-	-
Title: Robotics for Engineer Operations ***Description:*** Mature and demonstrate robotic and autonomous technologies for Engineer operations supporting mobility, countermobility, and advanced construction methods for deployed operations. ***FY 2019 Plans:*** Mature risk mitigation frameworks associated with contingency autonomous construction methods and activities. Mature algorithms and decision making software for control processes (bandwidth needs, response time lag, and override response times) developed to facilitate autonomous methods necessary for expedient point of need construction. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603462 / Project BK8 (Robotics for Engineer Operations Advanced Technology) in FY 2020.	-	2.352	-
Accomplishments/Planned Programs Subtotals	2.162	2.352	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 025 / *Pollution Prevention Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
025: *Pollution Prevention Technology*	-	1.429	0.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	1.429

Note

Planned efforts in this Project were completed in Fiscal Year (FY) 2018.

A. Mission Description and Budget Item Justification

This Project matures and demonstrates pollution prevention advanced technologies required for sustainable operation of Army weapon systems, to include compliance with regulations mandated by federal, state, and local environmental and health laws. Technology thrusts under this Project include demonstration of advanced technologies to enable sustainment of propellant, explosive, and pyrotechnic production and maintenance facilities and training ranges through elimination or significant reduction of environmental impacts. These technologies will ensure that advanced energetic materials required for the future force's high performance munitions are developed that meet weapons lethality and survivability goals and that are compliant with environmental and health laws. Technology thrusts also include demonstration of more sustainable technologies for surface finishing processes, paints and coatings, cleaning solvents, refrigerants, and fire suppressants.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy and supports the Army Strategy for the Environment.

The Project is fully coordinated and complementary to Program Element (PE) 0602720A, Project 895.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Pollution Prevention Technology	1.429	-	-
Description: This effort demonstrates pollution prevention advanced technologies required to sustain operation of Army weapons systems to comply with state, federal, and local environmental and health laws and regulations.			
Accomplishments/Planned Programs Subtotals	1.429	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 025 / *Pollution Prevention Technology*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*				Project (Number/Name) 03E / *Environmental Restoration Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
03E: *Environmental Restoration Technology*	-	6.559	6.780	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	13.339

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* AR4 Intelligent Environmental Battlefield Awareness Advanced Technology
* AR6 Understanding the Environment as a Threat Advanced Technology
PE 0603119A Ground Advanced Technology, Project:
* BM1 Protection from Advanced Weapon Effects Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates technologies transitioned from PE 0602720A (Environmental Quality Technology) Projects 835 and 896 that address the management and mitigation of hazardous materials and chemicals, with a focus on mitigating impacts of new materiel that will enter the Army inventory within the next decade and beyond. This Project will shape and protect Army investments in next generation fires by delivering proactive, scientifically sound risk and environmental impact management strategies. Efforts in this Project assess environmental factors in mission planning activities that impact the battlefield landscape of future threats while also identifying opportunities and impacts to mission success in sparse data environments. These efforts will enable mission planners to identify the industrial/ commercial resources used as components of weapons development. Technologies matured within this Project: inform the Army of potential environmental threats, opportunities, and mission impacts; help decision makers understand environmental threats in urban and industrial contested environments; and provide rapid sensing and assessment of the presence and extent of dangerous compounds in battlefield environments.

A key aspect of this work is the enhancement of risk assessment and life cycle analysis techniques that can more accurately predict and identify the environmental liabilities associated with fielding new systems and technologies. Efforts also identify ways to economically comply with myriad federal, state, and host country regulations dealing with contaminated soil and water. This Project includes pilot-scale field studies to demonstrate technological feasibility and optimize performance and productivity of risk mitigation techniques.

FY 2020 realignments are due to financial restructuring in support of Army Modernization Priorities.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army Strategy for the Environment.

Work in this Project is performed by the Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Hazard Assessment for Military Materials ***Description:*** This effort demonstrates tools to assess hazard and risk of Army-unique chemicals and materials. The tools provide for rapid environmental baseline survey reporting and screening assessments of existing and future militarily relevant compounds and allow for improved predictive risk assessment and provide environmental life cycle assessment capability. ***FY 2019 Plans:*** Characterize environmental fate, degradation and transport of obscurants and tone-down materials in different environments ranging from open lands to dense urban areas. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603119A / Project BM1(Protection from Advanced Weapon Effects Advanced Technology) in FY 2020.	1.398	0.273	-
Title: Technologies for Sustainable and Green Operations and Acquisition ***Description:*** This effort exploits and matures technologies to control contaminant transport in environmental media on Army lands and mission spaces as well as assesses and demonstrates novel detection, remediation, and mitigation capabilities for existing and emerging contaminants.	3.160	-	-
Title: Risk Prediction and Decision Technologies ***Description:*** This effort matures and provides integrated science and technology solutions to Army environmental challenges with a focus on predicting the environmental attributes of emerging chemicals and materials, predictions that inform acquisition lifecycle models in order to minimize impacts to the mission and to the Soldier.	2.001	-	-
Title: Rapid Risk Analysis of Fires ***Description:*** This effort is focused on health implications of new, to-be fielded munitions and investigates the overall life cycle of the materials to shape and protect Army investments in next generation fires supporting Army Modernization Priority Long Range Precision Fires. ***FY 2019 Plans:*** Demonstrate proactive environment, safety, and occupational health risk assessment tools to ensure rapid fielding of energetics, propellants, and munitions. Validate models to predict chemical impacts on select species using embryo gene expression, and	-	2.822	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
demonstrate new computational technologies with high potential for meeting the Army?s needs to predict the toxicity of new and novel chemical agents used in munitions, smoke screens, and energetics. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Advanced technologies within this effort are realigned to PE 0603116A / Project AI3 (Rapid Risk Analysis of Fires Technology) in FY 2020.			
Title: Understanding the Environment as a Threat ***Description:*** This effort provides environmental conditions and hazards in contested environments to enable operational planning and decisions to understand environmental threats from informed modeling and simulation supporting Modernization Priority Network/C3I Mission Planning Applications. ***FY 2019 Plans:*** Demonstrate predictive tools to inform engineer reconnaissance and provide environmental situational awareness for mission planning. Demonstrate in silico prediction of physical, chemical and biological properties of insensitive munitions compounds and their transformation products in the natural water, arid and semi-arid environments, and mature models capable of predicting chemical behavior in complex environments to support scientifically defensible knowledge, tools, and guidance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort is realigned to PE 0603463A / Project AR6 (Understanding the Environment as a Threat Advanced Technology) in FY 2020.	-	1.903	-
Title: Chemical Sensing in Contested Environments ***Description:*** This effort provides robust tools for environmental reconnaissance missions and environmental sensing technologies for mission readiness. Supports Modernization Priority C3I Persistent Surveillance. Enhanced situational understanding reduces surprise, and can prevent detection, acquisition and engagement. ***FY 2019 Plans:*** Demonstrate advanced environmental sensor technologies to enable rapid collection and data analysis of environmental information. Demonstrate printed, functionalized carbon nano-tube sensor elements to promote properties critical for sensing contaminants of interest (e.g., copper, arsenic, and nitrites), and demonstrate/validate experimental protocols for improved selectivity for passive samplers. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** This effort is realigned to PE 0603463A / Project AR8 (Sensing in Contested Environments Advanced Technology) in FY 2020.	-	1.662	-
Title: FY 2019 SBIR / STTR Transfer	-	0.120	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03E / *Environmental Restoration Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer			
Accomplishments/Planned Programs Subtotals	6.559	6.780	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603728A / *Environmental Quality Technology Demonstrations*	Project (Number/Name) 03F / *Environmental Quality Tech Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
03F: *Environmental Quality Tech Demonstrations (CA)*	-	19.000	20.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.000

A. Mission Description and Budget Item Justification

Congressional increases supporting the maturation and demonstration of technologies that assist the Army in becoming environmentally compliant and limiting future liability without compromising readiness or training assets critical to the success of the future force.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by the Army Engineer Research and Development Center (ERDC), Vicksburg, Mississippi.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Autonomous Transport Innovation ***FY 2018 Accomplishments:*** Autonomous Transport Innovation ***FY 2019 Plans:*** Autonomous Transport Innovation	5.000	5.000
Congressional Add: Depleted Uranium Cleanup ***FY 2018 Accomplishments:*** Depleted Uranium Cleanup	4.000	-
Congressional Add: Rapid Safe Carbon Nanotechnology Research ***FY 2018 Accomplishments:*** Rapid Safe Carbon Nanotechnology Research ***FY 2019 Plans:*** Rapid Safe Carbon Nanotechnology Research	10.000	8.000
Congressional Add: Smart Bases ***FY 2019 Plans:*** Smart Bases	-	5.000
Congressional Add: Environmental Sensors for Explosives ***FY 2019 Plans:*** Environmental Sensors for Explosives	-	2.000
Congressional Adds Subtotals	19.000	20.000

