Department of Defense
Fiscal Year (FY) 2025 Budget Estimates

March 2024

Army

Justification Book Volume 1b of 1

Research, Development, Test & Evaluation, Army

RDT&E − Volume I, Budget Activity 2

Volume 1b Table of Contents

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, $14,073,308,000.00 to remain available for obligation until September 30, 2026.

The FY 2025 Overseas Operational Costs accounted for in the Base budget total $3,157 thousand.

FY 2023 includes $7,626 thousand in Overseas Operations Costs (OOC) Actuals. FY 2024 includes $3,166 thousand in OOC Requested. FY 2025 includes $3,157 thousand for the OOC Budget Estimate. OOC were financed previously with former Overseas Contingency Operations (OCO) funding.

COST STATEMENT

The following Justification Books were prepared at a cost of $277,115.51 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 5C, Budget Activity 5D, Budget Activity 6, Budget Activity 7, and Budget Activity 8.

FY 2025 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 2025.

2.   Relationship of the FY 2025 Budget Submitted to Congress to the FY 2024 Budget Submitted to Congress. This paragraph provides a list of program elements/projects that are major new starts 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	0602148A / CC3	FVL Radar Technologies
02	0602183A / DK1	Air Vehicle Integrated & Alternative Tech (AVIATe)
02	0602386A / SM1	Scale-Up Microbial Products for Biomanufacturing
02	0602150A / SU1	Counter Small Unmanned Aircraft Sys (C-sUAS) Tech
03	0603464A / CE9	Armaments Advanced Technology
03	0603119A / DI9	Comprehensive Adapt Operational Energy Adv Tech
03	0603043A / DK2	Air Vehicle Improvement & Adv Tech (AVIATe)
03	0603044A / EA7	Enhanced Indirect Fire Adv Tech
03	0603466A / IB1	Integrated Beam Control Systems Demo for C-CM
03	0603116A / LR1	Long Range Sensing Adv Tech
03	0603465A / CK2	High Speed Maneuverable Missile (HSMM) Adv Tech
03	0603042A / DI6	Anti-Tamper Advanced Tech Development
04	0604386A / CQ9	Biotechnology for Materials - Dem/Val
04	0604019A / DJ5	Multi-Domain Artillery Cannon System (MDACS)
04	0305251A / FA8	Cyberspace Operations Forces and Force Support
04	0603639A / FG1	Cannon-Delivered Area Effects Munitions (C-DAEM)
04	0603639A / XT5	30mm Anti-Personnel and Counter UAS

05	0604805A / DH4	CMOSS Mounted Form Factor (CMFF) Radio Cards
05	0604710A / DI5	FALCONS
05	0605244A / DJ3	Joint Reduced Range Rocket
05	0605242A / DJ4	Theater SIGINT System (TSIGS)
05	0605247A / DJ8	Spectrum Situational Awareness System (S2AS)
05	0605054A / DJ9	Guam Defense System - Management
05	0604854A / DH7	Next Generation Howitzer
05	0604818A / DK3	Sensor Computing Environment (SCE)
05	0604713A / EL2	Army Field Feeding Equipment
05	0605038A / EQ7	NBC Reconnaissance Vehicle (NBCRV) Sensor Suite
05	0605051A / ITD	Improved Threat Detection System (ITDS)
05	0604827A / LS2	Lethal Semi-Autonomous Aerial Unmanned Sys-Eng Dev
05	0604802A / MS1	Battalion Mortar System Modernization
05	0605241A / DG5	Future Long Range Assault Aircraft
05	0604805A / DH5	CMOSS Mounted Form Factor (CMFF)Chassis
06	0605805A / 857	DoD Explosives Safety Standards
07	0607101A / DJ7	Radiological Detection System Development

Program Terminations (including transfers to Procurement and Sustainment):

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Budget Activity	*OSDPE / Project*	*Project Title*
02	0602002A / DC5	Team Ignite
02	0602145A / BI4	Materials Application and Integration Tech
03	0603464A / AG5	Extended Range Artillery Munition Suite Adv Tech
03	0603118A / AY7	Small Arms Fire Control Advanced Technology
03	0603118A / BB8	Soldier Centric Advanced Technology
03	0603462A / BI5	Materials Application and Integration Adv Tech
03	0603462A / BK4	Next Gen Intelligent Fire Control(NG-IFC) Adv Tech

03	0603041A / CM8	Convergence Battlefield Integration
04	0603801A / CK7	FARA Ecosystem
04	0603801A / F12	Future Attack Reconnaissance Aircraft
04	0604120A / EJ2	MOUNTED
04	0604120A / BV4	Area Protection and Alt Nav Technology Development
05	0604802A / EP2	Shoulder-Launched Munitions
05	0604802A / EP4	One-Way Luminescence for Small Caliber Ammo
05	0604802A / FA6	30mm Lethality
05	0604818A / EJ6	TACTICAL ENHANCEMENT
05	0605041A / CY5	CYBER Situational Understanding
05	0605053A / BS9	Robotic Payloads
05	0604808A / CS3	Next Generation Advanced Bomb Suit (NGABS)
06	0605326A / 33B	Soldier-Centered Analyses For Future Force
07	0203735A / 280	RECOV VEH IMPROV PROG
07	0303028A / FG2	Counterintelligence & Human Intel Modernization
07	0607142A / EW9	Aviation Rocket System Product Improvement and Dev

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.

Department of the Army
FY 2025 President's Budget
Exhibit R-1 FY 2025 President's Budget
Total Obligational Authority

Mar 2024

(Dollars in Thousands)

Appropriation: 2040A Research, Development, Test and Evaluation, Army

Line No	Program Element Number	Item	Act	Sec	FY 2023 Actuals	FY 2024 PB Request with CR Adjustments*	FY 2025 Request
1	0601102A	Defense Research Sciences	01	U	386,594	296,670	310,191
2	0601103A	University Research Initiatives	01	U	97,598	75,672	78,166
3	0601104A	University and Industry Research Centers	01	U	119,270	108,946	109,726
4	0601121A	Cyber Collaborative Research Alliance	01	U	5,355	5,459	5,525
5	0601601A	Artificial Intelligence and Machine Learning Basic Research	01	U	7,985	10,708	10,309
	Basic Research				**616,802**	**497,455**	**513,917**
6	0602002A	Army Agile Innovation and Development-Applied Research	02	U	127	5,613	8,032
7	0602134A	Counter Improvised-Threat Advanced Studies	02	U	5,966	6,242	6,163
8	0602141A	Lethality Technology	02	U	180,191	85,578	96,094
9	0602142A	Army Applied Research	02	U	27,833	34,572	
10	0602143A	Soldier Lethality Technology	02	U	266,501	104,470	102,236
11	0602144A	Ground Technology	02	U	256,916	60,005	66,707
12	0602145A	Next Generation Combat Vehicle Technology	02	U	273,166	166,500	149,108
13	0602146A	Network C3I Technology	02	U	221,293	81,618	84,576
14	0602147A	Long Range Precision Fires Technology	02	U	113,099	34,683	32,089
15	0602148A	Future Verticle Lift Technology	02	U	103,022	73,844	52,685
16	0602150A	Air and Missile Defense Technology	02	U	94,972	33,301	39,188
17	0602180A	Artificial Intelligence and Machine Learning Technologies	02	U	15,481	24,142	20,319
18	0602181A	All Domain Convergence Applied Research	02	U	26,362	14,297	12,269
19	0602182A	C3I Applied Research	02	U	26,913	30,659	25,839
20	0602183A	Air Platform Applied Research	02	U	40,372	48,163	53,206
21	0602184A	Soldier Applied Research	02	U	15,427	18,986	21,069

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22	0602213A	C3I Applied Cyber	02	U	13,605	22,714	28,656
23	0602386A	Biotechnology for Materials – Applied Research	02	U	21,015	16,736	11,780
25	0602785A	Manpower/Personnel/Training Technology	02	U	19,343	19,969	19,795
26	0602787A	Medical Technology	02	U	79,851	66,266	68,481
999	999999999	Classified Programs	02	U			35,766
		Applied Research			**1,801,455**	**948,358**	**934,058**
27	0603002A	Medical Advanced Technology	03	U	31,398	4,147	3,112
28	0603007A	Manpower, Personnel and Training Advanced Technology	03	U	15,146	16,316	16,716
29	0603025A	Army Agile Innovation and Demonstration	03	U	17,757	23,156	14,608
30	0603040A	Artificial Intelligence and Machine Learning Advanced Technologies	03	U	6,162	13,187	18,263
31	0603041A	All Domain Convergence Advanced Technology	03	U	40,955	33,332	23,722
32	0603042A	C3I Advanced Technology	03	U	12,252	19,225	22,814
33	0603043A	Air Platform Advanced Technology	03	U	13,062	14,165	17,076
34	0603044A	Soldier Advanced Technology	03	U	462	1,214	10,133
35	0603116A	Lethality Advanced Technology	03	U	11,460	20,582	33,969
36	0603117A	Army Advanced Technology Development	03	U	138,774	136,280	
37	0603118A	Soldier Lethality Advanced Technology	03	U	150,020	102,778	94,899
38	0603119A	Ground Advanced Technology	03	U	415,104	40,597	45,880
39	0603134A	Counter Improvised-Threat Simulation	03	U	20,782	21,672	21,398
40	0603386A	Biotechnology for Materials – Advanced Research	03	U	54,778	59,871	36,360
41	0603457A	C3I Cyber Advanced Development	03	U	41,354	28,847	19,616
42	0603461A	High Performance Computing Modernization Program	03	U	293,043	255,772	239,597
43	0603462A	Next Generation Combat Vehicle Advanced Technology	03	U	467,533	217,394	175,198

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44	0603463A	Network C3I Advanced Technology	03	U	174,768	105,549	94,424
45	0603464A	Long Range Precision Fires Advanced Technology	03	U	225,921	153,024	164,943
46	0603465A	Future Vertical Lift Advanced Technology	03	U	265,429	158,795	140,578
47	0603466A	Air and Missile Defense Advanced Technology	03	U	108,758	21,015	28,333
49	0603920A	Humanitarian Demining	03	U	20,674	9,068	9,272
999	999999999	Classified Programs	03	U			155,526
		Advanced Technology Development			**2,525,592**	**1,455,986**	**1,386,437**
51	0603305A	Army Missle Defense Systems Integration	04	U	117,723	12,904	13,031
52	0603308A	Army Space Systems Integration	04	U	30,453	19,120	19,659
53	0603327A	Air and Missile Defense Systems Engineering	04	U	15,000		
54	0603619A	Landmine Warfare and Barrier - Adv Dev	04	U	59,911	47,537	58,617
55	0603639A	Tank and Medium Caliber Ammunition	04	U	49,609	91,323	116,027
56	0603645A	Armored System Modernization - Adv Dev	04	U	133,300	43,026	23,235
57	0603747A	Soldier Support and Survivability	04	U	4,030	3,550	4,059
58	0603766A	Tactical Electronic Surveillance System - Adv Dev	04	U	72,364	65,567	90,265
59	0603774A	Night Vision Systems Advanced Development	04	U	96,819	73,675	64,113
60	0603779A	Environmental Quality Technology - Dem/Val	04	U	75,614	31,720	34,091
61	0603790A	NATO Research and Development	04	U	3,666	4,143	4,184
62	0603801A	Aviation - Adv Dev	04	U	1,113,295	1,502,160	6,591
63	0603804A	Logistics and Engineer Equipment - Adv Dev	04	U	24,287	7,604	12,445
64	0603807A	Medical Systems - Adv Dev	04	U	5,598	1,602	582
65	0603827A	Soldier Systems - Advanced Development	04	U	20,807	27,681	24,284
66	0604017A	Robotics Development	04	U	27,444	3,024	3,039
67	0604019A	Expanded Mission Area Missile (EMAM)	04	U	250,351	97,018	102,589

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68	0604020A	Cross Functional Team (CFT) Advanced Development & Prototyping	04	U	74,189	117,557	63,831
69	0604035A	Low Earth Orbit (LEO) Satellite Capability	04	U	34,213	38,851	21,935
70	0604036A	Multi-Domain Sensing System (MDSS) Adv Dev	04	U	47,915	191,394	239,135
71	0604037A	Tactical Intel Targeting Access Node (TITAN) Adv Dev	04	U	863	10,626	4,317
72	0604100A	Analysis Of Alternatives	04	U	10,270	11,095	11,234
73	0604101A	Small Unmanned Aerial Vehicle (SUAV) (6.4)	04	U	1,373	5,144	1,800
74	0604103A	Electronic Warfare Planning and Management Tool (EWPMT)	04	U		2,260	2,004
75	0604113A	Future Tactical Unmanned Aircraft System (FTUAS)	04	U	134,719	53,143	127,870
76	0604114A	Lower Tier Air Missile Defense (LTAMD) Sensor	04	U	366,637	816,663	149,463
77	0604115A	Technology Maturation Initiatives	04	U	209,220	281,314	252,000
78	0604117A	Maneuver - Short Range Air Defense (M-SHORAD)	04	U	269,186	281,239	315,772
79	0604119A	Army Advanced Component Development & Prototyping	04	U	198,111	204,914	
80	0604120A	Assured Positioning, Navigation and Timing (PNT)	04	U	54,728	40,930	24,168
81	0604121A	Synthetic Training Environment Refinement & Prototyping	04	U	236,396	109,714	136,029
82	0604134A	Counter Improvised-Threat Demonstration, Prototype Development, and Testing	04	U	14,298	16,426	17,341
83	0604135A	Strategic Mid-Range Fires	04	U	379,535	31,559	
84	0604182A	Hypersonics	04	U	309,068	43,435	
85	0604386A	Biotechnology for Materials - Dem/Val	04	U			20,862
86	0604403A	Future Interceptor	04	U	7,880	8,040	8,058
88	0604531A	Counter - Small Unmanned Aircraft Systems Advanced Development	04	U	36,629	64,242	59,983
90	0604541A	Unified Network Transport	04	U	35,616	40,915	31,837

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91	0305251A	Cyberspace Operations Forces and Force Support	04	U	55,599		2,270
999	999999999	Classified Programs	04	U		19,200	277,181
		Advanced Component Development & Prototypes			**4,576,716**	**4,420,315**	**2,343,901**
92	0604201A	Aircraft Avionics	05	U	3,213	13,673	7,171
93	0604270A	Electronic Warfare Development	05	U	3,987	12,789	35,942
94	0604601A	Infantry Support Weapons	05	U	80,115	64,076	52,586
95	0604604A	Medium Tactical Vehicles	05	U	21,354	28,226	15,088
96	0604611A	JAVELIN	05	U	15,899	7,827	10,405
97	0604622A	Family of Heavy Tactical Vehicles	05	U	51,261	44,197	50,011
98	0604633A	Air Traffic Control	05	U	2,527	1,134	982
99	0604641A	Tactical Unmanned Ground Vehicle (TUGV)	05	U	107,975	142,125	92,540
100	0604642A	Light Tactical Wheeled Vehicles	05	U	13,667	53,564	100,257
101	0604645A	Armored Systems Modernization (ASM) – Eng Dev	05	U	60,827	102,201	48,097
102	0604710A	Night Vision Systems – Eng Dev	05	U	89,273	48,720	89,259
103	0604713A	Combat Feeding, Clothing, and Equipment	05	U	1,509	2,223	3,286
104	0604715A	Non-System Training Devices – Eng Dev	05	U	17,910	21,441	28,427
105	0604741A	Air Defense Command, Control and Intelligence – Eng Dev	05	U	54,244	74,738	69,653
106	0604742A	Constructive Simulation Systems Development	05	U	28,404	30,985	30,097
107	0604746A	Automatic Test Equipment Development	05	U	4,989	13,626	12,927
108	0604760A	Distributive Interactive Simulations (DIS) – Eng Dev	05	U	7,890	8,802	8,914
109	0604798A	Brigade Analysis, Integration and Evaluation	05	U	22,207	20,828	26,352
110	0604802A	Weapons and Munitions – Eng Dev	05	U	284,859	243,851	242,949
111	0604804A	Logistics and Engineer Equipment – Eng Dev	05	U	74,150	37,420	41,829