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603728A / *Environmental Quality Technology Demonstrations*	**Project (Number/Name)** 03F / *Environmental Quality Tech Demonstrations (CA)*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army												Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603734A *I Military Engineering Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	96.586	101.438	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	198.024
T08: *Combat Eng Systems*	-	31.386	25.838	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	57.224
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	65.200	75.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	140.800

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being realigned, with continuity of effort realigned to the following PEs:
* PE 0603119A Ground Advanced Technology Projects
* PE 0603462A Next Generation Combat Vehicle Advanced Technology
* PE 0603463A Network C3I Advanced Technology
* PE 0603465A Future Vertical Lift Advanced Technology
* PE 0603466A Air and Missile Defense Advanced Technology

A. Mission Description and Budget Item Justification

This Program Element (PE) demonstrates data and information architectures and software applications, as well as sensing systems, that can be used to provide Warfighters with timely, accurate, easily interpretable data and information for the operational and tactical mission environments, focusing on physical and human terrain and weather; methodologies, software applications, and hardware for improving ground vehicle mobility and countermobility to support ground force operations including manned-unmanned teaming; demonstrates material technologies and tools for force projection, and sustainment. This PE also demonstrates subsystems and systems to increase the survivability of personnel, critical assets, and facilities through structures, shields, and barriers to combat highly adaptive and increasingly severe threats; and systems and interoperable systems of systems for detecting threats, assessing situations, defending against threats, and communicating information and warnings for force protection.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this PE is led by the Army Engineering Research and Development Center (ERDC)

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A *I Military Engineering Advanced Technology*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	32.448	25.864	26.236	-	26.236
Current President's Budget	96.586	101.438	0.000	-	0.000
Total Adjustments	64.138	75.574	-26.236	-	-26.236
• Congressional General Reductions	-0.022	-0.026			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	65.200	75.600			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.040	-			
• Adjustments to Budget Years	-	-	-26.236	-	-26.236

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*		
Congressional Add: *Resilient Energy Systems*	1.000	1.000
Congressional Add: *Visualization Research and Asset Characterization*	2.000	-
Congressional Add: *Remote Soil Analysis*	2.000	-
Congressional Add: *Passive Remote Sensing from Underground Threats*	3.000	-
Congressional Add: *Novel Technologies*	2.000	-
Congressional Add: *Additive Manufacturing/3D Printing*	2.000	2.000
Congressional Add: *Advanced Polymer Development*	5.000	20.000
Congressional Add: *Bathymetric-topographic LIDAR Research*	8.000	8.200
Congressional Add: *Demonstration of Ultra-high Efficiency Natural Gas Technologies*	4.000	-
Congressional Add: *Emerging Natural Gas Technologies*	10.000	-
Congressional Add: *Energy Efficient Window Insulation Research*	5.000	-
Congressional Add: *Heavy Vehicle Simulator Research*	8.200	-
Congressional Add: *Inferential Sensing on Tactical Wheeled Vehicles*	5.000	-
Congressional Add: *Reliable Distributed Generation in Austere Environments*	3.000	-
Congressional Add: *Sensor Protection from Underground Threats*	5.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603734A *I Military Engineering Advanced Technology*

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Congressional Add: *Extreme Terrain Research*	-	4.000
Congressional Add: *Secure Management of energy generation and storage*	-	3.000
Congressional Add: *Rapid low energy mobile manufacturing*	-	3.000
Congressional Add: *Centrifuge Enabled Research*	-	2.500
Congressional Add: *Energy and technology research in cold and arctic regions*	-	4.000
Congressional Add: *ERDC Collaboration (Transportation System Assessment Technologies)*	-	2.000
Congressional Add: *Natural Gas technology*	-	4.000
Congressional Add: *Reliable Distributed Energy in Austere Environments*	-	3.000
Congressional Add: *Research Facility Modernization*	-	2.000
Congressional Add: *Research in the Permafrost environment*	-	4.000
Congressional Add: *Secure and resilient power generation in cold region environments*	-	5.000
Congressional Add: *Silicone anode technology*	-	4.000
Congressional Add: *Transportation infrastructure evaluation system*	-	3.900
Congressional Add Subtotals for Project: T15	65.200	75.600
Congressional Add Totals for all Projects	65.200	75.600

Change Summary Explanation

FY18 congressional adds for: Additive Manufacturing/3D Printing; Advanced Polymer Development; Bathymetric-topographic LIDAR Research; demo of ultra-high efficiency natural gas techniques; emerging natural gas techniques; energy efficient window insulation research; heavy vehicle simulator research; inferential sensing on tactical wheeled vehicles; reliable distributed generation in austere environments; and sensor protection form underground threats.

FY19 congressional adds for: secure management of energy generation and storage; rapid low energy mobile manufacturing; additive manufacturing/3-D printing; advanced polymer development; bathymetric-topographic LiDAR research; centrifuge enabled research; energy technology research in cold and arctic regions; ERDC collaboration; extreme terrain research; natural gas technology; reliable distributed energy in austere environments; research facility modernization; research in the permafrost environment; resilient energy systems; secure and resilient power generation in cold region environments; silicon anode technology; and transportation infrastructure evaluation system.

FY20 reduction - PE eliminated due to Science and Technology portfolio Financial Restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T08 / *Combat Eng Systems*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
T08: *Combat Eng Systems*	-	31.386	25.838	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	57.224

Note

In FY20 this Project is being realigned to:
Program Element (PE) 0603119A Ground Advanced Technology, Projects:
* BL6 Expedient Passive Protection for Critical Assets Advanced Technology
* BL8 Power Projection in A2/AD Environments Advanced Technology
* BM1 Protection from Advanced Weapon Effects Advanced Technology
PE 0603462A Next Generation Combat Vehicle Advanced Technology, Projects:
* BF2 Autonomous Ground Resupply (AGR) Advanced Technology
* BG3 Modeling & Simulation for MUMT Advanced Technology
PE 0603463A Network C3I Advanced Technology, Projects:
* AO9 Information Trust Advanced Technology
* AS9 Asymmetric Vision by Persistent Geophysical Sensing and Infrasound Advanced Technology
* AT3 Subterranean Detection and Monitoring Advanced Technology
* AU4 Geospatially Enabled Operational Design (GEOD) Advanced Technology
* AT8 Network-Enabled GeoSpatial and GEOINT Services Advanced Technology
* AU6 Automated Analytics for Understanding the Operational Environment Advanced Technology
* AU1 Tactical GeoSpatial Information Capabilities Advanced Technology
PE 0603465A Future Vertical Lift Advanced Technology, Project:
* AL3 High Performance Computing for Rotorcraft Applications Advanced Technology
PE 0603466A Air and Missile Defense Advanced Technology, Project:
* AE3 Unconventional Countermeasures & Survivability Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software and architectures for geospatial mapping applications and decision aids for the Warfighter. Project components, systems, system of systems, and decision aids enable ground vehicle mobility (freedom of movement), including force projection, and counter-mobility to impede movement of threat forces. Additional components, systems, system of systems for survivability support protection of personnel, facilities, and assets through design and reinforcement of structures, and for force protection to detect, assess, and defend against threats for troops and critical fixed and semi-fixed assets. Protection measures support force projection in areas such as air and sea ports of debarkation, dispersed small units, and units operating in complex and urban environments, which may include subterranean challenges. Work is in support of current and future ground force operations and future vertical lift. Software and architectures for geospatial projects mature and validate geospatial decision tools in support of operations planning and decision making to advance utility of geospatial capability and techniques across the Army, services, and coalition, and to advance and mature the information architecture that supports the total Army's discovery and access to data, geospatial

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

information, and analytical tool suites. Methods to characterize and visualize behavior and population dynamics mature and validate efforts to portray the operational environment including culture, demographics, terrain, climate, and infrastructure, into geospatial frameworks. Force protection activities are focused on filling critical gaps in protecting forces operating in disbursed small units over complex and urban terrain and include maturation, integration, and demonstration of components, systems, and systems of systems for rapidly deployable threat detection in direct line-of-site and nonline-of-site environments; situation assessment to help reduce false alarms and decrease manpower required to monitor the environment; and passive protection to mitigate blast and weapon effects from advanced and emerging threats. Work in survivability and force protection also includes maturing and demonstrating software to characterize blast effects generated from explosive events, such as improvised explosive device detonation in soils, and supports design and decision aids. Force protection activities are also focused on protection of critical assets and infrastructure required to project forces into denied access areas. Work in mobility and force projection includes maturing and demonstrating software and hardware to assess and improve freedom of movement for ground forces, including autonomous ground resupply and manned-unmanned teaming and demonstrates infrastructure health monitoring assessment technologies to support emerging projection challenges in complex, contested environments such as distributed sustainment over large distances. Engineered Resilient Systems (ERS) activities focus on developing capabilities for "upfront engineering" that will result in more operationally efficient and resilient systems that are more affordable in a more rapid fashion. This effort develops and demonstrates an end-to-end thread involving analysis to inform requirements, reduce risk, and assess lifecycle cost pre-milestone A through tradespace analytics for selected systems of interest.

This work is being fully coordinated and is complementary to the ERS work described in the Office of the Secretary of Defense (OSD) Program Element (PE) 0603832/ Project D8Z.

This work is fully coordinated with and complementary to PE 0602784A (Military Engineering Technology). Geospatial activities are coordinated with the National Geospatial Intelligence Agency (NGA). Autonomous ground resupply activities are coordinated with PEs 0603005A (Combat Vehicle and Automotive Advanced Tech) / Project 515 (Robotic Ground Systems), and PE 0602601A (Combat Vehicle and Automotive Technology) / Project H77 (National Automotive Center), and 0602601A (Combat Vehicle and Automotive Technology) / H91 (Ground Vehicle Technology) in collaboration with the Tank and Automotive Research, Development and Engineering Center (TARDEC). Autonomous ground resupply activities are also coordinated with PEs 0603001A (Warfighter Advanced Technology) / Project 543 (Ammunition Logistics), PE 0604639A (Weapons and Munitions - Advanced Development) / EC3 (Ammunition Logistics Prototyping), and 0605805A (Munitions Standardization, Effectiveness and Safety) / Project 297 (Mun Survivability & Log). Unconventional Countermeasure activities are coordinated with PE 0602720A (Environmental Quality Technology) / Project 835 (Mil Med Environ Crit) and PE 0603728 (Environmental Quality Technology Demonstrations) / Project 03E (Environmental Restoration Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The work cited is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this Project is led by the Army Engineering Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Geo-Enabled Mission Command Enterprise	-	2.832	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures methods and demonstrates data, information, and software tools and architectures to bring physical and human terrain and effects data into decision frameworks for consistent and accurate implementation in the Army Geospatial Enterprise (AGE). This provides ready-access of low-overhead, light-weight, analytic tools to other Services and the Department of Defense (DoD) and increases situational awareness of the operational environment in support of mission planning and operations. ***FY 2019 Plans:*** Mature a flexible Army geospatially-enabled planning environment that enables mission analysis and development of staff estimates (such as Intelligence Preparation of the Battlefield) at the tactical level that enables data synchronization with the Command Post Computing Environment systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort is realigned to PE0603463A, Project AU4, (Geospatially Enabled Operational Design (GEOD) Advanced Technology).			
Title: Map-Based Planning Services (MBPS) ***Description:*** This effort matures geospatially enabled, collaborative mission planning capabilities providing services, data, and information to Army planners, staffs, and leaders. These mission planning capabilities will allow collecting, processing, storing, displaying, and sharing of authoritative data and information in a geo-temporal context. Work will leverage a Standard Shareable Geospatial Foundation provided by the AGE and incorporate Geo-Enabled Mission Command tools and analytical capabilities. This effort continues work that was part of Geo-Enabled Mission Command Enterprise and matures work in PE 0602784A/Project 855.	8.568	-	-
Title: GeoIntelligence - Enabling Technology Demonstration ***Description:*** This effort provides demonstration of analytic tools and algorithms that use multi-source (e.g. optical, Light detection and ranging (LiDAR)), multiplatform (e.g. satellite, light Unmanned Aerial Vehicle (UAV)), multi-temporal image sources to build urban tactical decision aids suitable for use on mobile devices to provide geospatial analysis to the Army, other Services, and DoD, in support of mission planning and operations (such as small units in an urban setting). This effort continues work that was part of Geo-Enabled Mission Command Enterprise. ***FY 2019 Plans:***	2.000	1.938	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Develop man/machine learning algorithms to automate production processes, to enable change detection, and to support learning by manned and autonomous systems with the capability to collect and/or complete 3D high-resolution common operating picture of complex and urban terrain. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort is realigned to PE0603463 Project AU1 (Tactical GeoSpatial Information Capabilities Advanced Technology), and Project AT8 (Network-Enabled GeoSpatial and GEOINT Services Advanced Technology).			
Title: Human Geography Demonstration ***Description:*** This effort matures and demonstrates the integration of behavior and population dynamics research and analysis into geospatial frameworks to depict aspects of the operational environment including culture, demographics, terrain, climate, and infrastructure for mission planning and awareness. Efforts include exploitation of existing open source text, leveraging multi-media and cartographic materials, and data collection methods from the tactical edge to characterize parameters of social, cultural, and economic geography of special interest to the Warfighter. ***FY 2019 Plans:*** Demonstrate methods for military assessment of population vulnerability and resilience disruptors as a result of combat, disasters, disease, etc., within dense urban and complex environments; demonstrate computational models to support a federated model approach for complex urban systems; and will develop methodologies to support the military decision making process addressing the impacts of the physical, ecological, and sociocultural environments relative to contingency base site selection, design, operations and maintenance. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort ends in FY19.	1.000	0.969	-
Title: Austere Entry and Maneuver Support Demonstrations ***Description:*** This effort matures and demonstrates improved means for achieving force projection in in austere and complex environments and integrated sensing and simulation systems for predicting physical conditions in these operational environments. This effort matures and demonstrates technologies to assess, construct, or repair infrastructure required to support entry, sustainment, and maneuver operations in complex and contested battlespaces. This effort matures and demonstrates simulation technology for manned-unmanned teaming maneuver. ***FY 2019 Plans:*** Mature real-time hardware-in-the-loop simulator to validate autonomous vehicle maneuver configurations and will demonstrate performance through field experiments. Demonstrate obstacle detection software to support real-time mobility decisions in urban environments. Mature and demonstrate near-real time infrastructure monitoring technology that automates analyses of seismic-	6.889	6.682	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
infrasound-acoustic-meteorological (SIAM) data to eliminate subject matter expert requirement and will mature toolkits to support littoral zone maneuver and vehicle operating surfaces assessment. Mature all-season austere entry and sustainment node decision support tools for site selection. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort is realigned to PE0603463 Project AS9 (Asymmetric Vision by Persistent Geophysical Sensing and Infrasound Advanced Technology); and PE0603462 Project BG3 (Modeling & Simulation for MUMT Advanced Technology), and Project BF2 (Autonomous Ground Resupply (AGR) Advanced Technology); and PE0603119A Project BL8 (Power Projection in A2/AD Environments Advanced Technology).			
Title: Adaptive Protection Demonstrations ***Description:*** This effort validates protection solutions for facilities and critical assets, including fixed and semi-fixed. A focus will be on technologies to defeat new and emerging advanced weapons threats. Technologies include: low-logistics protective construction and facility protection, use of indigenous materials, innovative structural hardening and retrofit, and the synergistic use of unconventional countermeasures to increase the effectiveness of protection to critical assets. This effort also demonstrates rapidly deployable protective measures and retrofit technologies for use in urban environments. ***FY 2019 Plans:*** Mature and demonstrate urban building assessment tool and mature retrofit technologies to ensure safe building occupation decisions for dismounted soldiers in urban environments. Mature and demonstrate rapid signature reduction methods to increase critical asset survivability. Mature perimeter security and surveillance monitoring and detection systems to detect, track, and classify subterranean and other threat activities. Mature and demonstrate new protective technologies to defeat future near-peer adversarial threats. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort is realigned to PE0603463 Project AT3 (Subterranean Detection and Monitoring Advanced Technology); PE0603466 Project AE3 (Unconventional Countermeasures & Survivability Advanced Technology); and PE0603119A Project BL6 (Expedient Passive Protection for Critical Assets Advanced Technology), and Project BM1 (Protection from Advanced Weapon Effects Advanced Technology).	7.929	7.794	-
Title: Engineered Resilient Systems ***Description:*** This effort matures and demonstrates capabilities (tools and methodologies) to rapidly create high-fidelity environmental data to support the simulation of system performance for different Army missions in various geographic settings worldwide; provide input to and obtain output from combat simulations for different echelons pertaining to system performance; and conduct system trades that consider system performance in different operational environments and mission contexts. The	5.000	4.844	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Engineered Resilient Systems (ERS) initiative has been identified as a Science and Technology emphasis area by the Assistant Secretary of Defense for Research and Engineering, ASD(R&E). This effort focuses on Army systems of interest and on high-fidelity environmental data for the associated battlespace, on linkages to force-on-force combat simulations representing the systems of interest, and on tools to explore trades in order to help inform requirements, reduce risk, and assess lifecycle cost pre-milestone A. ***FY 2019 Plans:*** Validate environmental effects as they relate to the acquisition of Army aviation, ground vehicle, and sensor platforms; develop workflow automation processes for these platforms; integrate mission effectiveness into the resulting tradespaces; leverage emerging data analytics techniques and machine learning algorithms to optimizes insight prior to acquisition decision points; develop novel methodologies through the use of environmental simulation, tradespace analytics, and computational prototyping of Army systems. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort is realigned to PE0603465 / Project AL3 (High Performance Computing for Rotorcraft Applications Advanced Technology).			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.779	-
Accomplishments/Planned Programs Subtotals	31.386	25.838	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T08 / *Combat Eng Systems*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army				Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603734A / *Military Engineering Advanced Technology*	Project (Number/Name) T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*		