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112	0604805A	Command, Control, Communications Systems - Eng Dev	05	U	43,533	34,214	92,300
113	0604807A	Medical Materiel/Medical Biological Defense Equipment - Eng Dev	05	U	25,035	6,496	7,143
114	0604808A	Landmine Warfare/Barrier - Eng Dev	05	U	36,707	13,581	19,134
115	0604818A	Army Tactical Command & Control Hardware & Software	05	U	128,240	168,574	165,229
116	0604820A	Radar Development	05	U	77,158	94,944	76,090
117	0604822A	General Fund Enterprise Business System (GFEBS)	05	U	10,022	2,965	1,995
118	0604827A	Soldier Systems - Warrior Dem/Val	05	U	19,237	11,333	29,132
119	0604852A	Suite of Survivability Enhancement Systems - EMD	05	U	75,520	79,250	77,864
120	0604854A	Artillery Systems - EMD	05	U	42,261	42,490	50,495
121	0605013A	Information Technology Development	05	U	85,713	104,024	120,076
122	0605018A	Integrated Personnel and Pay System-Army (IPPS-A)	05	U	65,055	102,084	126,354
123	0605030A	Joint Tactical Network Center (JTNC)	05	U	17,274	18,662	20,191
124	0605031A	Joint Tactical Network (JTN)	05	U	29,050	30,328	31,214
125	0605035A	Common Infrared Countermeasures (CIRCM)	05	U	9,602	11,509	11,691
126	0605036A	Combating Weapons of Mass Destruction (CWMD)	05	U		1,050	7,846
127	0605038A	Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV) Sensor Suite	05	U			7,886
128	0605041A	Defensive CYBER Tool Development	05	U	33,029	27,714	4,176
129	0605042A	Tactical Network Radio Systems (Low-Tier)	05	U	4,265	4,318	4,288
130	0605047A	Contract Writing System	05	U	13,220	16,355	9,276
131	0605049A	Missile Warning System Modernization (MWSM)	05	U		27,571	
132	0605051A	Aircraft Survivability Development	05	U	18,425	24,900	38,225
133	0605052A	Indirect Fire Protection Capability Inc 2 - Block 1	05	U	126,308	196,248	167,912
134	0605053A	Ground Robotics	05	U	25,131	35,319	28,378

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135	0605054A	Emerging Technology Initiatives	05	U	212,750	201,274	164,734
136	0605143A	Biometrics Enabling Capability (BEC)	05	U	9,186		
137	0605144A	Next Generation Load Device – Medium	05	U	24,094	36,970	2,931
138	0605148A	Tactical Intel Targeting Access Node (TITAN) EMD	05	U	103,987	132,136	157,036
139	0605203A	Army System Development & Demonstration	05	U	143,616	81,657	
140	0605205A	Small Unmanned Aerial Vehicle (SUAV) (6.5)	05	U	6,292	31,284	37,876
141	0605206A	CI and HUMINT Equipment Program-Army (CIHEP-A)	05	U		2,170	1,296
142	0605216A	Joint Targeting Integrated Command and Coordination Suite (JTIC2S)	05	U		9,290	28,553
143	0605224A	Multi-Domain Intelligence	05	U	6,008	41,003	18,913
144	0605231A	Precision Strike Missile (PrSM)	05	U	250,034	272,786	184,046
145	0605232A	Hypersonics EMD	05	U	533,520	900,920	538,017
146	0605233A	Accessions Information Environment (AIE)	05	U	9,720	27,361	32,265
147	0605235A	Strategic Mid-Range Capability	05	U	4,833	348,855	182,823
148	0605236A	Integrated Tactical Communications	05	U	11,993	22,901	23,363
149	0605241A	Future Long Range Assault Aircraft Development	05	U			1,253,637
150	0605242A	Theater SIGINT System (TSIGS)	05	U			6,660
151	0605244A	Joint Reduced Range Rocket (JR3)	05	U			13,565
152	0605247A	Spectrum Situational Awareness System (S2AS)	05	U			9,330
153	0605450A	Joint Air-to-Ground Missile (JAGM)	05	U	2,280	3,014	3,030
154	0605457A	Army Integrated Air and Missile Defense (AIAMD)	05	U	245,791	284,095	602,045
155	0605531A	Counter – Small Unmanned Aircraft Systems Sys Dev & Demonstration	05	U	11,548	36,016	59,563
157	0605625A	Manned Ground Vehicle	05	U	519,131	996,653	504,841
158	0605766A	National Capabilities Integration (MIP)	05	U	16,790	15,129	16,565

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159	0605812A	Joint Light Tactical Vehicle (JLTV) Engineering and Manufacturing Development Phase (EMD)	05	U	9,033	27,243	27,013
160	0605830A	Aviation Ground Support Equipment	05	U	2,851	1,167	979
161	0303032A	TROJAN – RH12	05	U	3,761	3,879	3,930
162	0303767A	AMBIT – Pre-Auctioned SRF	05	U	21,730		
163	0304270A	Electronic Warfare Development	05	U	97,616	137,186	131,096
999	999999999	Classified Programs	05	U			83,136
		System Development & Demonstration			**4,077,609**	**5,639,364**	**6,150,910**
164	0604256A	Threat Simulator Development	06	U	138,264	38,492	71,298
165	0604258A	Target Systems Development	06	U	53,434	11,873	15,788
166	0604759A	Major T&E Investment	06	U	144,173	76,167	78,613
167	0605103A	Rand Arroyo Center	06	U	30,800	37,078	38,122
168	0605301A	Army Kwajalein Atoll	06	U	297,859	314,872	321,755
169	0605326A	Concepts Experimentation Program	06	U	83,668	95,551	86,645
170	0605502A	Small Business Innovative Research	06	U	382,638		
171	0605601A	Army Test Ranges and Facilities	06	U	414,662	439,118	461,085
172	0605602A	Army Technical Test Instrumentation and Targets	06	U	72,760	42,220	75,591
173	0605604A	Survivability/Lethality Analysis	06	U	35,750	37,518	37,604
174	0605606A	Aircraft Certification	06	U	4,777	2,718	2,201
175	0605702A	Meteorological Support to RDT&E Activities	06	U	6,820		
176	0605706A	Materiel Systems Analysis	06	U	22,004	26,902	27,420
177	0605709A	Exploitation of Foreign Items	06	U	6,186	7,805	6,245
178	0605712A	Support of Operational Testing	06	U	69,879	75,133	76,088
179	0605716A	Army Evaluation Center	06	U	67,058	71,118	73,220

Department of the Army
FY 2025 President's Budget
Exhibit R-1 FY 2025 President's Budget
Total Obligational Authority

Mar 2024

(Dollars in Thousands)

Appropriation: 2040A Research, Development, Test and Evaluation, Army

Line No	Program Element Number	Item	Act	Sec	FY 2023 Actuals	FY 2024 PB Request with CR Adjustments*	FY 2025 Request
180	0605718A	Army Modeling & Sim X-Cmd Collaboration & Integ	06	U	5,874	11,204	11,257
181	0605801A	Programwide Activities	06	U	88,780	93,895	91,895
182	0605803A	Technical Information Activities	06	U	36,821	31,327	32,385
183	0605805A	Munitions Standardization, Effectiveness and Safety	06	U	59,088	50,409	50,766
184	0605857A	Environmental Quality Technology Mgmt Support	06	U	1,842	1,629	1,659
185	0605898A	Army Direct Report Headquarters - R&D - MHA	06	U	53,003	55,843	59,727
186	0606002A	Ronald Reagan Ballistic Missile Defense Test Site	06	U	85,873	91,340	73,400
187	0606003A	CounterIntel and Human Intel Modernization	06	U	1,424	6,348	4,574
188	0606942A	Assessments and Evaluations Cyber Vulnerabilities	06	U	5,816	6,025	10,105
189	0909999A	Financing for Cancelled Account Adjustments	06	U	135		
Management Support					**2,169,388**	**1,624,585**	**1,707,443**
190	0603778A	MLRS Product Improvement Program	07	U	17,790	14,465	14,188
191	0605024A	Anti-Tamper Technology Support	07	U	9,028	7,472	7,489
192	0607101A	Combating Weapons of Mass Destruction (CWMD) Product Improvement	07	U			271
193	0607131A	Weapons and Munitions Product Improvement Programs	07	U	54,216	8,425	9,363
194	0607136A	Blackhawk Product Improvement Program	07	U		1,507	25,000
195	0607137A	Chinook Product Improvement Program	07	U	65,596	9,265	4,816
196	0607139A	Improved Turbine Engine Program	07	U	219,713	201,247	67,029
197	0607142A	Aviation Rocket System Product Improvement and Development	07	U	10,899	3,014	
198	0607143A	Unmanned Aircraft System Universal Products	07	U	10,493	25,393	24,539
199	0607145A	Apache Future Development	07	U	26,607	10,547	8,243
200	0607148A	AN/TPQ-53 Counterfire Target Acquisition Radar System	07	U	59,312	54,167	53,652
201	0607150A	Intel Cyber Development	07	U	13,343	4,345	9,753

Department of the Army
FY 2025 President's Budget
Exhibit R-1 FY 2025 President's Budget
Total Obligational Authority

Mar 2024

(Dollars in Thousands)

Appropriation: 2040A Research, Development, Test and Evaluation, Army

Line No	Program Element Number	Item	Act	Sec	FY 2023 Actuals	FY 2024 PB Request with CR Adjustments*	FY 2025 Request
202	0607312A	Army Operational Systems Development	07	U	26,131	19,000	
203	0607313A	Electronic Warfare Development	07	U	11,417	6,389	5,559
204	0607315A	Enduring Turbine Engines and Power Systems	07	U		2,411	2,620
206	0607665A	Family of Biometrics	07	U	1,073	797	590
207	0607865A	Patriot Product Improvement	07	U	146,753	177,197	168,458
208	0203728A	Joint Automated Deep Operation Coordination System (JADOCS)	07	U	18,606	42,177	27,582
209	0203735A	Combat Vehicle Improvement Programs	07	U	187,377	146,635	272,926
210	0203743A	155mm Self-Propelled Howitzer Improvements	07	U	112,257	122,902	55,205
211	0203752A	Aircraft Engine Component Improvement Program	07	U	148	146	142
212	0203758A	Digitization	07	U		1,515	1,562
213	0203801A	Missile/Air Defense Product Improvement Program	07	U	2,996	4,520	1,511
214	0203802A	Other Missile Product Improvement Programs	07	U	8,698	10,044	23,708
215	0205412A	Environmental Quality Technology - Operational System Dev	07	U	764	281	269
216	0205778A	Guided Multiple-Launch Rocket System (GMLRS)	07	U	19,443	75,952	20,590
217	0208053A	Joint Tactical Ground System	07	U	8,813	203	
220	0303028A	Security and Intelligence Activities	07	U		301	
221	0303140A	Information Systems Security Program	07	U	15,554	15,323	15,733
222	0303141A	Global Combat Support System	07	U	21,775	13,082	2,566
223	0303142A	SATCOM Ground Environment (SPACE)	07	U	14,551	26,838	26,643
226	0305179A	Integrated Broadcast Service (IBS)	07	U	9,426	9,456	5,701
227	0305204A	Tactical Unmanned Aerial Vehicles	07	U	4,500		
228	0305206A	Airborne Reconnaissance Systems	07	U	6,402		
229	0305219A	MQ-1 Gray Eagle UAV	07	U		6,629	6,681

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FY 2025 President's Budget
Exhibit R-1 FY 2025 President's Budget
Total Obligational Authority

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(Dollars in Thousands)

Appropriation: 2040A Research, Development, Test and Evaluation, Army

Line No	Program Element Number	Item	Act	Sec	FY 2023 Actuals	FY 2024 PB Request with CR Adjustments*	FY 2025 Request
230	0708045A	End Item Industrial Preparedness Activities	07	U	128,617	75,317	67,187
999	999999999	Classified Programs	07	U	6,664	8,786	32,518
		Operational Systems Development			**1,238,962**	**1,105,748**	**962,094**
231	0608041A	Defensive CYBER - Software Prototype Development	08	U	92,460	83,570	74,548
		Software And Digital Technology Pilot Programs			**92,460**	**83,570**	**74,548**
232	0901560A	Continuing Resolution Programs	20	U		1,366,740	
		Undistributed				**1,366,740**	
		Total Research, Development, Test and Evaluation, Army			**17,098,984**	**17,142,121**	**14,073,308**

*A full-year FY 2024 appropriation for this account was not enacted at the time the budget was prepared;

account is operating under the Further Additional Continuing Appropriations and Other Extensions Act, 2024 (Public Law 118-35). The amounts

included for FY 2024 reflect the annualized level provided by the continuing resolution.

*FY 2023 includes $7,626 thousand in Overseas Operations Costs (OOC) Actuals. FY 2024 includes $3,166 thousand in OOC Requested.

FY 2025 includes $3,157 thousand for the OOC Budget Estimate. OOC were financed previously with former Overseas Contingengy Operations (OCO) funding.

Program Element Table of Contents (by Budget Activity then Line Item Number)

Appropriation 2040: Research, Development, Test & Evaluation, Army

Appropriation 2040: Research, Development, Test & Evaluation, Army

Program Element Table of Contents (Alphabetically by Program Element Title)

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| Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army | | | | | | | | | | | Date: March 2024 | |

Appropriation/Budget Activity
2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*

R-1 Program Element (Number/Name)
PE 0602002A *I Army Agile Innovation and Development-Applied Research*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	0.127	5.613	8.032	-	8.032	7.639	6.391	6.457	6.704	0.000	40.963
DC4: *Army Applied Innovation*	-	0.001	3.135	1.750	-	1.750	2.063	2.286	2.303	2.205	0.000	13.743
DC5: *Team Ignite*	-	0.126	0.345	-	-	-	-	-	-	-	0.000	0.471
DC6: *Sci & Analysis for Autonomous Sys & Counter-Auton*	-	-	2.133	6.282	-	6.282	5.576	4.105	4.154	4.499	0.000	26.749

Note

DC5 / Team Ignite - In Fiscal Year (FY) 2025 this Project is Terminated.

A. Mission Description and Budget Item Justification

This Program Element (PE) funds the Army's goal of assessing and seeding innovative research solutions to achieve future force modernization. Critical technologies that allow for technological superiority are increasingly dual-use or developed in academia-led partnerships that leverage cutting edge innovation. Cross-cutting modernization initiatives leverage strategic partnerships and foster an environment to bring knowledge and expertise to demonstrate breakthrough and innovative technologies that will benefit the warfighter. These collaborations bring new ways of doing business to assess and evaluate emerging technologies with high payoff potential to address current technology shortfalls. Leveraging other innovative mechanisms, to include accelerators, incubators, and other technology accelerants, to enhance innovation is part of the overall innovation strategy. Innovation includes not only hardware and physical products but also software, software development, artificial intelligence (AI) and machine learning; all are stand-alone initiatives that are part of broader innovation to programs and technology development. Through the Army's Innovation Oversight Board, Army senior leadership approves innovation projects in the budget year and year of execution based on priority and opportunity, ensuring that innovations have a high potential for filling capability gaps and transitioning to Army S&T projects to inform an optimal technology investment strategy and rapidly deliver capabilities to the Soldier.

Work is performed by the United States Army Combat Capabilities Development Command (DEVCOM), Army Artificial Intelligence Integration Center (AI2C), the Engineering Research and Development Center, Space and Missile Defense Technical Center, and the United States Army Research Institute for the Behavioral and Social Sciences.

PE 0602002A: *Army Agile Innovation and Development-Ap...*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602002A *I Army Agile Innovation and Development-Applied Research*	

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	1.000	5.613	18.845	-	18.845
Current President's Budget	0.127	5.613	8.032	-	8.032
Total Adjustments	-0.873	0.000	-10.813	-	-10.813
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.837	-			
• SBIR/STTR Transfer	-0.036	-			
• Adjustments to Budget Years	-	-	-10.813	-	-10.813

Change Summary Explanation

Decrease in funding is due to the termination of the Team Ignite program, since it was determined that the expansion of the multi-tiered Innovation plan to integrate non-traditional technologies in support of Army Modernization is already supported in the Science & Technology Program. Funding was realigned to support the Army's priority for Long Range Maneuverable Fires Precision Strike Missile, Increment 4, to address extended range.

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	

Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602002A *I Army Agile Innovation and Development-Applied Research*	**Project (Number/Name)** DC4 *I Army Applied Innovation*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DC4: *Army Applied Innovation*	-	0.001	3.135	1.750	-	1.750	2.063	2.286	2.303	2.205	0.000	13.743

A. Mission Description and Budget Item Justification

This project funds the Applied Research portion of the Army Innovation Plan, the Army's investment strategy to rapidly accelerate innovative solutions to challenging Warfighter problems. This project will provide the Army with the most advanced and cutting-edge solutions and the ability to adapt and integrate multi-disciplinary innovative technologies. This project accelerates breakthrough and disruptive innovations based on assessing and seeding a solution with multi-disciplinary knowledge. It addresses ideation and system-level integration applied research and development leading to potential emerging technologies in areas of strategic importance to the Army. Through the Army's Innovation Oversight Board, the Army senior leadership approves the innovation projects in the budget year and year of execution based on priority and opportunity, ensuring that innovations have a high potential for filling capability gaps and transitioning to Army S&T projects to inform an optimal technology investment strategy and rapidly deliver capabilities to the Soldier.