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
T15: *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*	-	65.200	75.600	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	140.800

A. Mission Description and Budget Item Justification

This is a Congressional Interest Item for Military Engineering Technology Demonstrations.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Resilient Energy Systems ***FY 2018 Accomplishments:*** Resilient Energy Systems ***FY 2019 Plans:*** Resilient Energy Systems	1.000	1.000
Congressional Add: Visualization Research and Asset Characterization ***FY 2018 Accomplishments:*** Visualization Research and Asset Characterization	2.000	-
Congressional Add: Remote Soil Analysis ***FY 2018 Accomplishments:*** Remote Soil Analysis	2.000	-
Congressional Add: Passive Remote Sensing from Underground Threats ***FY 2018 Accomplishments:*** Passive Remote Sensing from Underground Threats	3.000	-
Congressional Add: Novel Technologies ***FY 2018 Accomplishments:*** Novel Technologies	2.000	-
Congressional Add: Additive Manufacturing/3D Printing ***FY 2018 Accomplishments:*** Additive Manufacturing/3D Printing ***FY 2019 Plans:*** Additive Manufacturing/3D Printing	2.000	2.000
Congressional Add: Advanced Polymer Development ***FY 2018 Accomplishments:*** Advanced Polymer Development ***FY 2019 Plans:*** Advanced Polymer Development	5.000	20.000
Congressional Add: Bathymetric-topographic LIDAR Research	8.000	8.200

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
FY 2018 Accomplishments: Bathymetric-topographic LIDAR Research ***FY 2019 Plans:*** Bathymetric-topographic LIDAR Research		
Congressional Add: Demonstration of Ultra-high Efficiency Natural Gas Technologies ***FY 2018 Accomplishments:*** Demonstration of Ultra-high Efficiency Natural Gas Technologies	4.000	-
Congressional Add: Emerging Natural Gas Technologies ***FY 2018 Accomplishments:*** Emerging Natural Gas Technologies	10.000	-
Congressional Add: Energy Efficient Window Insulation Research ***FY 2018 Accomplishments:*** Energy Efficient Window Insulation Research	5.000	-
Congressional Add: Heavy Vehicle Simulator Research ***FY 2018 Accomplishments:*** Heavy Vehicle Simulator Research	8.200	-
Congressional Add: Inferential Sensing on Tactical Wheeled Vehicles ***FY 2018 Accomplishments:*** Inferential Sensing on Tactical Wheeled Vehicles	5.000	-
Congressional Add: Reliable Distributed Generation in Austere Environments ***FY 2018 Accomplishments:*** Reliable Distributed Generation in Austere Environments	3.000	-
Congressional Add: Sensor Protection from Underground Threats ***FY 2018 Accomplishments:*** Sensor Protection from Underground Threats	5.000	-
Congressional Add: Extreme Terrain Research ***FY 2019 Plans:*** Extreme Terrain Research	-	4.000
Congressional Add: Secure Management of energy generation and storage ***FY 2019 Plans:*** Secure Management of energy generation and storage	-	3.000
Congressional Add: Rapid low energy mobile manufacturing ***FY 2019 Plans:*** Rapid low energy mobile manufacturing	-	3.000
Congressional Add: Centrifuge Enabled Research ***FY 2019 Plans:*** Centrifuge Enabled Research	-	2.500
Congressional Add: Energy and technology research in cold and arctic regions	-	4.000

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
FY 2019 Plans: Energy and technology research in cold and arctic regions		
Congressional Add: ERDC Collaboration (Transportation System Assessment Technologies) ***FY 2019 Plans:*** ERDC Collaboration (Transportation System Assessment Technologies)	-	2.000
Congressional Add: Natural Gas technology ***FY 2019 Plans:*** Natural Gas technology	-	4.000
Congressional Add: Reliable Distributed Energy in Austere Environments ***FY 2019 Plans:*** Reliable Distributed Energy in Austere Environments	-	3.000
Congressional Add: Research Facility Modernization ***FY 2019 Plans:*** Research Facility Modernization	-	2.000
Congressional Add: Research in the Permafrost environment ***FY 2019 Plans:*** Research in the Permafrost environment	-	4.000
Congressional Add: Secure and resilient power generation in cold region environments ***FY 2019 Plans:*** Secure and resilient power generation in cold region environments	-	5.000
Congressional Add: Silicone anode technology ***FY 2019 Plans:*** Silicone anode technology	-	4.000
Congressional Add: Transportation infrastructure evaluation system ***FY 2019 Plans:*** Transportation infrastructure evaluation system	-	3.900
Congressional Adds Subtotals	65.200	75.600

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603734A / *Military Engineering Advanced Technology*	**Project (Number/Name)** T15 / *MILITARY ENGINEERING TECHNOLOGY DEMONSTRATION (CA)*

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603772A *I Advanced Tactical Computer Science and Sensor Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	50.637	43.856	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	94.493
101: *Tactical Command and Control*	-	21.707	17.588	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.295
1AA: *Tactical Computer Science Demonstrations (CA)*	-	0.000	9.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.000
243: *Sensors And Signals Processing*	-	28.930	17.268	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.198

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is being eliminated, with continuity of effort realigned to the following PEs:
* PE 0603462A Next Generation Combat Vehicle Advanced Technology
* PE 0603463A Network C3I Advanced Technology
* PE 0603466A Air and Missile Defense Advanced Technology

A. Mission Description and Budget Item Justification

This PE matures and demonstrates technologies that allow the Warfighter to effectively collect, analyze, transfer and display situational awareness information in a network-centric battlefield environment, and the technologies that enable the integration of Robotics and Autonomous Systems (RAS) through Mission Command. It matures and demonstrates architectures, hardware, software and techniques that enable synchronized mission command (MC) during rapid, mobile, dispersed and Joint operations. Project 101 matures software, algorithms, services and devices to more effectively integrate MC across all echelons and enable more effective utilization of Warfighter resources including intelligent power management and distribution through accelerated information to decisions and rapid MC on the move. Project 243 matures and demonstrates signal processing and information/intelligence fusion software, algorithms, services and systems for Army sensors; radio frequency (RF) systems to track and identify enemy forces and personnel; and multi-sensor control and correlation software and algorithms to improve reconnaissance, surveillance, tracking, and target acquisition.