This project is coordinated with Program Element 0603025A (Army Agile Innovation and Demonstration), Project DA3 (Army Advanced Innovation).

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 Assistant Secretary of the Army for Acquisition Logistics and Technology and the Army Science and Technology Executing Commands.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Army Applied Innovation	0.001	3.135	1.750
Description: The Army seeks to research, evaluate, and validate cross-domain technology that display unique and innovative potential to rapidly produce disruptive and groundbreaking capabilities that fall outside of the normal acquisition pipeline. ***FY 2024 Plans:*** Identify breakthrough and disruptive technologies, engage novel ideation & system-level integration at the initial phase of the scientific concepts and technology development. Merge synergistic cross-cutting innovations that will lead to advance disruptive technological solutions to Army priorities that require an accelerated solution. Also Identify and initiate development of emergent technologies, for integration in the science and technology program, to address challenges in future operating concepts, operational needs and Army identified priorities. ***FY 2025 Plans:*** Innovation projects from the Army S&T Executing Commands will be approved by the Army Innovation Oversight Board in the budget year and year of execution based on priority and opportunity. Proposal topics will focus on mid-far term transformational			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602002A *I Army Agile Innovation and Development-Applied Research*	**Project (Number/Name)** DC4 *I Army Applied Innovation*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
technologies with a shift in focus to the design of the Army of 2040. Proposal will be informed by the Critical Technology Areas, Future Capabilities/Activities, and Army Senior Leader Priorities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects reduction of selected innovation proposal opportunities.			
Accomplishments/Planned Programs Subtotals	0.001	3.135	1.750

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602002A: *Army Agile Innovation and Development-Ap...*
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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602002A *I Army Agile Innovation and Development-Applied Research*				**Project (Number/Name)** DC5 *I Team Ignite*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DC5: *Team Ignite*	-	0.126	0.345	-	-	-	-	-	-	-	0.000	0.471

Note

In Fiscal Year (FY) 2025 this Project is Terminated.

A. Mission Description and Budget Item Justification

IGNITE is part of the multi-tiered Army Innovation Plan to investigate non-traditional and innovative technologies to rapidly develop the technology, delivering quick solutions for Army identified problems. IGNITE empowers individuals to create new approaches to ensure competitive advantage, identifies future warfighting concepts from recent scientific discoveries, ensures capability requirements are grounded in feasible technological advancements, and uses data and analytics to build a common language across communities. The primary end state of IGNITE is an Army Modernization Enterprise that has institutionalized a new way of business where modernization processes are inherently collaborative across our diverse expertise, including Science and Technology (S&T); conceptual, analytical, operational, experimental, requirements; and threat communities. This will allow decisive capabilities to be developed at a faster pace than our adversaries.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Team IGNITE	0.126	0.345	-
Description: The IGNITE philosophy emphasizes integration through numerous pathways and mechanisms. These include, but are not limited to, cross-organizational events, organizational offices, enduring cohorts, enabling processes, and Ignite innovators.			
FY 2024 Plans: Will support limited engagements between multiple communities to wrap up FY23 efforts and document collaborative learning outcomes/best practices.			
FY 2024 to FY 2025 Increase/Decrease Statement: In Fiscal Year (FY) 2025 this Project is Terminated.			
Accomplishments/Planned Programs Subtotals	0.126	0.345	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602002A *I Army Agile Innovation and Development-Applied Research*				**Project (Number/Name)** DC6 *I Sci & Analysis for Autonomous Sys & Counter-Auton*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DC6: *Sci & Analysis for Autonomous Sys & Counter-Auton*	-	-	2.133	6.282	-	6.282	5.576	4.105	4.154	4.499	0.000	26.749

A. Mission Description and Budget Item Justification

This Project investigates and develops capabilities to understand and characterize emerging Science and Technology (S&T) technical pursuits and impacts through collaborative analytics that enable the assessment of autonomous systems-of-systems, their implications to the future threat environment, and analyzes their contributions to the Multi-Domain Operations (MDO) concept in relevant operational scenarios. This is a cross-cutting effort that supports S&T, analysis, and modeling and simulation (M&S) efforts associated with the development of autonomous systems and their application in military operations.

Work in this Project also funds research to investigate, develop, and validate tools, methodologies, and analytical techniques to extend experimental results, assure early consideration of technology and system vulnerabilities, reduce developmental risk, provide mission context, and improve the robustness of technology readiness assessments.

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 Army Research Laboratory (ARL) and Data and Analysis Center (DAC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Threat and Operations Based Intelligent Autonomy Science (TOBIAS) *Description:* This effort develops and implements models that will be used to assess the vulnerability and lethality (kinetic and non-kinetic) of U.S. and threat autonomous systems. This work will also incorporate the software-based behavioral capabilities of these systems including interfacing with humans. Technology forecasting will be used to enable the development of optimal investment strategies for autonomy science on the basis of operational merit. *FY 2024 Plans:* Will characterize the elements of vulnerability of autonomy science for unmanned ground and air platforms; define taxonomy and metrics and the representation of these effects in tools that will be developed by the DEVCOM Data and Analysis Center (DAC); investigate the fragility of Artificial Intelligence/Machine Learning (AI/ML) for autonomous mobility of unmanned ground and air vehicles operating in a contested environment; perform baseline studies on vulnerability of software-based behaviors to non-	-	1.257	3.352

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602002A I *Army Agile Innovation and Development-Applied Research*	**Project (Number/Name)** DC6 I *Sci & Analysis for Autonomous Sys & Counter-Auton*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
kinetic effects; investigate approaches for modeling the vulnerabilities; explore forecasting science for autonomous warfare and its effective operational use during the period of 2030-2050, scope includes U.S. and allies versus near-peer threats. *FY 2025 Plans:* Will create digital models of unmanned ground and aerial vehicle concepts suitable for use in combat simulations versus near-peer threats; develop digital models that have the ability to represent the vulnerability and lethality characteristics of future science and technology options for autonomous combat systems with respect to mobility, target recognition, and classification; perform technology forecasting in the field of autonomy science and future autonomous warfare; develop digital representations of threat counter-autonomy capabilities for use as the opposing force in simulations; research and prioritize combat operational scenarios suitable for exploring the interdependencies between autonomy science and military science; investigate options for representing man-machine interfaces within the combat simulation; investigate metrics for characterizing resiliency of a team of autonomous combat systems for a baseline mission; assess the impact of enhanced autonomy science on effectiveness of Unmanned Ground Vehicles (UGVs) in simulated combat vignette. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase supports additional research in the area of digital models for unmanned ground and air vehicles.			
Title: Vulnerability and Lethality Analysis Tools for Early Science and Technology *Description:* Investigates, develops, and validates analytical tools, techniques, and methodologies to extend experimental and research results, ensuring early investigation of technology, system vulnerabilities, human systems integration, system performance, and mission effectiveness. Task objectives reduce developmental risk, provide validation of methodologies and tools in realistic mission contexts, and improve the robustness of technology readiness assessments. *FY 2024 Plans:* Will develop analytical capabilities for high priority autonomous technologies to enhance discovery and motivate early and comprehensive consideration of vulnerabilities; determine tactically critical technology metrics through scientific research and promote transition of science into systems at reduced risk with greater maturity and enhanced trust in functional autonomy; optimize analytical capabilities and assess system performance and effectiveness in an operational mission context. *FY 2025 Plans:* Will research and investigate novel techniques and initial methodologies to enable Modeling and Simulation (M&S) and analysis of unmanned ground system concepts; identify parameters and near-peer cyber and electromagnetic threats focusing initially on future autonomous ground system operating environments; develop initial methodologies for M&S and analysis of autonomous ground systems, including vulnerability and lethality performance characteristics and synergistic effects in the kinetic,	-	0.876	2.930

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602002A / *Army Agile Innovation and Development-Applied Research*	**Project (Number/Name)** DC6 / *Sci & Analysis for Autonomous Sys & Counter-Auton*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
electromagnetic, and cyber domains; identify learning objectives and applicable metrics for initial trial simulation experiments using developmental science and technology (S&T) alternatives for autonomous ground systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase supports additional Modeling and Simulation development and analysis.			
Accomplishments/Planned Programs Subtotals	-	2.133	6.282

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602002A: *Army Agile Innovation and Development-Ap...*
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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602134A *I Counter Improvised-Threat Advanced Studies*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	5.966	6.242	6.163	-	6.163	6.191	6.194	6.261	6.323	0.000	43.340
CD2: *Counter Improvised-Threat Advanced Studies*	-	5.966	6.242	6.163	-	6.163	6.191	6.194	6.261	6.323	0.000	43.340

A. Mission Description and Budget Item Justification

This Program Element (PE) executes applied research into novel methods for detecting and defeating Improvised Explosive Devices (IED) through the application of emerging technologies as well as research into emerging IED threats to evaluate potential methods of defeat. Efforts are selected in the budget year and current year of execution to address program requirements.

This PE is executed in coordination with the Under Secretary of Defense for Research and Engineering (USD/R&E) and the Defense Threat Reduction Agency (DTRA).

Work in this Project is fully coordinated with Program Element (PE) 0603134A (Counter Improvised Threat Simulation), Project CD3 (Counter Improvised Threat Simulation).

The cited work is consistent with the USD/R&E priority focus areas.

Work in this Project is managed by Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center. Work is performed by the United States Army Combat Capabilities Development Command (DEVCOM), Army Artificial Intelligence Integration Center (AI2C), the Engineering Research and Development Center, Space and Missile Defense Technical Center, and the United States Army Research Institute for the Behavioral and Social Sciences with oversight from Assistant Secretary of the Army for Acquisition, Logistics and Technology for Research and Technology (DASA R&T).

B. Program Change Summary ($ in Millions)

	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	6.192	6.242	6.245	-	6.245
Current President's Budget	5.966	6.242	6.163	-	6.163
Total Adjustments	-0.226	0.000	-0.082	-	-0.082
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.226	-			
• Adjustments to Budget Years	-	-	-0.082	-	-0.082

PE 0602134A: *Counter Improvised-Threat Advanced Studi...*
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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army	**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602134A *I Counter Improvised-Threat Advanced Studies*

Change Summary Explanation

The FY25 funding change from the previous PB to the current PB reflects an Army approved minor reduction.

PE 0602134A: *Counter Improvised-Threat Advanced Studi...*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 I 2				**R-1 Program Element (Number/Name)** PE 0602134A I *Counter Improvised-Threat Advanced Studies*					**Project (Number/Name)** CD2 I *Counter Improvised-Threat Advanced Studies*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CD2: *Counter Improvised-Threat Advanced Studies*	-	5.966	6.242	6.163	-	6.163	6.191	6.194	6.261	6.323	0.000	43.340

A. Mission Description and Budget Item Justification

This Project investigates novel methods for detecting and defeating improvised explosive devices (IED) as well as research into emerging IED threats to evaluate potential methods of defeat of the same.

This Project is executed by the Army Futures Command (AFC) in coordination with the Under Secretary of Defense for Research and Engineering (USD/R&E) and the Defense Threat Reduction Agency (DTRA).

Work in this Project is fully coordinated with Program Element (PE) 0603134A (Counter Improvised Threat Simulation), Project CD3 (Counter Improvised Threat Simulation).

The cited work is consistent with the USD/R&E priority focus areas and the Army Modernization Strategy.

Work in this Project is performed by Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Counter IED Emerging Technologies	5.966	6.242	6.163
Description: This effort investigates emerging technologies in physics, chemistry, biology and computer science to identify applications to detect and defeat current and emerging IED critical components. This effort investigates the combination of methods and maturation of technological solutions to detect and defeat IEDs threats. The goals include increasing the standoff detection distance, increasing probability of positive identification, and reducing the rate of false indications. This effort is informed by technology trends across the Department of Defense and by analysis of IED threats encountered in operational scenarios. ***FY 2024 Plans:*** Will investigate and mature optical and RF components and techniques to mitigate electromagnetic interference and increase detectability of physically obscured targets. Will reduce time needed for neutralization and expand effectiveness against various IED trigger types. Will continue to investigate and develop emerging technologies to assess their ability to counter IED threats. Will investigate sensor effectiveness in multiple locations and in varied environments. ***FY 2025 Plans:***			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602134A *I Counter Improvised-Threat Advanced Studies*	**Project (Number/Name)** CD2 *I Counter Improvised-Threat Advanced Studies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will continue to investigate and develop Electro-Optical, Infrared, and Radio Frequency (RF) techniques to detect buried Improvised Explosive Devices (IEDs) and their components. Develop data processing and data fusing techniques to detect partially hidden IEDs. Investigate and develop wide bandwidth electronics to counter radio controlled IEDs. Investigate electromagnetic and bulk detection technologies to detect personnel and vehicle borne IEDs. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle for this effort.			
Accomplishments/Planned Programs Subtotals	5.966	6.242	6.163

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602134A: *Counter Improvised-Threat Advanced Studi...*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*							
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	180.191	85.578	96.094	-	96.094	107.415	117.115	106.238	110.217	Continuing	Continuing
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.576	8.752	8.823	-	8.823	8.833	8.839	8.936	9.026	0.000	61.785
AH7: *Lethal and Scalable Effects Technologies*	-	1.297	1.574	1.577	-	1.577	1.579	1.580	1.597	1.613	Continuing	Continuing
AH8: *Lethality Materials and Processes Technology*	-	1.863	1.906	1.910	-	1.910	1.911	1.913	1.934	1.953	0.000	13.390
AH9: *Advanced Warheads Technology*	-	25.845	24.326	27.292	-	27.292	28.712	30.320	32.840	35.197	0.000	204.532
BS6: *Lethality Technology (CA)*	-	107.000	-	-	-	-	-	-	-	-	0.000	107.000
CF7: *Solid-state Laser Concepts and Architectures*	-	8.556	9.892	9.912	-	9.912:	7.920	6.924	6.532	7.133	0.000	56.869
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.851	2.180	1.034	-	1.034	5.184	4.339	3.736	2.462	0.000	22.786
CG4: *Advanced Radar Concepts and Technologies*	-	5.869	6.008	7.044	-	7.044:	12.014	15.039	12.123	9.202	0.000	67.299
CI1: *Advanced Armaments Lethality Technology*	-	1.493	1.684	4.352	-	4.352	4.518	6.493	6.121	5.960	0.000	30.621
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	3.445	-	-	-	-	2.204	2.825	8.476	0.000	16.950
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	6.468	7.909	-	7.909	9.264	9.371	-	-	0.000	33.012
CIC: *Fire Control Lethality Technology*	-	-	1.462	2.958	-	2.958	2.957	2.956	1.508	1.523	0.000	13.364
CJ1: *Lethality Enabling University Applied Research*	-	6.330	7.197	7.874	-	7.874:	8.354	8.360	8.451	8.536	0.000	55.102
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.922	2.324	4.608	-	4.608	4.613	4.616	4.667	4.714	0.000	27.464

PE 0602141A: *Lethality Technology*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I BA 2: Applied Research*				**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*							
CZ9: *Foundational Hypersonic Weapons Research*	-	7.589	8.360	10.801	-	10.801	11.556	14.161	14.968	14.422	0.000	81.857

A. Mission Description and Budget Item Justification

Work done in this Program Element (PE) supports research technologies, methodologies, and models required to enable next generation lethality. The effort focuses on: lethal mechanism technologies for projectiles and warheads that provide revolutionary capability to defeat Tier 1 adversary vehicle and body armors; selection of propulsion and energetic materials and technology to validate novel energetic materials concepts to exploit controllable energy release for future gun/missile systems; scalable effects for mixed target defeat while simultaneously decreasing warhead mass; development of materials solutions for improvement of weight and volume efficiency, lethal effects and sustainability for the warfighter in the Army of today and beyond; and multiple pathways to enhance lethal effects by investigating synergistic effects of novel micro warheads using advanced materials. Funding in this PE is a continuation of work done in PEs 0602105A (Materials Technology), 0602618A (Ballistics Technology), and 0602624A (Weapons and Munitions Technology).

Work in this PE complements PEs 0602147A (Long Range Precision Fires Technology), 0602150A (Air and Missile Defense Technology), 0602143A (Soldier Lethality Technology), 0602144A (Ground Technology), 0602145A (Next Generation Combat Vehicle Technology), and 0603116A (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.

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	194.717	85.578	86.406	-	86.406
Current President's Budget	180.191	85.578	96.094	-	96.094
Total Adjustments	-14.526	0.000	9.688	-	9.688
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-12.389	-			
• SBIR/STTR Transfer	-2.137	-			
• Adjustments to Budget Years	-	-	9.688	-	9.688

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BS6: *Lethality Technology (CA)*		
Congressional Add: *Program Increase - Materials Processing Manufacturing Technology*	12.000	-
Congressional Add: *Program Increase - Universal Nanocrystalline Alloys*	5.000	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*		**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Program Increase - ADVANCED MATERIALS AND MANUFACTURING FOR MODERNIZATION*	20.000	-
Congressional Add: *Program Increase - CERAMIC PROTECTION MATERIALS*	3.000	-
Congressional Add: *Program Increase - COLLABORATIVE NETWORKED ARMAMENT LETHALITY TECHNOLOGY*	15.000	-
Congressional Add: *Program Increase - ENHANCED ARMAMENT FIRE CONTROL*	10.000	-
Congressional Add: *Program Increase - HIGH TEMPERATURE POLYMER COMPOSITES*	10.000	-
Congressional Add: *Program Increase - INTELLIGENT NEXT-GENERATION ADDITIVE MANUFACTURING HUB*	2.000	-
Congressional Add: *Program Increase - NOVEL ARMAMENT SYSTEMS*	15.000	-
Congressional Add: *Program Increase - QUANTUM TECHNOLOGIES FOR ARMAMENT SYSTEMS*	10.000	-
Congressional Add: *Program Increase - TURRET GUNNER SURVIVABILITY AND SIMULATION ENVIRONMENT*	5.000	-
Congressional Add Subtotals for Project: BS6	107.000	-
Congressional Add Totals for all Projects	107.000	-

Change Summary Explanation

Funding increase was due to realignment for Sensor to Shooter from 0602181A CM1 Collab Battlefield Networked Leth Sys App Tech and 0602141A CI1 Advanced Armaments Lethality Technology.

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** AH6 *I Disruptive Energetics and Propulsion Technologies*	

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AH6: *Disruptive Energetics and Propulsion Technologies*	-	8.576	8.752	8.823	-	8.823	8.833	8.839	8.936	9.026	0.000	61.785

A. Mission Description and Budget Item Justification

This Project investigates, models, and assesses energetic material and propulsion technologies to validate novel concepts such as maximizing total energy density and power delivered on target. This Project also optimizes propellant grains for increased range and altering gun configurations to increase energy on target in order to exploit the controllable/scalable energy release required for improving effectiveness and reducing vulnerability of future gun/missile systems.

This Project complements disruptive energetic materials discovery efforts to synthesize new materials with energy content from 50% to up to two times that of Research Department Explosive (RDX) in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics). This Project also leverages the advanced additive manufacture efforts of PE 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Synthesis, Formulation, Modeling, and Diagnostics of Energetic Materials for Explosive and Propellant Applications *Description:* This effort pursues novel approaches to synthesize and scale up disruptive and traditional energetic materials with increased performance as well as design new formulation avenues in order to discover new materials and formulations to extend range and increase effect on target. This effort develops, codes, and subsequently employs advanced models to predict multiscale response of energetic materials for both propellant and explosive purposes. This effort develops new simulation and small scale experimental methods and techniques for understanding and design of advanced concepts and energetic formulations to rapidly iterate and optimize parameters to enable a "fail early, fail often" strategy towards increased range and enhanced lethality. This effort also investigates new propellants and grain designs, burn rate/combustion modifier ingredients, as well as new gun and munition designs for extended range. *FY 2024 Plans:* Will scale up, formulate, and assess novel energetic materials, energetic polymers, and novel metallic fuels for use in explosive and propellant applications; further development of machine learning models for predicting performance and physical metrics in order to guide synthesis; miniaturize diagnostic techniques in order to "fail early, fail fast" in assessing novel materials, models, and concepts; develop and validate mesoscale models for use in explosive applications and apply said models to Army relevant notional formulations and materials; develop novel chemical kinetics for rocket motors and initiation trains; develop validated	8.576	8.752	8.823

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** AH6 *I Disruptive Energetics and Propulsion Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
models of wear and erosion to determine mitigation routes for increased flame temperature, as well as enhanced pressure propellants and charge designs; model alternative initiation schemes for improved weapon performances; develop and validate post-launch propulsion concepts; develop and validate advanced grain and pressure chamber designs in order to enhance range without requiring propellant formation engineering; continue to develop lightweight, increased muzzle velocity Soldier weapon systems. *FY 2025 Plans:* Will assess novel energetic materials and fuels previously discovered for scale up and formulation. Conduct experiments and validate the in-house integrated materials engine and mesoscale model framework to assess strength models that incorporate higher-fidelity physics such as crystal plasticity, crystallographic slip, and/or shear banding. Determine final candidate reactive materials for further validation and transition. Assess quantum mechanical and/or machine learning models of reaction kinetics for computational fluid dynamic simulations of propellant initiation. Design and develop advanced grains for increased muzzle velocity and range for gun propellants. Develop and validate novel models of erosion for large caliber systems; develop novel gun tube designs for performance and thermal management to provide design paths for autocannon firepower from reduced weapon form factor. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects an economic adjustment.			
Accomplishments/Planned Programs Subtotals	8.576	8.752	8.823

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	

Appropriation/Budget Activity
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R-1 Program Element (Number/Name)
PE 0602141A / *Lethality Technology*

Project (Number/Name)
AH7 / *Lethal and Scalable Effects Technologies*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AH7: *Lethal and Scalable Effects Technologies*	-	1.297	1.574	1.577	-	1.577	1.579	1.580	1.597	1.613	Continuing	Continuing

A. Mission Description and Budget Item Justification

Work in this Project designs, determines, and assesses technology options for scaling warhead lethality and providing extreme efficiency for highly effective, simultaneous mixed/multi target defeat and collateral damage. This Project will also design and assess scalable structure defeat to mitigate collateral damage for disruptive urban Warfighting. This research complements Program Element (PE) 0602141A (Lethality Technology) / Project AH5 (Projectile and Multi-Function Warhead Technologies) and PE 0602141A (Lethality Technology) / Project AH6 (Disruptive Energetics and Propulsion Technologies) within this PE and builds upon disruptive energetic and ballistic sciences research in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Munition Efficiency and Scalability	1.297	1.574	1.577

Description: This effort investigates, designs, determines, and assesses technologies to produce blast-fragment warheads with tailored fragment geometries to optimize target defeat. This effort identifies and develops warhead impact patterns to optimize target defeat with reduced collateral damage. This effort also designs, models, and assesses technologies for the cost effective, preprogrammed delivery of multiple scalable warheads capable of simultaneously engaging multiple targets. This effort leverages guidance technologies from PE 0602147A (Long Range Precision Fires) / Project AH4 (Precision and Coop Weapons in a Denied Env Tech), and metal additive manufacturing from PE 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research Technology).

FY 2024 Plans:
Will investigate energy-efficient warhead concepts to increase fragment velocity to include improved explosive-to-metal coupling using two-phase flow computational modeling complemented by terminal ballistic experiments; mature distributed, collaborative, and synergistic effects by improving understanding of multiple lethal mechanisms (e.g., blast-fragmentation and penetration) and multiple high-speed weapons on single, simple, and complex targets; model lethality of energy-efficient warheads and distributed, collaborative, and synergistic effects for analytical campaign on Diverse, Disruptive Effects for Artillery with partners.

FY 2025 Plans:

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** AH7 *I Lethal and Scalable Effects Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will investigate promising mechanisms which maximize lethality across a broad range of targets through the study and modeling of multipurpose warhead technologies and multi-warhead collaborative engagement techniques. Develop lethality models and conduct experiments for validating terminal ballistic outcomes. Fund research and investigate compact and efficient warheads with more complex case designs by incorporating novel energetics and new materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	1.297	1.574	1.577

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				R-1 Program Element (Number/Name) PE 0602141A *I Lethality Technology*				Project (Number/Name) AH8 *I Lethality Materials and Processes Technology*			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AH8: *Lethality Materials and Processes Technology*	-	1.863	1.906	1.910	-	1.910	1.911	1.913	1.934	1.953	0.000	13.390

A. Mission Description and Budget Item Justification

Work in this Project designs, determines, and assesses innovative materials solutions aimed at achieving leap ahead increases in lethality and weapons effectiveness through improvements in weight and volume efficiency, lethal effects, and sustainability of military systems. This research complements Program Element (PE) 0602141A (Lethality Technology) / Project AH6 (Disruptive Energetics and Propulsion Technology) and Project AH7 (Lethal and Scalable Effects Technologies), and PE 0602147A (Long Range Precision Fires Technology) / AH4 (Precision and Cooperative Weapons in a Denied Environment) and builds upon and ballistic sciences research in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Materials for Advanced Lethality *Description:* This effort researches innovative materials aimed at achieving leap-ahead increases in lethality and weapons effectiveness through improvements in weight and volume efficiency, lethal effects, and sustainability of military systems that can only be achieved through advances in materials technology. *FY 2024 Plans:* Will print and validate topology optimized additively-manufactured (AM) rocket motor; print and assess solids loading energetic polymers; assess energetic Orzo material; use Orzo on topology-optimized propellants; print high-strength energetic binder for gun-launch application; develop multi-material-capable print head and develop g-code. *FY 2025 Plans:* Will mature the printed Orzo topology propellant technology. Investigation of materials and manufacturing methods for solid fuels for future air breathing propulsion: design and develop materials-by-design workflow to determine and mature novel alloy compositions to reduce gun barrel wear and erosion. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	1.863	1.906	1.910
Accomplishments/Planned Programs Subtotals	1.863	1.906	1.910

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** AH8 *I Lethality Materials and Processes Technology*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army | **Date:** March 2024

Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602141A / Lethality Technology	Project (Number/Name) AH9 / Advanced Warheads Technology

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AH9: *Advanced Warheads Technology*	-	25.845	24.326	27.292	-	27.292	28.712	30.320	32.840	35.197	0.000	204.532

A. Mission Description and Budget Item Justification

This Project explores multiple pathways to enhance lethal efforts for future warheads against emerging peer/near peer target sets and investigates synergistic effects of novel micro warheads using advance materials. This Project investigates innovative energetic materials and novel processing techniques for the next generation of explosives and propulsion applications to enable an increase in range, lethality, and utility of munitions. It also directly supports Army Modernization Priorities through researching and developing energetic (propellant) technologies and processes for increased performance, expanded operation temperature bounds, and improved safety and environmental compliance of missile systems.

Work in this Project complements Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BK5 (Adv Direct In-Direct Armament Sys (ADIDAS) Tech) and Program Element (PE) 0603464A (Long Range Precision Fires Advanced Technology) / Project CE9 (Armaments 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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Warheads	11.506	7.665	-
Description: This effort explores multiple pathways to enhance lethal effects for future warheads against emerging peer/near peer target sets and investigates synergistic effects of novel warheads using advanced concepts of operations, materials, geometries, and manufacturing processes. *FY 2024 Plans:* Will investigate novel designs, advanced materials, and manufacturing enablers to develop innovative lethal defeat mechanisms. Will develop advanced algorithms to optimize shape charge, fragmentation, and explosively formed penetrators through state of the art modeling and simulation. Will research munition warhead technologies for providing disruptive effects and/or defeating ground and aerial manned and unmanned targets. Will design and develop novel warheads for enhanced armor penetration and defeat that are survivable in high-g environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding change reflects planned life cycle conclusion of this effort.			
Title: Advanced Energetics	12.833	13.815	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** AH9 *I Advanced Warheads Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort develops advanced energetic materials and novel processing techniques for future explosives and propulsion applications that enable an increase in range, lethality, and utility of ammunitions. *FY 2024 Plans:* Will design and develop novel energetic materials utilizing advanced processing methodologies. Will investigate new propellant and explosive materials and formulations for increased energy and performance. Will develop advanced manufacturing methods for additively manufactured explosive and propellant components. Will investigate novel propellant grain geometries in concert with new propellant formulations as well as investigate embedded ignition that extend lethal munition system capabilities. Will utilize experimental outputs to refine modeling and simulation algorithms to predict performance of future propellant, explosive formulations, and geometries. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding change reflects planned life cycle conclusion of this effort.			
Title: Advanced Pyrotechnics *Description:* This effort investigates compositions, components, and technologies to provide novel pyrotechnic formulations and devices to increase overall system performance and survivability. Coordinates research, strategic assessments and development of novel pyrotechnic technologies that will enable disruptive capabilities for Multidomain Operations. This effort supports the Army Modernization Priorities. *FY 2024 Plans:* Will develop novel pyrotechnic materials, components, and configurations to extend shelf life, operate in extreme temperatures, and provide advanced capabilities for future fuze and munition performance. Will investigate the automation of pyrotechnic processes and procedures to improve safety and performance. Will investigate pyrotechnic materials for multi-point igniters and precision self-destruct pyrotechnic components. *FY 2025 Plans:* Will design and develop novel pyrotechnic materials, components, and configurations to extend shelf life and operate in extreme temperatures; design and develop the automation of pyrotechnic processes and procedures to improve safety, performance, and yield. Mature pyrotechnic components for multi-point igniters, alternate igniter formulations, and precision self-destruct pyrotechnic components. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	1.506	2.846	2.919
Title: Next Generation Warheads Technology	-	-	11.194

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** AH9 *I Advanced Warheads Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort designs novel warheads and lethal mechanisms for advanced payload concepts in current and future armaments. Develops methodologies to produce conventional, non-conventional, distributed, and synergistic effects and lethality in warhead payloads through advanced designs, materials, modeling, and manufacturing processes. *FY 2025 Plans:* Will fund research of reactive materials for blast augmentation and increased lethality through investigation of novel materials and updated equations of state. Design and develop advanced modeling techniques to optimize shaped charges, explosively formed penetrators, and advanced fragmentation lethal mechanisms. Investigate concepts for armor defeat, combined effects, and behind armor effects scalable to multiple payload sizes; investigate modular payload concepts for use in both traditional and non-traditional carriers for desired effects. Mature warhead components for survivability in high-g and other extreme environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY2025, Warheads efforts re-aligned from Advanced Warheads to Next Generation Warheads Technology for better fidelity in funding for designs novel warheads and lethal mechanisms for advanced payload concepts, and to mature warhead components for survivability.			
Title: Next Generation Energetics Technology *Description:* This effort designs and develops energetics in support of increased lethality and range and seeks to reduce operational and safety risk. The effort will focus on the following areas related to energetics: additive manufacturing, tailorable outputs, survivability in extreme environments, and advanced processing techniques. *FY 2025 Plans:* Will design enhanced explosive fills, distributed energetic initiation, novel gun propulsion, and embedded ignition for additive and advanced manufacturing technologies; investigate energetic materials including high energy propulsion technologies and high energy explosives supporting lethal systems' capabilities; investigate energetic materials for extreme cold, extreme heat, high pressure, and extreme set-back conditions, funds research of continuous flow reactors and advanced mixing technologies for energetic materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY2025, Energetics efforts re-aligned from Advanced Energetics to Next Generation Energetics Technology for better fidelity in funding additive manufacturing, tailorable outputs, survivability in extreme environments, and advanced processing techniques.	-	-	13.179
Accomplishments/Planned Programs Subtotals	25.845	24.326	27.292

C. Other Program Funding Summary ($ in Millions)
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602141A / Lethality Technology	Project (Number/Name) AH9 / Advanced Warheads Technology

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army				**Date:** March 2024
Appropriation/Budget Activity 2040 / 2		**R-1 Program Element (Number/Name)** PE 0602141A / *Lethality Technology*		**Project (Number/Name)** BS6 / *Lethality Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - INTELLIGENT NEXT-GENERATION ADDITIVE MANUFACTURING HUB	2.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - NOVEL ARMAMENT SYSTEMS	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - QUANTUM TECHNOLOGIES FOR ARMAMENT SYSTEMS	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Add: Program Increase - TURRET GUNNER SURVIVABILITY AND SIMULATION ENVIRONMENT	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lethality Technology.		
Congressional Adds Subtotals	107.000	-

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army									**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2				**R-1 Program Element (Number/Name)** PE 0602141A / *Lethality Technology*				**Project (Number/Name)** CF7 / *Solid-state Laser Concepts and Architectures*		

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CF7: *Solid-state Laser Concepts and Architectures*	-	8.556	9.892	9.912	-	9.912	7.920	6.924	6.532	7.133	0.000	56.869

A. Mission Description and Budget Item Justification

This Project provides the research and development of advanced solid-state laser materials and architectures to support the Army Directed Energy Strategy for laser-based directed energy (DE) weapons. This Project investigates advanced laser technologies based on unconventional solid-state laser concepts and designs, scalable and intelligent power modules, and advanced thermal management systems for the development of less complex, low size, weight, and power (SWaP) Army DE weapons and tactical lasers with much improved capabilities.