Work in this PE complements PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602303A (Missile Technology), PE 0602705A (Electronics and Electronic Devices), PE 0602782A (Command, Control, Communications Technology), and PE 0603270A (Electronic Warfare Technology), and is coordinated with PE 0602783A (Computer and Software Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*	**R-1 Program Element (Number/Name)** PE 0603772A *I Advanced Tactical Computer Science and Sensor Technology*

Work in this PE is performed by the Research, Development, and Engineering Command, Aberdeen Proving Ground, MD.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	52.206	34.883	39.847	-	39.847
Current President's Budget	50.637	43.856	0.000	-	0.000
Total Adjustments	-1.569	8.973	-39.847	-	-39.847
• Congressional General Reductions	-0.032	-0.027			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	9.000			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.537	-			
• Adjustments to Budget Years	-	-	-39.847	-	-39.847

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 1AA: *Tactical Computer Science Demonstrations (CA)*		
Congressional Add: *Assured Positioning, Navigation and Timing*	-	9.000
Congressional Add Subtotals for Project: 1AA	-	9.000
Congressional Add Totals for all Projects	-	9.000

Change Summary Explanation

FY19 congressional add for assured position, navigation, and timing.
FY20 reduction -- PE eliminated due to S&T Financial Restructuring.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	Project (Number/Name) 101 / *Tactical Command and Control*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
101: *Tactical Command and Control*	-	21.707	17.588	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	39.295

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603462A Next Generation Ground Combat Vehicle Advanced Technology, Project:
* BH3 C4ISR Modular Autonomy Advanced Technology
PE 0603463A Network C3I Advanced Technology, Project
* AQ8 High Tempo Data Driven Decision Tools Adv Tech
* AV8 Navigation Warfare (NAVWAR) Advanced Technology
* AW2 Autonomous Navigation Advanced Technology
* AW4 DoD PNT M&S Collaborative Initiative (CI) Adv Tech
* AW6 Modular GPS Independent Sensors Advanced Tech
* AR2 Energy Informed Operations Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software, algorithms, services and devices that move and display timely and relevant information across the battlefield to provide Commanders at all echelons with situational awareness (SA) that allows them to understand, decide and act faster than their adversaries. This project also matures and demonstrates software, algorithms and devices supporting information storage and retrieval; digital transfer and display of battlefield SA, with an emphasis on positioning, navigation, and timing (PNT) and power and energy resource information while keeping in mind the cognitive limit of the Soldier's use of software, algorithms and services optimized for expeditionary and uninterrupted mission command.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Assistant Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Integrated Mission Command (MC)	5.904	7.398	-
Description: This effort matures and demonstrates technologies to simplify mission command (MC) software and data architectures and reduce complexity in all battlefield environments, to include command post (CP), mounted, and dismounted operations. Work accomplished under Program Element (PE) 0602782A/Project 779 complements this effort. Beginning in Fiscal Year (FY) 18, work supporting expeditionary mission command is moved to an ?Expeditionary MC? program.			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Develop and mature software demonstrators that implement artificial intelligence techniques including intelligent agents to assess mission objectives against the current situation to facilitate situational understanding; optimize software to visualize when the current situation is deviating from the commander's intent with continuous running estimates and an on-going analysis of risks and opportunities; mature software and algorithms to integrate Robotics and Autonomous Systems (RAS) with MC information systems to better allow Commanders the ability to plan, monitor and incorporate RAS into unit formations and missions and assist the development of doctrine. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20 this effort is realigned to PE 0603462A / Project BH3 and PE 0603463A / Project AQ8			
Title: Expeditionary Mission Command (MC) ***Description:*** This effort matures and demonstrates hardware and software command post (CP) enabling technologies to support expeditionary maneuver and effective, uninterrupted MC operations. Work accomplished under PE 0602782A/project 779 complements this effort. In FY19, effort is realigned in support of the Army science and technology (S&T) Modernization priorities for Network/Command, Control, Communications and Intelligence (C3I).	6.147	-	-
Title: Assured Positioning, Navigation and Timing (A-PNT) ***Description:*** This effort matures, demonstrates and performs modeling and simulation (M&S) of positioning, navigation, and timing (PNT) technologies to provide access to trusted PNT information in global positioning system (GPS)-denied or degraded environments. Work being accomplished under PE 0602782A/Project 779 complements this effort. ***FY 2019 Plans:*** Improve the performance of a Navigation Warfare (NAVWAR) breadboard that will enable continued operations in hostile, GPS denied environments by integrating electronic attack, electronic protection and electronic support hardware and software; incorporate the new Military Code (M-Code) GPS signal for offensive and defensive NAVWAR operations into the breadboard; mature and code a PNT situational awareness software tool utilizing existing sensors and GPS receivers; mature and demonstrate a hardware solution using multi-GNSS signals for integrity monitoring; integrate PNT technologies such as radio frequency (RF) ranging beacons for in-building navigation to augment PNT solutions for mounted and dismounted platforms; mature and demonstrate two way time transfer hardware that will provide accurate time to users and systems in the absence of GPS; and conduct advanced modeling and simulation (M&S) of PNT sensors, systems, and platforms to validate M&S environment to support Joint analysis of effects of PNT and PNT based attacks to Joint United States (U.S.) forces. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	7.651	7.884	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
In FY20, this effort realigns to PE0603463A/Project AV8 (Navigation Warfare Advanced Technology), AW2 (Autonomous Navigation Advanced Technology), AW4 (DoD PNT M&S Collaborative Initiative Adv Tech), and AW6 (Modular GPS Independent Sensors Advanced Tech).			
Title: Advanced Intelligent Power Management & Distribution ***Description:*** This effort matures and demonstrates advanced power and thermal management and distribution technologies for command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) applications as well as validates and integrates designs in power generation, hybrid energy storage, and assessments Work accomplished under PE 0602705A/Project H11 complements this effort. ***FY 2019 Plans:*** Mature and demonstrate alternating current power source self-tuning protocols to manage synchronization in multi-power source configurations in support of ad-hoc arrangements of power equipment for emerging Command, Control, Communications, computers, Intelligence, Surveillance and Reconnaissance (C4ISR) systems; validate tuning protocols to ensure stability and robustness of intelligent power systems to support unique load profiles generated by directed energy, high power sensors, and electromagnetic weapon systems; integrate multiple-master control methodologies into intelligent power system software controllers to allow power sharing on C4ISR platforms like vehicles, airframes or other platforms with intelligent power loads that must join together in an ad-hoc power network with competing prioritizations; validate single-bus vs. multiple-bus implementation of multiple-master control strategy hardware configurations. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort realigns to PE 0603463A / Project AR2 (Energy Informed Operations Advanced Technology).	2.005	1.960	-
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.346	-
Accomplishments/Planned Programs Subtotals	21.707	17.588	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 101 / *Tactical Command and Control*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	Project (Number/Name) 1AA / *Tactical Computer Science Demonstrations (CA)*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
1AA: *Tactical Computer Science Demonstrations (CA)*	-	0.000	9.000	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	9.000

A. Mission Description and Budget Item Justification

Congressional Interest Item funding for Tactical Computer Science and Sensor advanced technology development.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Assured Positioning, Navigation and Timing	-	9.000
FY 2019 Plans: Assured Positioning, Navigation and Timing		
Congressional Adds Subtotals	-	9.000

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*				Project (Number/Name) 243 / *Sensors And Signals Processing*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
243: *Sensors And Signals Processing*	-	28.930	17.268	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	46.198