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: High Energy Laser (HEL) Enabling Technologies for Tactical Directed Energy Weapons *Description:* Investigate novel solid-state laser concepts, architectures, and components in support of the Army's HEL weapons strategy. Develop innovative laser gain materials with much improved spectral, thermal, thermo-mechanical, and thermo-optical properties. Develop increased power while reducing size and weight, and complexity of all HEL components. *FY 2024 Plans:* Will determine critical pathways to both crystalline core/crystalline cladding (C4) and Raman fiber fabrication with the lowest achievable loss figure; mature components enabling directly-diode-cladding-pumped Raman fiber laser and C4 fiber laser power scaling to 5kW out of a single fiber; design and develop thermal material integration concepts, conduct experiments, and validate device and system-level numerical modeling optimization approaches. *FY 2025 Plans:* Will assess the results achieved from a crystalline core/crystalline cladding (C4) fiber laser and a directly diode-pumped Raman fiber laser for laser power scaling toward the goal of 5 kW out of a single fiber aperture; identify the most feasible laser technology for further development towards achieving higher power based on Size, Weight and Power (SWaP) and manufacturability considerations. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	8.556	2.250	2.266
Title: Advanced High Energy Laser Technology	-	7.642	7.646

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CF7 *I Solid-state Laser Concepts and Architectures*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: Investigate power scaling strategies for advanced solid-state lasers through the exploitation of the unique properties of advanced materials to develop higher power lasers with lower size, weight, and power requirements. This effort funds research to maximize output power towards theoretical limits, design and develop scalable power conversion with intelligent control for improved efficiency and resiliency, and designs and develops an optimized preliminary design fiber laser to best serve the purpose of power scaling analysis toward 5 kW and 50 kW of output power. Effort will also assess scaled 50 kW power and thermal concepts. *FY 2024 Plans:* Will validate major clusters of fiber laser modeling for both crystalline core/crystalline cladding (C4) and Raman fiber laser power scaling out of a single fiber aperture; identify the most promising C4 fiber fabrication technique as it pertains specifically to fiber length scaling required to achieve 5 kW power level. Will mature C4 fiber laser components to enable power scaling to 5 kW out of a single fiber. Will mature thermal management and damage resistance related concepts for achieving objective output power. *FY 2025 Plans:* Will mature the required components and develop conceptual designs for the breadboard 50 kW fiber laser; develop diode laser pumping designs; perform high power component damage validation and develop mitigation strategies; verify performance versus modelling as power scales beyond 5 kW; develop safety and assessment infrastructure for higher powers; develop thermal management system designs to achieve objective output power and develop experimental validation strategies. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	8.556	9.892	9.912

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040 / 2				R-1 Program Element (Number/Name) PE 0602141A / *Lethality Technology*				Project (Number/Name) CF8 / *Terminal Effects Against Critical Targets Tech*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CF8: *Terminal Effects Against Critical Targets Tech*	-	3.851	2.180	1.034	-	1.034	5.184	4.339	3.736	2.462	0.000	22.786

A. Mission Description and Budget Item Justification

This Project designs and develops engineering tools and high-fidelity modeling and simulation capabilities for materials and structural response to predict and enhance weapons performance to ensure lethality against structures and critical assets. Through dynamic impact experiments for a broad range of velocities against conventional and advanced structural materials, this project develops engineering tools and technologies to rapidly evaluate and predict weapon performance.

Work in this Project complements Program Element (PE) 0603116A (Lethality Advanced Technology) / Project CH5 (Terminal Effects Against Critical Targets Adv Tech).

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 United States Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Terminal Weapons Effects Technology	3.851	2.180	-
Description: This effort develops and validates terminal weapons effects prediction capabilities for Long Range Precision Fires (LRPF) weapons against geomaterials, structures, and other critical assets.			
FY 2024 Plans: Will mature Virtual Material Library (VML) which provides additional weapon/target pairing for predictive models; will develop high-fidelity predictive capabilities for blast and penetration of higher velocity warheads for key weaponeering tools; will validate semi-automated 3D change detection tool for rapid BDA capabilities.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603116A (Lethality Advanced Technology) / Project CH5 (Terminal Effects Against Critical Targets Adv Tech).			
Title: Adaptive Technologies for Advanced Weapons	-	-	1.034
Description: Develops and validates the capability to predict terminal weapons effects for new advanced warheads and weapon systems with initial operational capabilities past Fiscal Year 2025 against geomaterials, structures, and other critical assets.			
FY 2025 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CF8 *I Terminal Effects Against Critical Targets Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will conduct experiments of new advanced munitions against critical targets and target materials. Will investigate and develop fast running engineering tools to support new warhead capabilities for blast and blast/fragment effects. Design, develop and mature fast running penetration predictive models and analysis codes for high velocity impact/penetration conditions into critical targets of interest. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	3.851	2.180	1.034

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CG4 *I Advanced Radar Concepts and Technologies*			

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CG4: *Advanced Radar Concepts and Technologies*	-	5.869	6.008	7.044	-	7.044	12.014	15.039	12.123	9.202	0.000	67.299

A. Mission Description and Budget Item Justification

This Project conducts experiments on single crystal diamond and diamond hetero-structure semiconductor materials, layered structures, and novel devices for Diamond Electronics and integrated photonics structures and devices for Radar, Communications, and improved Size, Weight, and Power (SWaP) Department of Defense systems. Efforts include multiscale modeling, material and structure growth and characterization, and novel device design and fabrication as well as two-dimensional (2-D) electronics for bio-inspired neuromorphic sensors, processors, and memory. This research has application to radars, communication systems, electronic warfare, directed energy, electronics for hypersonic systems, radiation hard systems, quantum sensing, and others. This Project directly supports Air and Missile Defense modernization priority capabilities by investigating essential component technologies for insertion into Multi-Mission Army Radar systems. This Project addresses the challenges of integrating new materials into Silicon Complementary Metal Oxide Semiconductor (CMOS) processing flows, and electronics reliability including protection against unintended adversarial use of state-of-the-art semiconductor materials, devices, and systems for Air and Missile Defense in contested environments.

Work in this Project complements Program Element (PE) 0603466A (Air and Missile Defense Advanced Technology) Project AD6 (Next Generation Fires Radar 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 Army Research Laboratory (ARL) and Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Antennas and Radio Frequency (RF) Device Components for Advanced Electronic Systems *Description:* Conduct experiments into novel diamond material and silicon photonic device structures operable in the RF electromagnetic spectrum with high radiated power density for increased radar range and better target detection, improved efficiency of communications systems, smaller SWaP for electronics/cooling of autonomous systems, high temperature electronics for hypersonics, and radiation hardened electronics. *FY 2024 Plans:* Will conduct research of ultra-wide bandgap (diamond based) RF power amplifier test articles for improvements in RF power density, embodied by circuits that will be aligned with requirements for phased array antenna systems and low SWaP applications; conduct preliminary assessment of a phased array antenna with chip-scale beamformer photonic circuitry; investigate novel multi-function and reconfigurable antenna solutions across distributed assets for data collection and dissemination based on additive	4.930	5.054	5.062

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army			**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2		**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CG4 *I Advanced Radar Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
manufacturing technology; investigate methodologies for integrating materials that naturally exhibit neuromorphic function into Silicon Complementary Metal Oxide Semiconductor (CMOS) process flows; integrate and assess novel multi-frequency antenna designs and algorithms for future Army systems. *FY 2025 Plans:* Will investigate and validate phased array antenna with chip-scale beamformer photonic circuitry performance. Fund research of the interaction between RF signals and topological materials and determine the value of incorporating those materials into advanced RF systems. Investigate multi-layer electromagnetic metasurface designs incorporating wideband and multi-function conformal skins for smart radar enclosures. Design and develop low-SWaP multiband and distributed anti-jam antennas and algorithms for Army position, navigation and timing (PNT) and communications systems. Assess novel multiband antenna array integrated with anti-jam system testbed; mature diamond surface field effect transistor output power density, device stability, and frequency range; and investigate techniques to expand electronic grade single crystal diamond wafer diameter size. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned lifecycle of this effort.			
Title: Distributed Radar Architectures *Description:* This research seeks to validate critical functions and perform proof-of-concept laboratory experimentation to develop phase synchronous, coordinated radar and multi-function effects that enable distributed, global positioning system (GPS)-independent, autonomous capabilities. This effort validates critical synchronized distributed networked sensor functions and novel signal processing methods. This effort validates advanced antenna designs for low size, weight, power and cost (SWAP-C), multi-function systems. *FY 2024 Plans:* Will conduct experiments for coherent radar beamforming using a 2-node distributed transceiver. Will design and develop a model of a 5-node sensing network and a method for establishing relative position without GPS. *FY 2025 Plans:* Will validate coherent beamforming performance with a 2-node distributed transceiver; create a 5-node distributed transceiver and benchmark its performance; develop methods to calibrate the distributed transceivers and optimize the two-way time and frequency transfer algorithm. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	0.939	0.954	0.980
Title: Radar Digital Twin (EXHILARAMA)	-	-	1.002

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CG4 *I Advanced Radar Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort researches, designs, and develops a radar digital engineering environment, virtual prototype radar system architecture, and component technology to address next generation radar requirements, and quantifies performance through rapid persistent modeling and simulation. *FY 2025 Plans:* Will investigate and perform a technology trade study to evaluate state-of-the-art hardware and software, determine system requirements, and quantify initial impact of hardware and software components to next generation radar performance through system-level modeling. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025 this effort is restructured from Program Element (PE) 0603464 (Long Range Precision Fires Advanced Technology) / CE9 (Armaments Advanced Technology).			
Accomplishments/Planned Programs Subtotals	5.869	6.008	7.044

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CI1 *I Advanced Armaments Lethality Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CI1: *Advanced Armaments Lethality Technology*	-	1.493	1.684	4.352	-	4.352	4.518	6.493	6.121	5.960	0.000	30.621

A. Mission Description and Budget Item Justification

This Project designs and develops novel armament systems concepts and enabling technologies in weapons, munitions, and fire control, in order to advance range and accuracy capabilities.

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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Armaments Lethality Technology	1.493	1.684	4.352
Description: This project designs and develops novel armament systems concepts and enabling technologies in weapons, munitions, and fire control required to enable and dominate Multi Domain Operations (MDO). This includes advancing state of the art armament system technologies to provide overmatch against current and future threats. *FY 2024 Plans:* Will conduct threat based analysis to defeat evolving and forecasted threats, assess technological trends, and develop enabling technologies in weapons, munitions, and fire control to support exploration of new concepts for Multi Domain Operations; investigate complex trade space consisting of multi-role/multi-mission, kinetic/non-kinetic, and dynamic targeting. *FY 2025 Plans:* Will investigate prioritization algorithms for multi-target engagement scenarios involving unmanned vehicles; design and develop weapon, munition, and fire control concepts to defeat multi-target swarming scenarios; investigate solutions for combined terrain shaping and breaching operations from a single armament system. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned development of lethal mechanisms, development of fire control targeting algorithms, and design of mobile terrain shaping and breaching hardware components.			
Accomplishments/Planned Programs Subtotals	1.493	1.684	4.352

C. Other Program Funding Summary ($ in Millions)
N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
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C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CIA *I Applied Armaments Tech for Distributed Lethality*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete** / **Total Cost**
CIA: *Applied Armaments Tech for Distributed Lethality*	-	-	3.445	-	-	-	-	2.204	2.825	8.476	0.000 / 16.950

A. Mission Description and Budget Item Justification

Platform Agnostic Armaments Applied Tech investigates technologies that holistically maximize armament performance, minimize target engagement timelines, reduce crew workloads, enhance responsiveness and enable collaborative lethal effectiveness on target across distributed platforms & missions. This project researches cross caliber weapon, munition & fire-control technologies to enhance Remote Weapon Systems (RWS) responsiveness and single or combined platform lethality in Multi-Domain Operations (MDO) environments.

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 Next Generation Combat Vehicle Army Modernization Priority.

Work in this Project is performed by the Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Platform Agnostic Armaments Applied Tech	-	3.445	-
Description: This effort designs and develops technologies that enables platform performance by increasing range without degrading accuracy, reducing size, weight, and power and impact to lighter platforms, enhancing weapon, munitions, fire control, & agnostic remote weapon automation tech to reduce the kill chain timeline. This effort enables Army Modernization and Multi-Domain Operations (MDOs) in support of the Army's future and planned vehicles. *FY 2024 Plans:* Will develop concepts and supporting?critical enabling technologies that include?communication mechanisms and electrically-powered weapon technologies; focus on?decreased size, weight, and power usage while increasing performance and safety of remote weapon systems; investigate reduction of remote armament system target engagement time through novel fire control techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025, this Project is terminated.			
Accomplishments/Planned Programs Subtotals	-	3.445	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CIA *I Applied Armaments Tech for Distributed Lethality*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CIB *I Sensor to Shooter (STS) Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CIB: *Sensor to Shooter (STS) Applied Research*	-	-	6.468	7.909	-	7.909	9.264	9.371	-	-	0.000	33.012

A. Mission Description and Budget Item Justification

This Project designs and develops advanced algorithms for sensor to shooter decision aids and incorporates predictive tools and permissive airspace capabilities to reduce the sensor to shooter timeline and effects execution. Investigate technologies for enabling multi-sensor fusion for collaborative tracking of multi-theater threat tracks to enable tactical target engagement and counter fires across threat flight timeline.

Work in this Project complements Program Element (PE) 0603116A (Lethality Advanced Technology) / Project CID (Sensor to Shooter (STS) 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 supports Next Generation Combat Vehicle, Tactical Network, Future Vertical Lift, and Long-Range Precision Fires Army Modernization Priorities.

Work in this Project is performed by the Armaments Center, Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center, and United States Army Space and Missile Defense Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Lethal Effects Architecture for Decision Synchronization Technology	-	6.468	6.199

Description: This effort designs and develops advanced adaptive algorithms and architectures to improve threat prediction, reduce the sensor to shooter timeline, and enhance airspace deconfliction in support of Large-Scale Combat Operations in a dynamic multi-domain environment.

FY 2024 Plans:
Will investigate advanced algorithm concepts to support decision aid recommendations across dynamic conditions. Will research advanced decentralized algorithms for networked lethality collaboration across manned and unmanned systems. Will investigate predictive and adaptive algorithm concepts and design algorithms to align with Decision Point methodologies. Will explore algorithms to predict threat behavior to improve current sensor to shooter decision aid systems for large scale combat operations. Will investigate advanced predictive tools to synchronize and de-conflict airspace.

FY 2025 Plans:
Will design and develop advanced algorithms to support decision aid recommendations and distributed lethality multi-effects in a dynamic environment across echelons. Funds research development of algorithms predictive threat behavioral algorithms to

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CIB *I Sensor to Shooter (STS) Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
improve sensor to shooter decision aids for large scale combat operations; design advanced predictive algorithms to synchronize and de-conflict airspace; investigate temporal decision aids concepts to enhance algorithm predictions across time as the battlefield evolves. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease is an economic adjustment.			
Title: C-SR QC2	-	-	1.710
Description: Investigates, designs and develops counter-surveillance and reconnaissance solutions to determine optimal threat engagement in support of Large-Scale Combat Operations in a joint all-domain command and control environment. ***FY 2025 Plans:*** Will investigate counter-surveillance and reconnaissance concepts for degrading adversary capabilities. Design and develop concept of operation to achieve mission requirements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase due to new task in Program Element (PE) 0602141A / Lethality Technology/Project CIB / Sensor to Shooter (STS) Applied Research.			
Accomplishments/Planned Programs Subtotals	-	6.468	7.909

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CIC *I Fire Control Lethality Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CIC: *Fire Control Lethality Technology*	-	-	1.462	2.958	-	2.958	2.957	2.956	1.508	1.523	0.000	13.364

A. Mission Description and Budget Item Justification

Work in this Project researches, investigates and develops concepts for common open architecture fire control systems to maximize distributed armament systems performance. Researches fire control architecture framework and protocols utilizing artificial intelligence and machine learning to minimize target engagement timelines, reduce cognitive processes, and enable collaborative lethal effectiveness on target across weapon platforms. Develops modular fire control concepts enabling safe, lethal, and agile integration of current systems to engage emerging threats and decrease system vulnerabilities for maximize performance and combined arms effects.