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* AO1 UNT - Every Receiver is a Sensor Advanced Tech
* AV4 Foundational S&T for Network C3I Advanced Tech
PE 0603466A Air and Missile Defense Advanced Technology, Project:
* AD6 Next Generation Fires Radar Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates improved radar, sensor fusion, and correlation software, services, devices and systems for wide area reconnaissance, surveillance, tracking and targeting of ground and aerial platforms and individuals, including complex and urban environments. Sensor fusion efforts mature and demonstrate software, algorithms and services for sensor management, data correlation, and relationship discovery for a multi-intelligence fusion system. Sensor and simulated sensor candidates may include moving-target-indicator/synthetic aperture radar, electro-optical/infrared (EO/IR), signals intelligence (SIGINT), measurements and signatures intelligence (MASINT), human intelligence (HUMINT), multiple intelligence (Multi-Int) and biometrics.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Assistant Secretary of Defense, Research and Engineering priority focus areas and the Army Modernization Strategy.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Collaborative Intelligence, Surveillance and Reconnaissance (ISR) Sensor processing and analytics	2.698	4.550	-
Description: This effort develops software that gathers data from multi-function Airborne ISR sensor sources into a single common operating environment to streamline analysts processing, exploitation and dissemination (PED) workflows. The focus centers on developing scalable software that provides a near real time PED capability on board the platform with applicability at the ground stations and reach back for forensics and pattern analysis. It will increase the utility of moving target indicator (MTI) radar to the greater multiple intelligence (multi-INT) picture for better origin-to-destination tracking, which is crucial to understanding the higher-level threat picture and increases the effectiveness and action-ability of battlespace awareness/ intelligence data throughout an area of operations. This effort implements an open architecture extensible throughout the			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
tactical enterprise, allowing for growth to include future ISR sensors. Work being accomplished under PE 0602270/Project 906 complements this effort. ***FY 2019 Plans:*** Evaluate, and mature advanced exploitation and activity detection algorithms against real and operational datasets of full motion video and electronic support data; demonstrate advanced exploitation and activity detection algorithms, including route avoidance, co-traveler, and convoy detection, in a laboratory environment; optimize processing, exploitation and dissemination (PED) workflow development to reduce operator workload and time to develop intelligence products; complete integration into existing PED Army Tactical systems to align algorithms across platforms and ground stations to support distributed processing and intelligence exploitation; complete and transition processing and exploitation algorithms to intelligence collection platforms programs of record (POR) and PED frameworks to ground station POR. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort realigns to PE 0602150A / Project AE4 and PE 0603463A / Project AO1.			
Title: Omni-directional Situational Awareness (SA) Airborne radar technologies ***Description:*** This effort matures and demonstrates multi-function SA sensors for small unmanned air systems and other aircraft to improve sensing and detection capabilities in support of wide-area persistent surveillance.	4.753	-	-
Title: Counter-concealment Moving Target Indicator (MTI) Airborne Radar Demonstration ***Description:*** This effort will mature antenna design and signal processing and define the architecture to ensure simplified integration on a Multi-Int platform to deliver an advanced generation of airborne MTI radars. This will allow for third party mode development and exploitation techniques, with emphasis on automated target declaration and tracking. Efforts focus on antenna and signal processing advancements that allow the detection/tracking of targets despite camouflage, concealment and deception and a well-defined systems architecture to cover large areas and persistently scan named areas of interest. This effort leverages work being completed under the Omni-directional situational awareness (SA) Airborne radar technologies effort in Fiscal Year (FY) 18. ***FY 2019 Plans:*** Begin development of a Multi-Intelligence airborne ISR/RSTA and targeting radar capability, capitalizing on investments in wide band MTI/SAR radar antennas capable of Electronic Warfare, Electronic Support and Targeting. Develop scalable apertures and processing suitable for both airborne manned and unmanned platforms addressing open architecture, modularity, and scalability of the payloads. Further develop existing active electronically scanned array (AESA) antenna technology investments partnered	5.355	2.908	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
with modeling and simulation and software development tools compatible with third party mode development within a well-defined Multi-Intelligence architectures. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Realigned to support the Army?s Modernization Priorities.			
Title: Advanced All Source Fusion ***Description:*** This effort develops software technologies for intelligence/mission command (MC) mission collaboration to provide faster and higher quality decision making support for the commander and his key staff. Specific efforts focus on integrating intelligence, surveillance and reconnaissance (ISR) planning and execution at the Task Force/Battalion through troop-level, as well as efforts that provide the capability to identify, fuse, and trace/track specific targets in an asymmetric environment. Work accomplished under Program Element (PE) 0602270A/Project 906 complements this effort. In FY 2019, funds from this effort are realigned outside of this project to support the Army science and technology (S&T) Modernization priorities.	4.953	-	-
Title: Multi-mode Air Defense Radar Demonstration ***Description:*** This effort matures the architectures, processing and components necessary to deliver next generation capability, flexibility and supportability to the fires family of radar systems. Efforts focus on development of a modular and scalable open architecture that is extensible to multiple radar systems technologies in support of air defense and area/base camp protection. Work being accomplished under PE 0602270A/Project 906, 0602120A/Project H16, 0602705A/Projects EM8 and H94, 0602303A/ Project 214 and 0603270A/Project K16 complements this effort. ***FY 2019 Plans:*** Leverage the previously developed open radar architecture processing environment for algorithm/mode design, and demonstrate capability to implement additional third party modes, including multi-mission, target identification, and with a large focus on multi-static modes leveraging multiple radars for improved capabilities; complete design of interface definitions and demonstrate integration of radar antenna and processor hardware using multi-mission and multi-function modes to assess integration of software at the signal processor level; develop multi-static data alignment and fusion algorithms to leverage multiple radars for improved performance; develop concepts for advanced multi-function, multi-system resource management and proactive radar capabilities that allow systems to adapt to changes in threat scenarios, the environment, or concept of operations changes on the fly; ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, this effort realigns to PE 0603466A / Project AD6.	5.967	5.396	-
Title: Degraded Visual Environment (DVE) ? Air	5.204	3.903	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603772A / *Advanced Tactical Computer Science and Sensor Technology*	**Project (Number/Name)** 243 / *Sensors And Signals Processing*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates software and hardware for a millimeter wave radar system (conformal phased array radar) to provide obscurant penetration for terrain and object awareness while providing pilotage aids in all degraded visual environments. Work accomplished under PE 0603710A/Project K86 and 0603003A/Project 313 complements this effort. ***FY 2019 Plans:*** Integrate forward looking millimeter wave radar, small low-cost situational awareness (SA) radars, Light Detection and Ranging (LIDAR), and light detection sensors into the ground systems integration lab to support radar assessments for ground and follow-on flight testing activities; demonstrate integrated sensor data collection and fusion of the data in a multi-sensor environment to provide obscurant penetration for terrain and object awareness using the various sensors; integrate the radar collocated with SA radar, LIDAR and light detection sensors onto aircraft. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Work ends in FY19.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.511	-
Accomplishments/Planned Programs Subtotals	28.930	17.268	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*					R-1 Program Element (Number/Name) PE 0603794A *I C3 Advanced Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	32.404	52.332	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	84.736
EL4: *Tactical Comms and Networking Technology Int*	-	16.822	37.787	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	54.609
EL5: *Secure Tactical Information Integration*	-	15.582	14.545	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.127

Note

In Fiscal Year (FY) 2020 this Program Element (PE) is realigned with continuity of effort provided in the following PE:
* PE 0603463A Network C3I Advanced Technology
* PE 0603457A C3I Cyber Advanced Development

A. Mission Description and Budget Item Justification

This PE matures and demonstrates technologies to address the integrated tactical communications challenge with distributed, secure, mobile, wireless, and self-organizing communications networks and networked transceivers that must operate reliably in diverse and complex terrains and environments. Efforts demonstrate seamlessly integrated communications and information security technologies across all network tiers, ranging from unattended networks and sensors, through maneuver elements using airborne and space assets. Project EL4 matures and integrates antennas, wireless networking devices, protocols, and software; network operations tools and techniques; and combines these with current fielded networks and systems in a series of command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) network modernization demonstrations to measure their technology readiness levels and assess them against currently fielded network architectures in an operationally relevant environment. Project EL5 matures information security devices, techniques, services, software and algorithms to protect tactical wired and wireless networks against modern network attacks; generates and distributes tactical cyber situational awareness; and focuses on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions.

Work in this PE complements PE 0602782A (Command, Control, Communications Technology), and fully coordinated with PE 0602120A (Sensors and Electronic Survivability), PE 0602270A (Electronic Warfare Technology), PE 0602783A (Computer and Software Technology), PE 0603001A (Warfighter Advanced Technology), PE 0603270A (Electronic Warfare Technology) and PE 0603772A (Advanced Tactical Computer Science and Sensor Technology).

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Work in this PE is performed by U.S. Army Futures Command (AFC).