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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Future Fire Control Tech (F2CT)	-	1.462	2.958
Description: This effort designs and develops fire control technologies to increase interoperability and improve performance across future distributed armament systems. This effort designs and develops novel components, algorithms, and architectures necessary for future fire control systems. *FY 2024 Plans:* Will investigate open and common fire control architectures to improve combined arms engagement effects from future distributed manned/unmanned armament systems; investigate novel algorithms and components for reduced fire control decision time, interoperability, and insertion into future fire control open architecture designs. *FY 2025 Plans:* Will investigate a novel cross cutting fire control framework supporting armaments interoperability across distributed platforms; investigate the collection, processing and transmission of various target data sets and solutions across small arms, aviation, combat vehicle, mortars and artillery platforms; investigate the feasibility of an expanded fire direction center capability to include other fire support elements. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned work to investigate a fire control framework that supports armaments interoperability.			
Accomplishments/Planned Programs Subtotals	-	1.462	2.958

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CIC *I Fire Control Lethality Technology*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*					**Project (Number/Name)** CJ1 *I Lethality Enabling University Applied Research*	
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CJ1: *Lethality Enabling University Applied Research*	-	6.330	7.197	7.874	-	7.874	8.354	8.360	8.451	8.536	0.000	55.102

A. Mission Description and Budget Item Justification

The Project leverages research and technological innovations from academia, of lethal directed energy, laser diagnostics and accelerated design of future hypersonics and their scramjet engine combustion, deep learning (DL) guidance tools and novel materials of importance to the Army, by accelerating research and conducting experiments focused on getting technology to the warfighter more quickly. This Project performs discovery research efforts to focus more on mid to far-term Army modernization priorities while also maintaining delivery of near-term technologies critical to the Long Range Precision Fires and Air and Missile Defense. This Project focuses on employment of research technologies originating from extramural applied research in academia pertaining to lethal directed energy, laser diagnostics, future hypersonic glide body and scramjet propulsor design, DL guidance tools, novel materials, and expansion of the Ballistic, Aero-Optics and Materials (B.A.M.) range applied to lethality. This effort conducts applied research and development leading to potential emerging technologies in areas of strategic importance to the Army in directed energy, future hypersonic glide body design, DL and novel materials, etc., by bringing competitively selected Universities with research and development teams into Technical Alliances.

Work in this Project complements Program Element 0602147A (Long Range Precision Fires) and Program Element 0602150A (Air and Missile Defense Technologies)

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

Work in this Project is performed by the University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Laser Diagnostics for Hypersonics and Directed Energy *Description:* This effort researched systematic expansion in laser diagnostics technologies to assess hypersonic turbulence and boundary layer transition. Work is conducted in collaboration with university partners to advance the effects of atmospheric turbulence on laser propagation and gain applied knowledge in directed energy systems effectiveness and range. *FY 2024 Plans:* Will continue to investigate methods for measuring hypersonic air flow, impacts of atmospheric and environmental conditions both close to the source, near field, and close to the target, far field. Will validate models that predict impacts those conditions have on directed energy systems. Will investigate methods of sensing for hypersonic ground test and flight applications and for the	1.609	1.842	2.399

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024		
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CJ1 *I Lethality Enabling University Applied Research*		

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
measurement of turbulent aero-optical environments. Will investigate directed energy applications and effectiveness of various types of laser systems. *FY 2025 Plans:* Will design and develop diagnostic tools and methods for quantification and visualization of hypersonic flows and hypersonic interactions to improve prediction and optimization of the performance of hypersonic systems based on well characterized ground testing. Funds research in academia to enhance the effectiveness and utility of Directed Energy (DE) systems operating under realistic atmospheric conditions to enable the prediction of the effectiveness of DE systems. Funds academic applied research in emerging aero-optic technologies for laser diagnostic and directed energy effectiveness; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.			
Title: Turbulence and Transition Modeling and Validation for Hypersonic Vehicles *Description:* This effort is conducted in collaboration with university partners to develop modeling tools to help inform the flight envelope of existing hypersonic vehicles to accelerate design of future hypersonic glide bodies. *FY 2024 Plans:* Continues to mature modeling techniques and methods to improve the design and control of future hypersonic glide bodies. Investigate commercial methods to improve the implementation of models into relevant government tools in a high performance computing environment. *FY 2025 Plans:* Will design and develop methods to predict and control drag and investigate thermal loading of hypersonic platforms. Develop accurate aerothermo-dynamic modeling of missile geometries with experimental validation from Mach 6 - 12 at true flight temperatures and high Reynolds numbers, including high incidence angles; funds academic applied research in emerging technologies to improve modeling for hypersonic flight activity; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.	1.703	1.976	3.342
Title: Novel Materials for Extreme Environments	1.200	1.309	1.613

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602141A / *Lethality Technology*	Project (Number/Name) CJ1 / *Lethality Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort produces a test environment for thermal and ablation evaluation of novel materials relevant to hypersonic vehicles. Work is conducted in collaboration with university partners to assess material characteristics and develop computational models of high strain rate materials to mitigate the effects of high kinetic energy impacts. *FY 2024 Plans:* Will continue to develop critical high temperature materials and characterize for the design of thermal protection systems and investigate material ablation modeling. Will investigate high temperature thermal management systems for hypersonic leading edges. Will investigate thermal resistance between dissimilar hypersonic materials. Will investigate material oxidation and determine deployable solutions, advanced materials and composites to protect the hypersonic vehicles in extreme heat. Will continue to use the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. Investigate methods to discover high entropy materials for extreme environments. *FY 2025 Plans:* Will develop the test environment and manufacturing techniques of materials for production of hypersonic vehicles using newly developed refractory high-entropy alloy (RHEA) materials capable of withstanding extreme environments; funds applied academic research for emerging technologies for novel materials in hypersonic applications; funds research and incorporates the Ballistic Aero-Optics and Materials (BAM) range to validate data and improve test techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects an administrative realignment from task (Intelligent Hypersonics and Other Vehicle Systems) within this project.			
Title: Intelligent Hypersonics and Other Vehicle Systems *Description:* This effort develops and designs geometrically relevant testing hardware required to study aerothermodynamic performance, increase impact velocity and extend range of precision strike munitions. Work is conducted in collaboration with university partners to collect experimental data and insights required to train deep learning neural networks used for the development of hypersonic vehicle flight systems with adaptability and increased lethality. *FY 2024 Plans:* Will continue to develop intelligent defense vehicle systems and their self health-monitoring sensors to survive and optimize path planning. Will develop dynamic adversarial machine learning (ML) and training for rapid response automated tracking, and disguised flying objects. Will recommend sensor deployment to maximize information gain for swift decision making and suggest vulnerability scores to all locations, in complex terrains, overcoming line-of-sight constraints. *FY 2025 Plans:*	1.818	2.070	0.520

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CJ1 *I Lethality Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will fund applied academic research in emerging intelligent hypersonics systems; continues to develop relevant hardware required to study aerothermodynamic performance, collect experimental data and insights required to inform advanced technology research. The benefits of this effort improve hypersonic flight adaptability and lethality. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects an administrative realignment to tasks (Laser Diagnostics for Hypersonics and Directed Energy), task (Turbulence and Transition Modeling and Validation for Hypersonic Vehicles), and task (Novel Materials for Extreme Environments) within this project.			
Accomplishments/Planned Programs Subtotals	6.330	7.197	7.874

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CJ7 *I Future Air Defense Missile Enabling Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CJ7: *Future Air Defense Missile Enabling Tech*	-	1.922	2.324	4.608	-	4.608	4.613	4.616	4.667	4.714	0.000	27.464

A. Mission Description and Budget Item Justification

This Project investigates, develops, and evaluates critical missile technologies and components necessary for advanced lethal capability in support of future/mid to far term affordable short range air defense interceptor capability to defeat Cruise Missile (CM), Rotary Wing (RW), Tactical / Lethal Unmanned Aerial System (UAS), and Fixed Wing (FW) threats. This effort designs and develops technologies to provide advanced materials, seekers, guidance and control, and propulsion for reduced size weight and power and cost for Maneuver Short Range Air Defense (MSHORAD), Short Range Air Defense (SHORAD), and Lower Tier essential to maintain overmatch against mid-/far-term threats. This project supports Air and Missile Defense Modernization priority efforts.

This research complements Program Element (PE) 0602147A (Long Range Precision Fires Technology / Project AF3 (Extended Range Propulsion Technology) and Project AF8 (Affordable Extended Range Precision 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Future Air Defense Missile Enabling Technology	1.922	2.324	4.608
Description: Designs and develops reduced cost advanced Air Defense missile critical components essential to maintain overmatch against mid/far term M-SHORAD, SHORAD, and Lower Tier threats. *FY 2024 Plans:* Will investigate and develop novel missile technologies that inform future lower tier and SHORAD capabilities; investigate solid fuel ramjet (SFRJ) propulsion technology in the current Stinger form factor for increased range while maintaining current system compatibility; design and develop missile attitude control systems (MACS) for increased maneuverability and investigate reactive material warhead technologies to improve lethality for Lower Tier Future Interceptor. *FY 2025 Plans:* Will develop and evaluate SFRJ propulsion technology in the current Stinger form factor to achieve increased range while maintaining current launcher compatibility; validate MACS design by conducting experiments on component technology for various missile defense applications; develop and evaluate reactive material warhead technologies to improve lethality for lower-tier air and missile defense applications; investigate, develop concepts, perform trade studies, improve modeling and simulation			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CJ7 *I Future Air Defense Missile Enabling Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
capabilities, and develop critical missile component technologies required to defeat emerging Air and Missile Defense (AMD) threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects technology development and evaluation for reactive material warheads for lower-tier air and missile defense applications. Additional investments in missile component technology required to outpace AMD threats and inform future AMD capabilities.			
Accomplishments/Planned Programs Subtotals	1.922	2.324	4.608

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*				**Project (Number/Name)** CZ9 *I Foundational Hypersonic Weapons Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CZ9: *Foundational Hypersonic Weapons Research*	-	7.589	8.360	10.801	-	10.801	11.556	14.161	14.968	14.422	0.000	81.857

A. Mission Description and Budget Item Justification

This Project investigates foundational problems associated with high-speed weapons and informs the future strategic fires echelon of Long-Range Precision Fires (LRPF) capabilities. This Project funds the research of material science subjects such as extreme thermal loading and aero-thermodynamics and control technologies for high- speed vehicles which may encounter high mechanical loads at launch.

Work in this Project transitions foundational research obtained in Program Element (PE) 0601102A (Defense Research Sciences) / AA7 (Mechanics and Ballistics) and complements PE 0602141A (Lethality Technology) / AH4 (Precision and Cooperative Weapons in Denied Environments), AH5 (Projectile and Multi-Function Warhead Technologies), Project AH6 (Disruptive Energetics and Propulsion Technologies), AH7 (Lethal and Scalable Effects Technologies), and AH8 (Lethality Materials and Processes Technology), PE 0602144A (Ground Technology) / BL1 (Materials and Manufacturing Research Technology), and PE 0602145A (Next Generation Combat Vehicle) / BI4 (Materials Application and Integration Tech).

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 consistent with the needs of the Army Research Priority of Hypersonic Flight.

Work in this Project is performed by the Army Research Laboratory (ARL) and the United States Army Space and Missile Defense Command, Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Foundational Hypersonic Weapon Materials *Description:* This effort investigates materials synthesis and processing (including innovative approaches such as high-throughput materials-by-design using artificial intelligence and machine learning algorithms), novel experimental techniques, and fundamental theoretical modeling to decrease cost, increase availability, and model thermal and mechanical survivability on hypersonic vehicles. Specific research topics include polymer/resin synthesis for composites, novel three-dimensional composite weave architectures, composite processing (process by which the material is made), ceramic window/dome materials, high-temperature metallic alloys, and joining techniques. *FY 2024 Plans:* Will continue to reduce processing costs of carbon-carbon composites and characterize resulting materials in comparison to industrial materials; execute materials-by-design workflow on refractory alloy compositions and high temperature ceramic blends;	5.926	6.279	6.389

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CZ9 *I Foundational Hypersonic Weapons Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
investigate ablation and oxidation resistance through torch assessments; characterize mechanical performance of various window and dome materials of interest. *FY 2025 Plans:* Will investigate ultra-high temperature ceramic matrix composites for use as ablation-resistant, shape stable leading edges. Design and develop a matrix of composite chemistries and processing methods to infiltrate fiber pre-forms with ceramic material. Develop processing methods to produce coupons of novel alloys and execute high temperature characterization of optimized compositions. Investigate processing methods to join dissimilar materials such as composites to metal or composites to ceramic; examine functionally graded materials for use as window and dome materials; develop processing methods to fabricate layered structures and form them into curved structures. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Foundational Hypersonic Weapons Flight and Control *Description:* This effort increases understanding of hypersonic vehicle flight behavior and control approaches for more aggressive, rapid, low risk multi-disciplinary designs of future hypersonic vehicles featuring enhanced agility/stability necessary for survivable delivery to advanced threats of the future. Research includes fundamental flow physics and chemistry, guidance and flight control algorithms, vehicle maneuver control mechanisms, novel vehicle shapes, and the theoretical modeling, computational toolsets, and experimental techniques to achieve these advancements. *FY 2024 Plans:* Will continue to explore aero-thermodynamics related to Army hypersonic vehicle concepts through advanced computational and experimental techniques; discover flight mechanisms and algorithms that overcome barriers to help enable affordable, high magazine depth, high-speed weapons. *FY 2025 Plans:* Will mature diagnostics for measuring hypersonic vehicle behaviors on free-flight ballistic ranges; investigates models coupling fluid-thermal-structural interactions with chemistry effects on hypersonic weapons; determines high-level control of hypersonic weapons to include dynamic path planning that considers adversarial response. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase supports additional research in the area of dynamic path planning for hypersonic weapons.	1.663	2.081	2.408
Title: Foundational Hypersonic System Component	-	-	2.004

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602141A *I Lethality Technology*	**Project (Number/Name)** CZ9 *I Foundational Hypersonic Weapons Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort supports the investigation, design and development of hardware and software components, models and simulations to further advance Hypersonic capabilities. *FY 2025 Plans:* Will fund research and investigate novel materials for development of hypersonic components to increase performance of radio frequency radomes, electro-optic windows, and advanced structures in extreme hypersonic conditions. Investigates alternative navigation, guidance and control techniques and algorithms in GPS-denied and extreme flight dynamics environments for defense applications. Designs and develops novel lethality enhancers, energetics, and deployables.to increase endgame and battlefield damage assessments. Determines requirements for advance hypersonic architectures and simulation testbeds developments to enable, test and verify research. *FY 2024 to FY 2025 Increase/Decrease Statement:* Increase in FY2025 to further advance Hypersonic capabilities by investigating, designing and developing of hardware and software components, models and simulations as well as determining requirements for advance hypersonic architectures.			
Accomplishments/Planned Programs Subtotals	7.589	8.360	10.801

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*						**R-1 Program Element (Number/Name)** PE 0602142A *I Army Applied Research*						
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	27.833	34.572	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	62.405
BS1: *Army Applied Research*	-	27.833	34.572	-	-	-	-	-	-	-	0.000	62.405

A. Mission Description and Budget Item Justification

The Army Applied Research budget line includes systematic application of knowledge toward the production of useful materials, devices and systems or methods including the design, development and improvement of science and technology for Army applications.

Efforts in this budget line include studies, investigations and non-system specific technology efforts leading to bread-board hardware or proof of principle analysis.

B. Program Change Summary ($ in Millions)

	FY 2023	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	27.833	34.572	35.766	-	35.766
Current President's Budget	27.833	34.572	0.000	-	0.000
Total Adjustments	0.000	0.000	-35.766	-	-35.766
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-35.766	-	-35.766

Change Summary Explanation
Funding decrease due to budget line item restructure.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*						
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	266.501	104.470	102.236	-	102.236	104.027	104.357	105.930	106.681	0.000	894.202
AY6: *Soldier Squad Small Arms Armaments Technology*	-	10.962	10.143	10.343	-	10.343	10.442	10.448	10.622	10.728	0.000	73.688
AY8: *Small Arms Fire Control Technology*	-	2.091	-	-	-	-	-	-	-	-	0.000	2.091
AZ2: *Body Armor & Integrated Headborne Technology*	-	6.617	6.321	5.807	-	5.807	5.814	5.817	5.881	5.941	0.000	42.198
AZ5: *Soldier Protection Technology - Vulnerability*	-	10.734	11.370	11.397	-	11.397	11.409	11.416	11.540	11.656	0.000	79.522
AZ9: *Soldier Protection Advanced Tech - Detectability*	-	1.747	-	-	-	-	-	-	-	-	0.000	1.747
BB4: *Dismounted Soldier Survivability Materials*	-	2.948	4.985	5.267	-	5.267	5.355	7.867	7.905	7.984	0.000	42.311
BB5: *Physical Augmentation: Tech for Human Interactions*	-	0.567	-	-	-	-	-	-	-	-	0.000	0.567
BC2: *Next Gen Mobility & Lethality Tech for Warfighters*	-	4.259	6.894	8.334	-	8.334	8.120	11.100	11.171	11.282	0.000	61.160
BC6: *Human Perf - Tech for Warfighter Enhancement*	-	1.348	-	-	-	-	-	-	-	-	0.000	1.348
BC7: *Training Technology (Other than STE)*	-	24.354	33.822	29.446	-	29.446	26.831	21.505	21.748	21.966	0.000	179.672
BD1: *Adv Soldier Sensors/ Displays Tech for Dismounts*	-	15.939	16.557	16.598	-	16.598	16.609	16.619	16.802	16.970	0.000	116.094
BD6: *Soldier Sys Interfaces/ Integration- Sensor Tech*	-	0.237	0.301	0.401	-	0.401	0.802	0.802	0.902	0.601	0.000	4.046
BD8: *Soldier & Sm Unit Tactical Energy Tech*	-	6.291	6.911	7.465	-	7.465	10.575	10.058	10.540	10.646	0.000	62.486
BE3: *Joint Service Combat Feeding Technology*	-	4.627	4.074	4.081	-	4.081	4.328	4.980	5.034	5.084	0.000	32.208

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*						
BE8: *Synthetic Training Environment (STE) Technology*	-	5.743	-	-	-	-	-	-	-	-	0.000	5.743
BP9: *Soldier Lethality Technologies (CA)*	-	164.700	-	-	-	-	-	-	-	-	0.000	164.700
BR9: *Personnel & Airdrop Safety Technology*	-	3.337	3.092	3.097	-	3.097	3.742	3.745	3.785	3.823	0.000	24.621

Note

 Project BD6 has realignments from Soldier System Interfaces & Integration (Sensor Technology) within this project and from task PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces Integration-Sensor Advanced Technology).

A. Mission Description and Budget Item Justification

 This Program Element (PE) conducts fundamental research on Soldier Lethality technologies to develop an integrated Soldier and Squad architecture of equipment and systems that improve Soldier and Small Combat Unit survivability, sustainability, mobility, combat effectiveness, and individual cognitive and physical readiness. To address the challenges of integrating multiple technologies and sub-systems, research conducted in this PE, significant Science and Technology applied research investments in all areas of Soldier Lethality focuses on how to improve the effectiveness of the technologies a Soldier utilizes and apply systems-level practices to mitigate constraints from size and weight of the equipment. Research areas encompass individual and crew-served weapon designs and technologies as well as applied research in lightweight and transparent armor materials to mitigate effects from blast and ballistic threats, counter explosive hazard detection, counter-sensor capabilities, and signature management of weapons, equipment, personnel and high value targets. This PE investigates, develops and designs materials, technologies, methodologies and system models required to experiment and optimize Soldier lethality and survivability through investments in mobility, human-agent teaming, and improved situational awareness interfaces and display technologies as well as to provide Soldier-borne power and energy materials and components that support multiple Soldier-borne systems. This PE also investigates Warfighter training technologies and develops the underpinning technologies to establish architecture standards and interfaces necessary for creating realistic synthetic environments to create a single, interconnected synthetic training system to enable Army units and leaders to conduct realistic multi-echelon / multi-domain combined arms maneuver and mission command training, increasing proficiency through repetition. Human Factors Engineering projects conduct applied research to design weapon systems standards, guidelines, handbooks, and Soldier training curriculum and tools.

 Results of these efforts are transitioned within the Army Futures Command, the Program Executive Offices, Army Training and Doctrine Command (TRADOC), Army Medical Command (MEDCOM), and the Army Test and Evaluation Command (ATEC).

 Work in this PE complements PE 0603118A (Soldier Lethality Advanced Technology).

 Portions of this funding line support the Soldier Lethality Army Modernization Priority.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	253.539	104.470	108.668	-	108.668
Current President's Budget	266.501	104.470	102.236	-	102.236
Total Adjustments	12.962	0.000	-6.432	-	-6.432
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	15.221	-			
• SBIR/STTR Transfer	-2.259	-			
• Adjustments to Budget Years	-	-	-6.432	-	-6.432

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BP9: *Soldier Lethality Technologies (CA)*		
Congressional Add: *Program increase - Pathfinder Airborne*	8.000	-
Congressional Add: *Program increase - HEROES Program*	10.000	-
Congressional Add: *Program Increase - ADVANCED TEXTILES AND SHELTERS*	6.000	-
Congressional Add: *Program Increase - Digital Night Vision Technology*	9.700	-
Congressional Add: *Program Increase - Military Footwear Research*	10.000	-
Congressional Add: *Program Increase - Nanolayered Polymer Optics*	10.000	-
Congressional Add: *Program Increase - ADVANCED BALLISTIC PROTECTION TECHNOLOGY*	25.000	-
Congressional Add: *Program Increase - ARTIFICIAL INTELLIGENCE - ENHANCED EDUCATIONAL TECHNOLOGY AND LEARNING*	5.000	-
Congressional Add: *Program Increase - ENHANCED BALLISTIC PROTECTIVE EYEWEAR*	5.000	-
Congressional Add: *Program Increase - ENHANCING SOLDIER BALLISTIC TECHNOLOGIES*	5.000	-
Congressional Add: *Program Increase - FLAT PANEL TECHNOLOGY*	2.000	-
Congressional Add: *Program Increase - FUTURE FORCE REQUIREMENTS EXPERIMENTATION*	10.000	-
Congressional Add: *Program Increase - INNOVATIVE TRAINING TECHNOLOGIES*	5.000	-
Congressional Add: *Program Increase - LITHIUM-ION BATTERY CELL RESEARCH PILOT*	9.000	-
Congressional Add: *Program Increase - PATHFINDER ADAPTIVE EXPERIMENTATION FORCE*	5.000	-

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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Congressional Add: *Program Increase - PATHFINDER CYBER INITIATIVES*	12.000	-
Congressional Add: *Program Increase - REGIONAL WORKFORCE PILOT*	10.000	-
Congressional Add: *Program Increase - SOLDIER & SMALL UNIT TACTICAL ENERGY TECHNOLOGY*	3.000	-
Congressional Add: *Program Increase - Extended Range and Hybrid Gun Launched Unmanned Aerial Systems*	15.000	-
Congressional Add Subtotals for Project: BP9	164.700	-
Congressional Add Totals for all Projects	164.700	-

Change Summary Explanation

FY2025 decrease reflects limitation of new innovation proposals for the novel training applications of emergent AI methods that are for specific learning outcomes with military-relevant AI training methods that expand the utility of AI for generating educational, training, or operational-insights and recommendations.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army							Date: March 2024				
Appropriation/Budget Activity 2040 I 2					**R-1 Program Element (Number/Name)** PE 0602143A I *Soldier Lethality Technology*				**Project (Number/Name)** AY6 I *Soldier Squad Small Arms Armaments Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AY6: *Soldier Squad Small Arms Armaments Technology*	-	10.962	10.143	10.343	-	10.343	10.442	10.448	10.622	10.728	0.000	73.688

A. Mission Description and Budget Item Justification

This Project investigates individual and crew-served weapon designs and technologies that enhance the fighting capabilities and survivability of the dismounted Warfighter in support of all of the Services. In addition, it conceives and advances weapon concepts based on innovative ballistic and advanced incapacitation technologies that will enhance the defeat of hard and soft infantry targets at extended ranges based upon the Joint Service Small Arms Technology Development Strategy (JSATDS). The Project will continue to support technology needs from all Services to include the Next Generation Family of Weapons. In addition, this Project will develop the technology/weapons concepts that will upgrade medium and heavy support weapons at echelons. Finally, this Project will perform research directed toward non-kinetic modalities to incapacitate combatants.

Work in this Project supports key Army needs and leverages the technical research of several Program Elements (PEs) to include PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics), PE 0603118A (Soldier Lethality Advanced Technology), and PE 0602141A (Lethality 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 Armaments Center (AC) and Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Soldier/Squad Lethality Technology	4.676	3.848	3.875

Description: This effort conceives and investigates advanced weapons concepts based on innovative ballistic technologies that will enhance the defeat of hard and soft infantry targets at extended ranges to ensure overmatch for Soldier Lethality. This effort will also perform research directed toward non-ballistic modalities to incapacitate combatants.

FY 2024 Plans:
Will develop lethal mechanisms related to the mounted machine gun roll to include defilade mission; investigate threat progression and how it relates to lethal mechanism performance in small caliber projectiles; complete development and validation of automatic jump range/approach for dispersion reduction; conduct advanced diagnostic experiments of novel propellant charges; investigate opportunities to improve performance of heavy mounted weapons in the platoon; mature weapon technologies enabling high performance, compact lightweight weapons; utilize modeling and simulation to assess the effects of standoff energy delivery and expand experimental capability.

FY 2025 Plans:

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AY6 *I Soldier Squad Small Arms Armaments Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will assess viability of candidate lethal mechanisms related to the mounted machine gun (MG) role to include defilade mission; mature understanding of threat growth implications to medium machine gun (MMG) and mounted MG capabilities; validate the fundamental explanations for the dispersion reductions in Next Generation Squad Weapons allowing for applications to other types of systems; conduct advanced diagnostic laboratory experiments of novel propellant charges; assess system applications and validate weapon technologies enabling high performance compact lightweight weapons; complete theoretical and computational analyses for prescribing near-field energy field parameters for biological effects; validate the ability to produce scalable incapacitating effects using near-field energy field mechanism in the appropriate biological model. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Small Arms Enabling Technologies ***Description:*** This effort designs and develops small arms weapon systems, enablers, and ammunition technologies that will maintain decisive lethal overmatch capabilities to the Joint Warfighter. This effort matures small arms weapon system designs in support of Joint Warfighter's capability needs. ***FY 2024 Plans:*** Will investigate future small arms concepts to enable a more efficient and lethal Joint Warfighter; design concepts to explore new small arms characterization techniques and metrics; investigate machine gun component technology for increased volume fire effectiveness from small units; validate algorithms and models used for advanced ballistics and holistic weapon signature system analysis; investigate fire control components and methodologies to improve future small arms system precision; develop technologies supporting future remote small?arms systems. ***FY 2025 Plans:*** Will design concepts to study small arms characterization techniques and metrics; design and develop machine gun component technology for increased volume fire effectiveness; mature algorithms and models used for advanced ballistics and holistic weapon signature system analysis; investigate fire control components and methodologies to improve future small arms system performance and emission reduction. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	6.286	6.295	6.468
Accomplishments/Planned Programs Subtotals	10.962	10.143	10.343

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AY6 *I Soldier Squad Small Arms Armaments Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602143A / Soldier Lethality Technology				Project (Number/Name) AY8 / Small Arms Fire Control Technology		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AY8: *Small Arms Fire Control Technology*	-	2.091	-	-	-	-	-	-	-	-	0.000	2.091

A. Mission Description and Budget Item Justification

This Project designs and develops technology for advanced small arms fire control in order to achieve lethality overmatch by supporting target prioritization, enhancing processing of information from multiple sources, and investigating aim assistance tools which remove Soldier aim error. This Project specifically supports the Army Science and Technology Soldier Lethality modernization priority.

Work in this Project complements work done in Program Element (PE) 0603118A (Soldier Lethality Advanced Technology) / AY7 (Small Arms Fire Control Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and the Soldier Lethality Cross Functional Team (CFT) efforts.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Adv. Fire Control Tech *Description:* This Project investigates software and hardware mechanisms to enable enhanced kill chain processes on small arms platforms. This includes investigating artificial intelligence and neural network hardware, conducting experiments on both Commercial and Government Off-The-Shelf (COTS and GOTS) artificial intelligence and machine learning algorithms, and validating Soldier accuracy performance models. It also includes investigation of lightweight optical components and determines viability of weight reduction and balancing approaches.	2.091	-	-
Accomplishments/Planned Programs Subtotals	2.091	-	-

C. Other Program Funding Summary ($ in Millions)
N/A

Remarks

D. Acquisition Strategy
N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** AZ2 *I Body Armor & Integrated Headborne Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AZ2: *Body Armor & Integrated Headborne Technology*	-	6.617	6.321	5.807	-	5.807	5.814	5.817	5.881	5.941	0.000	42.198

A. Mission Description and Budget Item Justification

This Project investigates and develops materials for Soldier-borne protective equipment, such as body armor and combat helmets, to increase protection from ballistic, blast, and blunt impact threats. This Project also investigates and executes systematic studies to design and develop materials, devices, systems and methods that enable the identification of protective solutions against ballistic, blast and directed energy threats. Included are investigations of emerging technologies, novel materials, and test methods and integration of personal armor, combat helmets, hearing protection, eyewear, and other personal protective equipment items.

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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Body Armor & Integrated Headborne Technology *Description:* This research effort supports the investigation of novel materials, component designs, and material modeling to design and develop technologies that protect Soldiers against ballistic, blast, and directed energy threats. This effort utilizes a cross-disciplinary, human-focused approach to develop technologies which optimize tradeoffs in ballistic and blast protective component design. This effort addresses the Army challenge of easing overburdened Soldiers in small units and aligns to Soldier protection modernization priorities. *FY 2024 Plans:* Will mature film- insert molding- processing approaches that will enable integration of multi-layered lenses for eyewear and head mounted displays; optimize anti-scratch coatings to produce extreme high hardness durable lens surfaces to protect sophisticated head mounted displays and eyewear; optimize active and passive anti-fog technology; design and develop active cooling technology for integration into combat helmet systems; optimize the ability to highly control and engineer the structure of high performance composite armor subsystems via ultrasonic lamination techniques to produce increased protection against small arms threats; investigate threat- specific failure mechanisms and their relationship to microstructural parameters. *FY 2025 Plans:* Will characterize relationship between processing parameters, microstructure, and ballistic performance of state of the art ballistic materials; explore improvements to helmet preform processing methods to achieve desired microstructures; develop novel helmet materials and design concepts to achieve protection parity with vital torso armor; mature novel headform concept for dynamic	6.617	6.321	5.807

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AZ2 *I Body Armor & Integrated Headborne Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
measurements of behind-helmet energy transfer during ballistic impact; mature electrowetting component technologies for low-powered antifogging solution for combat eyewear; investigate new active laser eye protection technology concepts and assess sensory protection gaps against emerging directed energy threats; investigate innovative backing materials to reduce behind armor blunt trauma and improve edge performance of vital torso protection; design and develop new approaches to scalable plate protection which incorporates novel materials and processing techniques; determine the feasibility of conformal and extreme complex geometries with respect to ballistic performance; develop a test method to evaluate combat uniforms and blast protective equipment against long duration multi-fragmentation threats (earth, soil, structure, etc.). ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	6.617	6.321	5.807

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** AZ5 *I Soldier Protection Technology - Vulnerability*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AZ5: *Soldier Protection Technology - Vulnerability*	-	10.734	11.370	11.397	-	11.397	11.409	11.416	11.540	11.656	0.000	79.522

A. Mission Description and Budget Item Justification

This Project investigates and develops Soldier protection methodologies, which includes the materials, methods, and models that enable design and integration of emerging material technologies into lightweight, flexible and modular Soldier equipment to protect against the range of existing and emerging battlefield threats for head, torso, and extremity protection. Specific research thrusts include the development of materials and mechanisms to enhance ballistic protection; computational models and associated laboratory experiments to provide a fundamental understanding of material properties and failure mechanisms, as well as correlation to ballistic/blast/blunt impact performance of Soldier personal protective equipment (PPE) and improved fibers, composite, and ceramic materials. Specific technologies support experimental helmets that reduce impact and blast loading to the head, Soldier torso protection systems to increase protection from ballistic and blunt impacts, and novel fibers and fabrics that provide additional survivability mechanisms.