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army					Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 3: *Advanced Technology Development (ATD)*			R-1 Program Element (Number/Name) PE 0603794A *I C3 Advanced Technology*		
B. Program Change Summary ($ in Millions)	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**
Previous President's Budget	33.426	52.387	60.802	-	60.802
Current President's Budget	32.404	52.332	0.000	-	0.000
Total Adjustments	-1.022	-0.055	-60.802	-	-60.802
• Congressional General Reductions	-0.021	-0.055			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-1.001	-			
• Adjustments to Budget Years	-	-	-60.802	-	-60.802

Change Summary Explanation

FY20 decrease realigns program requirements to other PEs in the Science and Technology portfolio.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040 / 3					R-1 Program Element (Number/Name) PE 0603794A / *C3 Advanced Technology*				Project (Number/Name) EL4 / *Tactical Comms and Networking Technology Int*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
EL4: *Tactical Comms and Networking Technology Int*	-	16.822	37.787	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	54.609

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* AM7 Modular RF Communications Advanced Technology
* AM9 Protected SATCOM Advanced Technology
* AN2 Narrowband SATCOM Advanced Technology
* AN4 Non Traditional Waveforms Advanced Technology
* AN6 Prot SATCOM-WB Global SATCOM Inter Canc Adv Tech
* AO3 Robust Grey C3I Advanced Technology
* AP6 C4ISR Integrated Demonstrations Advanced Tech
* AP8 Comms Supp to CSA/Horizontal Int Fields Adv Tech
* AP9 Next Generation HF Advanced Technology
* AQ1 Spectrum Obfuscation Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates key communications and mobile networking technologies, such as antennas, transceivers, transceiver components, networking software and novel techniques to provide secure, reliable, mobile network solutions that function in complex and diverse terrains. This Project concentrates on four major goals: to provide a series of technology demonstrations of new and emerging command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) technology enabled capabilities to significantly reduce risk associated with the network-of-networks concept; to lower the size, weight, power and cost of wireless networking systems deployed on Army platforms through hardware and software convergence; to provide critical improvements in the ability to communicate and move large amounts of information in radio frequency (RF) contested environments, in a seamless, integrated manner across the Army's highly mobile manned and unmanned force structure; and to assess the technology readiness level (TRL) of emerging network technologies in an operationally relevant environment.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

This work is performed by U.S. Army Futures Command (AFC).

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Enabling C4ISR Infrastructure, formerly C4ISR On the Move (OTM) ***Description:*** This effort provides a venue for the demonstration of new and emerging Command, Control, Communications, computers, Intelligence, Surveillance and Reconnaissance (C4ISR) technologies. This venue performs field based risk reduction (FBRR) and technology readiness assessments (TRAs) by evaluating the Technology Readiness Levels (TRLs) of candidate Army science and technology (S&T) and best of Industry efforts to support tactical network modernization. The yearly themes for the integrated capabilities event are determined by the maturity of the tech base programs across the Army S&T command, control, communications and intelligence (C3I) portfolio. On an annual basis, those programs at or approaching TRL 6 will be solicited for participation based on their maturity to enter TRA in the FBRR environment located at Joint Base McGuire-Dix-Lakehurst (JB-MDL) (Fort Dix). Upon the completion of technology selection, themes will be developed that inform Army S&T, CERDEC Thrust Areas, Army Warfighting Challenges, Training and Doctrine Command (TRADOC) key technology imperatives, and the overall development of the Mission Command Network of 2025 and beyond. ***FY 2019 Plans:*** Mature and optimize S&T efforts through FBRR demonstration events; support excursions to assess early S&T efforts that are developing technologies to provide robust and adaptive networks; validate technologies prior to integration and assessment at larger Army-wide events, such as Cyber Quest; conduct an annual event for field demonstration of defensive cyber techniques to provide opportunities for red-team exploitation of defensive techniques to identify mature technologies and optimize current S&T efforts; exercise novel waveform and non-traditional spectrum technologies to demonstrate sustained communications in congested and contested radio frequency (RF) environments with high throughput and reliability; conduct a demonstration of electromagnetic spectrum signal protection technologies exercising systems to cloud the spectrum and/or directing enemy systems to non-priority platforms through techniques such as decoying to optimize management of the Army tactical network spectrum signature. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, work in this PE 0603794A/Project EL4 has been realigned to PE 0603463A/Projects AP6 in FY20 as part of the financial restructure in support of Army Modernization Priorities.	8.107	3.524	-
Title: Communications, Adaptive Networks to Improve Maneuver Operations, formerly Networking to Improve Maneuver Operations ***Description:*** This effort matures and demonstrates technologies and capabilities to provide a range of robust, reliable, scalable, interoperable and resource efficient communications capabilities to expeditionary forces and troops on the move. These capabilities will allow forces to conduct maneuver operations, develop situational understanding, and sustain operations while maintaining freedom of movement.	4.054	6.374	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
FY 2019 Plans: Exploit technologies operating at higher frequencies to move communications from congested spectrum; validate unconventional waveforms to provide increased capacity and reduced interference for operations such as distributed mission command while remaining elusive to adversary detection; validate mesh networking adaptation to adjust low probability of detection / low probability of intercept (LPI/LPD) and anti-jam enhancements, enabling to ability to adjust to the electromagnetic environment, such as enemy interference from jamming or localized congestion; optimize dismounted distributed beam-forming techniques that will enable distant network nodes to collectively operate as a single emitter to provide enhanced directivity to distant nodes ; provide enhanced situational understanding to enable an increased ability to maintain the network in a near-peer contested environment; optimize and demonstrate standard protocols and interfaces to leverage additional sensing devices and existing transceivers (e.g. spectrum sensing on networking radios); provide data analytics to parse increased spectrum sensing data to provide functional outputs); demonstrate network technologies in support of the priority Army operational capabilities (e.g. Long Range Precision Fires, Next Generation Combat Vehicle, Future Vertical Lift, Air and Missile Defense, and Soldier Lethality); optimize networking solutions to meet the needs of autonomous platforms to support manned/unmanned-teaming (MUM-T). ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20 work in this PE 0603794A/Project EL4 has been realigned to PE 0603463A/Projects AM7, AM9, AN2, AN4, AN6, AN9, AO3, AP6, AP7, AP8, AP9, AQ1.			
Title: Communications, Robust Tactical Systems, formerly Uninterrupted Communications	4.661	13.121	-
Description: This effort matures and demonstrates components, software, algorithms and technologies that enable Army tactical wireless networks to operate more efficiently in congested, contested and competitive electromagnetic environments across a multi-domain architecture for mission success. The capabilities developed in this effort provide assured uninterrupted access to critical communications and information links. Efforts will result in robust, reliable and secure terrestrial and satellite communication networks in austere, congested and hostile electromagnetic environments using cost-effective solutions while ensuring that the capability is interoperable and resource efficient. Work accomplished under PE 0602782A/Project H92 complements this effort. ***FY 2019 Plans:*** Demonstrate interference cancellation to maintain uninterrupted satellite communications for a Wideband Global Satellite Communications (WGS) Ka-band configuration; validate ground-based beam-forming algorithms to provide anti-jam access to WGS in close proximity to enemy jamming; validate interference cancellation systems to demonstrate the increased protection for different interferer types and optimize interference cancellation for the satellite modem; mature and demonstrate a cost effective solution to provide protection and operations management in the WGS communications frequency bands; validate interference cancellation systems within a laboratory environment to demonstrate the increased level of protection provided for different			

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
interferer types; optimize performance of interference cancellation integrated into satellite modems for enhanced suppression of interference in Army satellite terminals; demonstrate a solution to maintain communications in the presence of enemy jammers and prevent exploitation of the characteristics of Army communication signals through management of spectrum signatures; validate the ability to reduce the probability of detection of tactical waveforms through the use of techniques to camouflage the communications, such as the use of pseudo representative transmissions to cloud the spectrum environment with non-network emissions; improve performance of spectrum accessing waveforms through the implementation of techniques to sense the environment and avoid emissions that would result in interference; optimize deconfliction methods to limit systems from self-jamming; demonstrate protection of tactical networks and tactical assets through the use of decoying; demonstrate brassboard devices to generate varied decoying signals to present multiple signals at a given time, providing the ability to vary the platform projected; validate that decoy signals redirect threats away from valued platform and onto the decoy to enable continued operation of the valued platform; improve performance of assured long range terrestrial communications, such as high-frequency (HF), with the incorporation of low probability of detection / low probability of intercept techniques in contested environments; validate interfaces between developed reach back communication solutions and joint service solutions to enable interoperability. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20 work in this PE 0603794A/Project EL4 has been realigned to PE 0603463A/Projects AM7, AM9, AN2, AN4, AN6, AN9, AO3, AP6, AP7, AP8, AP9, AQ1.			
Title: Advanced Modular Radio Frequency (RF) ***Description:*** This effort will enable connectivity in contested & congested spectrum environments by applying modular radio frequency (RF) technologies within an automated network to adapt and continue operation under interference signals. This capability will reduce the rigorous network management through intelligent selection of diverse network connections to seamlessly transmit data and maintain communications within a contested RF environment. ***FY 2019 Plans:*** Demonstrate a system architecture for an automated network to provide a common interface to an automation algorithm with the capability to optimally select and negotiate across diverse communication links to execute an automated Primary, Alternative, Contingency, Emergency (PACE) military operational plan in support of maintaining resilient tactical communications in a contested and congested environments; demonstrate detection of locally available network products (e.g. Long Term Evolution [LTE], etc.) and incorporation of these products into the automated PACE plan process, including the ranking of the available networks for the PACE plan execution; optimize the mapping of the nodes into the network topology by the automated network through the association of the nodes and users connected to the sub-networks created by the networking technologies and products; validate standard interface specifications between the automated network and networking technologies to provide adaptability to incorporate a wide range of networking techniques and technologies into the automated network processing; mature and optimize algorithms to perform autonomous selection between network links based on link status and other	-	13.525	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
established criteria in an electromagnetic environment to provide maintain communications and overall network connectivity across multiple disparate network connections; optimize switching algorithms to seamlessly transition data flow between network connections available to the automated network as viable network connections become degraded, disrupted, or otherwise unavailable in order to maintain data integrity and throughput; optimize a common user device as the user?s input mechanism and interface to an automated network and demonstrate the reduced burden place on the user from this single device and the ability of the operator to focus on essential mission tasks rather than establishment and maintenance of the network; demonstrate techniques that will incorporate into an autonomous networking system, an ability to detect available communication systems that are both accessible and viable for the data need, and incorporate the sub-network mapping topology of each system within the autonomous mapping to identify diverse link paths; develop and mature situation-adaptive communications polling and reporting methods to inform contributing networks as to the to status of current spectrum environment changes (e.g. interference, congestion, link loss, etc.) for the network links, to optimize the functional performance based on available resiliency features of the principal links. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, work in PE 0603794A/Project EL4 has been realigned to PE 0603463A/Projects AM7, AM9, AN2, AN4, AN6, AN9, AO3, AP6, AP7, AP8, AP9, AQ1.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	1.243	-
Accomplishments/Planned Programs Subtotals	16.822	37.787	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL4 / *Tactical Comms and Networking Technology Int*

E. Performance Metrics

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 3	R-1 Program Element (Number/Name) PE 0603794A / *C3 Advanced Technology*	Project (Number/Name) EL5 / *Secure Tactical Information Integration*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
EL5: *Secure Tactical Information Integration*	-	15.582	14.545	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	30.127

Note

In Fiscal Year (FY) 2020 this Project is being realigned to:
Program Element (PE) 0603463A Network C3I Advanced Technology, Projects:
* AO9 Information Trust Advanced Technology
* AP2 Decoy and Deterrence Advanced Technology
PE 06034457A C3I Cyber Advanced Development, Project:
* 6CY Autonomous Cyber Advanced Technology

A. Mission Description and Budget Item Justification

This Project matures and demonstrates software, algorithms and services that focus on tactical cyber and cyberspace electromagnetic activities (CEMA) situational understanding (SU), autonomous network defense, cross domain security and encryption solutions to secure the Army's tactical network. Efforts focus on configuration, operation, monitoring, defense and network reconstitution in bandwidth constrained tactical environments while reducing the operator workload required to conduct these functions. This Project codes, optimizes, and demonstrates software based technologies for intrusion detection, high assurance internet protocol (IP) encryption, seamless communications across security boundaries, as well as information sharing across operations and intelligence functions. These capabilities to automate, protect, monitor, report and access cyber elements of the tactical network are intended to greatly reduce Soldier burden and protect the Army's tactical network by building upon enterprise solutions from commercial, Department of Defense, Department of the Army and other government agencies. This Project cumulatively builds science and technology capabilities in accordance with Army Cyber Material Development Strategy and the Office of the Secretary of Defense Cyber Community of Interest.

FY20 realignments are due to financial restructuring in support of Army Modernization Priorities.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

This work is performed by U.S. Army Futures Command (AFC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Title: Defensive Cyber Operations, Cyber Situational Understanding, formerly titled Cyber/CEMA Operations, Situational Awareness/Understanding	3.004	1.456	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL5 / *Secure Tactical Information Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates software and algorithms that facilitate actionable decision making through mission critical Cyber Electro Magnetic Activity (CEMA) information knowledge and by applying analysis and judgment to relevant information to help determine the relationships among the operational and mission variables across cyberspace. ***FY 2019 Plans:*** Mature CEMA workflow management tools to assist automation and decision support for Electronic Warfare Operations (EWO) and CEMA staff elements in execution and coordination of cyber SU across CEMA domains; mature a cyber SU security architecture that supports data and platform convergence across the Intel, cyber, EWO, and IO functions within a BCT TOC; mature machine learning based algorithms supporting the synchronization and correlation of DoDIN Ops management and Electromagnetic Spectrum (EMS) management within the cyber SU construct. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, work in PE 0603794A/Project EL5 has been realigned to PE 633463A/Projects AO9 and AP2.			
Title: Defensive Cyber Operations, Tactical Cyber Resilient Architectures & Platforms , formerly Cyber/CEMA Operations, Tactical Cyber Resilient Architectures & Platforms ***Description:*** This effort matures and demonstrates software, architectures and frameworks to allow systems and networks to withstand cyber-attacks, sustain or recover critical functions, and dynamically reshape cyber systems as conditions/goals change to escape harm. ***FY 2019 Plans:*** Mature cyber virtualization containment technologies to restrict and block the spread of malware within tactical command applications; mature stealthy container migration service algorithms to inhibit adversarial knowledge of virtual machine migration/ reconstitution; exploit scanning techniques to monitor, manage, and maintain virtual machine elements to facilitate the detection of anomalies within the element; provide reference implementation of computing environment to enable system to revert to a known secure state for rapid recovery after a known or suspected intrusion, exploit, or anomaly on a disadvantaged tactical network; enhance network display capabilities to map an entire network state through the sharing of network configurations via software defined networking message structures; demonstrate display tools for network state to the end user and associated tools to manipulate network state data; mature software defined networking controller algorithms to support virtual instantiations of tactical network elements to deceive and adversary?s knowledge of actual blue force elements; mature user-tailorable visualization overlays that enhance convergence and representation of information across Cyber Electro Magnetic Activity (CEMA) elements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, work in this PE 0603794A/Project EL5 has been realigned to PE 633463A/Projects AO9 and AP2.	8.572	5.875	-
Title: Defensive Cyber Operations, Trusted Self Defending Networks & Systems, formerly Cyber/CEMA Operations, Trusted Self Defending Networks & Systems	4.006	6.798	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL5 / *Secure Tactical Information Integration*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020
Description: This effort matures and demonstrates software, architectures and frameworks to support establishment of a known degree of assurance that devices, networks and cyber dependent functions perform as expected, despite attack or error and allow the Warfighter to maintain confidence in network information, resources, and identities. ***FY 2019 Plans:*** Develop a framework to support a common federated identity and access management solution for the Command Post computing environment by coupling next generation non Public Key Infrastructure (PKI) based wearable multi-factor authentication and access control technologies with authorization techniques; demonstrate access control improvements through removal of hardware focused identification methods (such as card based tokens) and instantiation of virtualized identifications with associated management and distribution solutions for tactical environments; mature application services (hashing, labeling, and integrity) to capture the lineage of tactical information flows as they traverse the network; mature data provenance techniques to enable trusted messages between producers and consumers through methods such as concealed file history; mature an enhanced reprogrammable miniaturized encryption module for tactical handhelds and Internet of Things (IoT) sensors/devices optimized for low power and low cost requirements to enable integration into smaller footprint platforms such as unmanned aerial vehicles and dismount Soldier systems; optimize a framework incorporating machine learning algorithms to capture data, model, understand, and dynamically tailor user experience and software vulnerability analysis results based on evidence collected; and provide a plug-in to enable rapid insertion of new software assurance methods through automated incorporation and application of the methods to existing software and firmware. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** In FY20, work in this PE 0603794A/Project EL5 has been realigned to PE 633463A/Projects AO9 and AP2.			
Title: FY 2019 SBIR / STTR Transfer ***Description:*** FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.416	-
Accomplishments/Planned Programs Subtotals	15.582	14.545	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 3	**R-1 Program Element (Number/Name)** PE 0603794A / *C3 Advanced Technology*	**Project (Number/Name)** EL5 / *Secure Tactical Information Integration*

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A