Work in this Project supports key Army needs and is fully coordinated with several PEs to include PE 0602143A (Soldier Lethality Technology) and 0603118A (Soldier Lethality Advanced Technology); and leverages the technical research of several PEs to include PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics) and 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Soldier Protection Technologies	3.836	4.047	4.075
Description: This effort develops integrated lightweight, flexible, and modular protection equipment that is tailored to support the 'Soldier as a system' approach for defeat of emerging threats. Research areas encompass high fidelity ballistic impact injury models for hard and soft tissues, novel ceramic architectures to include graded and hierarchically structured ceramics, and novel fiber solutions for backing materials to deliver Soldier protection systems to meet emerging ballistic and signature management threats. This effort supports small caliber lethal mechanisms research in PE 0602143A (Soldier Lethality Technology) / Project AY6 (Soldier Squad Small Arms Armaments Technology). **FY 2024 Plans:**			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) AZ5 / *Soldier Protection Technology -* *Vulnerability*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will mature and transition armor design to defeat advanced threats; document ballistic performance and manufacturing requirements for the advanced armor technology; develop and analyze conformal armor concepts to improve Soldier effectiveness; validate improved computational tools for ceramic-composite armor technology. *FY 2025 Plans:* Will augment and apply computational tools for ceramic-composite armor technology along with computational methods for critical tissue injury assessment for protection against current and emerging threats; implement conformal armor concepts into integrated protection system solutions; insert emerging material and fabrication solutions for robust protection systems. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Soldier-Borne Composite Materials	2.776	-	-
Description: Utilizing understanding of fibers, fabrics, and composite materials, conduct applied research of emerging lightweight materials and structures to enable affordable designs for head, torso, and extremity protection systems. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new schemes to enhance Warfighter survivability. This effort supports Soldier Protection Technologies bullet.			
Title: Soldier-Borne Advanced Protection Materials	4.122	4.398	4.378
Description: Utilizing understanding of protection materials such as armor ceramics and associated failure mechanisms, conduct applied research of emerging armor materials to enable affordable design of lightweight ballistic protective systems for the future Soldier. Provide quantitative scientific basis for modeling and simulation that result in materials that utilize new lethal mechanisms/protection schemes for the individual Warfighter. This effort supports Soldier Protection Technologies bullet and small caliber lethal mechanisms research in PE 0602143A (Soldier Lethality Technology) / Project AY6 (Soldier Squad Small Arms Armaments Technology). *FY 2024 Plans:* Will further investigate highly diamond-loaded composite ceramics for advanced ceramic plates; refine and innovate novel manufacturing approaches for achieving improved diamond packing and bulk density; perform residual stress characterization, analysis, and optimization from micro-scale to meso-scale to achieve ideal pre-stresses at material interfaces; integrate diamond composites into heterogenous ceramic assemblies via strike face, layering, and inclusion strategies; develop improved processing, ply orientation, and consolidation strategies for high performance, fiber-reinforced composites to achieve optimal system-level mechanical performance; engineer bonding and integration strategies for composites and ceramics to create armor packages that incorporate improved ballistic response relative to state-of-the-art. *FY 2025 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AZ5 *I Soldier Protection Technology - Vulnerability*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will refine and mature highly diamond-loaded composite ceramics for advanced ceramic plates; validate novel manufacturing approaches for achieving improved diamond packing and bulk density; optimize micro-scale to meso-scale designs to achieve ideal pre-stresses at material interfaces; continue to integrate diamond composites into heterogenous ceramic assemblies via strike face, layering, and inclusion strategies; conduct experiments on ceramic materials with geometries and structures for point-of-need protection; refine and mature improved processing, ply orientation, and consolidation strategies for high performance, fiber-reinforced composites to achieve optimal system-level mechanical performance; validate engineer bonding and integration strategies for composites and ceramics to create armor packages that incorporate improved ballistic response relative to state-of-the-art. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Novel Camouflage and Concealment Materials	-	2.925	2.944
Description: The modern battlefield presents a new generation of detection threats across a wide range of wavelengths and host platforms, coupled with increasingly sophisticated computational analysis tools for identification and targeting. This effort will develop new materials and manufacturing concepts that enable a new generation of lightweight, efficient camouflage and concealment systems for the dismounted Soldier. ***FY 2024 Plans:*** Will develop material synthesis pathways for creating fillers with tailored or dynamic spectral properties for future integration into coatings, fibers, and composites; characterize materials via directional spectroscopy, and utilize machine learning strategies for identifying optimized material designs; generate structurally robust, first-generation materials with engineered thermal conductivity, and characterize and report properties and pathways for further material development; identify opportunities for materials to influence decoy and deception systems, particularly for autonomous assets in support of small dismounted Soldier Teams. ***FY 2025 Plans:*** Will research novel camouflage and concealment materials identified as providing extreme material performance opportunities for use in decoy and deception systems; assess reported properties and pathways for materials developed through first generation machine learning strategies for further material development; design and develop materials providing novel camouflage and concealment to provide decoy and deception capabilities for autonomous assets in support of small dismounted Soldier teams and unit formations; validate material performance for further maturation through manufacturing science. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	10.734	11.370	11.397

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AZ5 *I Soldier Protection Technology - Vulnerability*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*					**Project (Number/Name)** AZ9 *I Soldier Protection Advanced Tech - Detectability*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AZ9: *Soldier Protection Advanced Tech - Detectability*	-	1.747	-	-	-	-	-	-	-	-	0.000	1.747

A. Mission Description and Budget Item Justification

This Project investigates and designs novel materials, technologies, techniques and applications increasing the capabilities of camouflage and concealment against known and emerging sensor threats. The results of this Project enable effective deception capabilities, combinations of physical and electronic signature decoy components, and determination of analytical processes for modeling signature management technologies during multi-domain operations. These technologies will provide subsystems and concepts that shall 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 dismounted soldiers. Components designed under this Project will transition to Advanced Technology Development efforts in Soldier Lethality protection/survivability Projects to provide disruptive Camouflage, Concealment and Deception technologies to the Operational Army to support expeditionary maneuver in the Multi-Domain Battle Environment and retain windows of advantage.

Work in this Project supports key Army needs and leverages/complements the technical research of several Program Elements (PEs) to include PE 0601102A (Defense Research Sciences) and PE 0603118A (Soldier Lethality Advanced Technology) / Project AZ8 (Soldier - Small Unit Detectability Adv 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 Soldier Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Camouflage, Concealment and Decoys Technologies for Soldier and High-Value Assets	1.747	-	-
Description: This effort investigates and designs materials, processes, and concepts for innovative camouflage, concealment and deception technologies for Soldier to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats and to reduce the probability of detection in multi-domain operations. Investigates analytical processes to model material and system performance and predict probability of detection 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.			
Accomplishments/Planned Programs Subtotals	1.747	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** AZ9 *I Soldier Protection Advanced Tech - Detectability*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 I 2					R-1 Program Element (Number/Name) PE 0602143A I *Soldier Lethality Technology*				Project (Number/Name) BB4 I *Dismounted Soldier Survivability Materials*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BB4: *Dismounted Soldier Survivability Materials*	-	2.948	4.985	5.267	-	5.267	5.355	7.867	7.905	7.984	0.000	42.311

A. Mission Description and Budget Item Justification

This Project investigates fibers, textiles, components, and materials focused on enhancing Soldier survivability from combat threats (flame and thermal, blast and ballistic, multispectral sensor, and laser threats) and environmental threats (e.g., cold, heat, wet, vector, antimicrobial, etc.) to increase operational effectiveness while decreasing the Soldier's physical and cognitive burden. The results from this Project will transition knowledge, materials, subcomponents and methods to Advanced Technology Development efforts in support of enhancing Soldier Lethality by providing protective material solutions focused on the aspects of dismounted movement and maneuver operations of the Army. This Project develops and applies validation methods that enable systematic studies of human systems integration principles and practices to protective equipment materials and designs to advance the understanding of trade-offs between protection, lethality, and mobility.

Work in this Project supports key Army needs and leverages/complements the technical research of several Program Elements (PEs) to include PE 0601102A (Defense Research Sciences), PE 0602143A (Soldier Lethality Technology) / Project AZ5 (Soldier Protection Technology - Vulnerability), and PE 0603118A Soldier Lethality Advanced Technology / Project BB3 (Dismounted Soldier Survivability Equip/Tech Integ).

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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Dismounted Soldier Survivability Materials *Description:* This effort investigates materials, devices and methods that aid in the design and development of multifunctional materials for Soldier protective clothing and individual equipment. This effort conducts research to investigate and identify multi-functional material properties at the micron and sub-micron level to mitigate Soldiers susceptibility and vulnerability to operational threat, i.e., flame, thermal, environmental, and multispectral sensors. Efforts also investigate and develop devices and systems that enable extended dismounted mission duration by reducing the demand for water resupply and enabling Squad organic water filtration systems *FY 2024 Plans:* Will validate the performance of four classes of engineered fibers and yarns (ballistic protection, vector protection, flame resistance, moisture wicking) at the textile and fabric level prior to multi-functional textile integration; integrate engineered fibers and yarns from the four classes of functionality into a single fabric to conduct investigations to assess baseline performance; investigate the effect of weave construction and machine processing parameters on the performance of multi-functional textiles	2.948	4.985	5.267

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BB4 *I Dismounted Soldier Survivability Materials*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
to establish sub-system functionality and performance against target metrics; conduct a study on polymer compounding to design conductive fibers for e-textile applications; validate the electrical and data carrying capability of thread coated conductive yarns in breadboard e-textile designs; research the mechanical properties and durability of baseline e-textile materials; design and develop e-textiles interfaces between Soldier uniform and power and data platforms; research in collaboration with Development Command (DEVCOM) Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) partners the functional components of aided target recognition algorithms and their ability to detect, recognize and identify dismounted Soldiers in support of investigating novel camouflage material approaches to reduce the effectiveness of these emerging threat sensor capabilities. *FY 2025 Plans:* Will perform studies to determine the effect of fiber spinning process parameters on the properties and fabrication of engineered fibers; investigate yarn design effect on properties and functionality, and design yarns to enhance multifunctional properties; investigate knitting, weaving and advanced fabric design methods to enhance blast debris protection, vector protection, flame resistance, and moisture wicking of potential military textiles; investigate electronics and programming needed for supporting fabrics with incorporated conductors for power and data; investigate ability to incorporate power and date transmission using commercial sensors; investigate the design and use of a management hub to support power and data distribution within the textile; design and investigate handheld water quality sensors that can measure water quality via more than one indicator (multiplexed); design a single water purification device at the soldier/squad level that combines capabilities to remove microbiological contaminants, hazardous chemicals and salt; investigate novel camouflage material approaches to reduce effectiveness of aided target recognition algorithms and their ability to detect, recognize and identify dismounted soldiers; develop simulated and laboratory-level demonstrators for camouflage materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	2.948	4.985	5.267

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** BB5 *I Physical Augmentation: Tech for Human Interactions*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BB5: *Physical Augmentation: Tech for Human Interactions*	-	0.567	-	-	-	-	-	-	-	-	0.000	0.567

Note

Beginning in FY24 all PE 0602143A (Soldier Lethality Technology) / Project BB5 (Physical Augmentation): Tech for Human Interactions funding will transition to PE 0602143A (Soldier Lethality Technology) / Project BC2 (Next Gen Mobility & Lethality Tech for Warfighters)

A. Mission Description and Budget Item Justification

This Project advances the understanding of human augmentation and interaction for enhanced operational performance with a focus on adaptation, training, human variability, metrics/methodologies for assessment, and task quantification. Research encompasses conducting applied research to develop metrics, measures, tools, and techniques to quantify and understand the relationships that enable maximum effectiveness of integrated Soldier-augmentation technologies. The resulting data are the basis for physical augmentation systems and equipment design standards, guidelines, and intelligent agent requirements to improve equipment operation and Soldier-system synergy. Application of this research will yield reduced workload, reduced Soldier training requirements, enhanced Soldier lethality/survivability, user acceptance, and allow Soldiers to achieve maximum performance. Major efforts explore novel techniques for Soldier assessment, characterization of individual variability effects on performance, development of evidence-based design guidance for the application of augmentation technologies, exploration of the relationship of exoskeleton and physical-assist device adaptation and baseline Soldier parameters such as gait, neuromuscular motor control and proprioception. This Project will also explore novel training paradigms for reduced Soldier-augmentation technology adaptation times to address current and future warrior performance issues. Individual efforts exploit wearable sensor technologies, translate surrogate task performance to operational outcomes, develop approaches to distinguish tasks and individual state and intent of movement, establish database of human movement variability to inform intelligent system design, and identify high impact applications of augmentation.

Work in this Project supports key Army needs and leverages the technical research of several Program Elements (PEs) to include PE 0602143A (Soldier Lethality Technology) / Project BC2 (Next Gen Mobility & Lethality Tech for Warfighters) and Project BC6 (Human Perf - Tech for Warfighter Enhancement); and supports PE 0603118A (Soldier Lethality Advanced Technology) / Project BC1 (Human Performance AdvTech for Mobility & Lethality). Additionally, work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program within PE 0602787A (Medical Technology) / Project MK4 (Warfighter Health Applied Research Technology), and the Veteran Administration's exoskeleton research area. 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: Protection, Sustainment, and Warfighter Performance and with our international partners through The Technical Cooperation Program / Human Resources and Performance Group / Panel JP1 (TTCP HUM JP1).

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 Soldier Center (SC).

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BB5 *I Physical Augmentation: Tech for Human Interactions*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Training Adaptation and Movement Science	0.567	-	-
Description: This effort investigates the science behind movement for physical augmentation to maximize mobility capacity and training adaptation to decrease learning curve with physical augmentation systems (e.g., physical-assist devices, exoskeletons). This work will enable the Army to make informed decisions on the ultimate effectiveness of human augmentation technologies before significant resources are expended.			
Accomplishments/Planned Programs Subtotals	0.567	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*					**Project (Number/Name)** BC2 *I Next Gen Mobility & Lethality Tech for Warfighters*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BC2: *Next Gen Mobility & Lethality Tech for Warfighters*	-	4.259	6.894	8.334	-	8.334	8.120	11.100	11.171	11.282	0.000	61.160

A. Mission Description and Budget Item Justification

This Project investigates the means to monitor, assess, predict and optimize/enhance Soldier and squad decision-making and shoot and move performance. In addition, it will provide design guidance for individual and mission specific equipment (e.g., individual protection, small arms, load carriage, information portrayal etc.) and quantitative impacts of mission and associated clothing and individual equipment (CIE) on individual and small unit performance. Research conducted focuses on translating mission tasks to measures of human performance. These measures of human performance will inform predictive algorithms, human based modeling and simulation, and assessment tools that enable Soldier performance trade space analysis for acquisition, training, and operations. These data and algorithms will allow us to determine the impact of new capabilities on Soldier and Squad performance and effectiveness, understand deficiencies in performance and investigate novel strategies to optimize and enhance performance.

Work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5) to include Projects in PE 0602787A (Medical Technology). This Project also complements and is fully coordinated with work performed across Army, Navy, and Air Force under the Human Systems Community of Interest: Protection, Sustainment, and Warfighter Performance.

This Project supports key Army needs and leverages the technical research of several Program Elements (PEs) to include the following: PE 0602143A (Soldier Lethality Technology) / Projects BC6 (Human Perf-Tech for Warfighter Enhancement), and PE 0603118A (Soldier Lethality Advanced Technology)/ Projects BC1 (Human Performance Adv Tech for Mobility & Lethality). This Project also supports and leverages PE 0603118A (Soldier Lethality Advanced Technology) / Project AY9 (Body Armor & Integrated Headborne Advanced Tech), and Project BD7 (Soldier Sys Interfaces/Integration- Sensor Adv Tech).

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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Human Interaction for Mobility & Lethality	4.259	6.894	8.334
Description: This effort investigates and develops human performance based design guidance for protection and weapon systems and sub systems to improve the mobility and lethality of individuals and small units. The applied research translates traditional means for measuring and understanding human performance to the means to conduct assessment for Warfighter and small unit readiness and/or new capabilities.			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BC2 *I Next Gen Mobility & Lethality Tech for Warfighters*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2024 Plans: Will investigate stressor interactions on Soldier, small unit, and leader tactical outcomes to advance predictive modeling; conduct experiments on the effects of head-support load and distribution configurations on female and male Soldier task performance to refine head supported mass guidelines and modeling and simulation tools; develop female & male neck models (or other anatomical models as needed) for headborne system design guidance; conduct experiments to address gaps in the optimization of augmented reality (AR) design elements, interactions, applications, and performance metrics to inform heads-up display (HUD) systems; begin the development of novel HSI test methodologies to inform lethality trade space impacts of Soldier clothing and individual equipment (CIE) and technologies; investigate novel cognitive and physical enhancement strategies on Soldier task performance and recovery. *FY 2025 Plans:* Will investigate a probiotic bacteria designed to mitigate fatigue and enhance Warfighter operational performance in a human study under simulated operational stress (sleep deprivation); investigate novel means (e.g., cognitive resistance training, neurostimulation, biofeedback, supplementation, physical augmentation systems) and guidelines for use to enhance Soldier performance; initiate the development of novel metrics to quantify the impacts of Soldier clothing and individual equipment (CIE) on Soldier performance that align to mobility, lethality and survivability continue to investigate the effects of head supported mass on Soldier task performance in order to develop higher fidelity models for simulation to inform headborne system design; conduct investigations to determine optimal combinations of information presentation and multimodal system inputs (e.g., gesture, gaze, voice, head movements) to optimize human performance when interacting with augmented reality during operationally relevant tasks; continue to conduct meta-analyses and conduct investigations to fill gaps of understanding between known stressors and their interaction on Soldier performance outcomes (e.g., reaction time, memory, endurance, strength, executive function, etc.). *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned design and development of methods, metrics, and tools to quantify and inform the Soldier lethality trade space and the maturation of human performance models for readiness quantification and prediction.			
Accomplishments/Planned Programs Subtotals	4.259	6.894	8.334

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 *I* 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BC6 *I Human Perf - Tech for Warfighter Enhancement*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BC6: *Human Perf - Tech for Warfighter Enhancement*	-	1.348	-	-	-	-	-	-	-	-	0.000	1.348

Note

Beginning in FY24 all PE 0602143A / Soldier Lethality Technology Project BC6 / Human Perf - Tech for Warfighter Enhancement funding will realign to PE 0602143A / Soldier Lethality Technology BC2 / Next Gen Mobility & Lethality Tech for Warfighters.

A. Mission Description and Budget Item Justification

This Project investigates and develops mechanisms for safely and effectively optimizing and enhancing Warfighter ability to shoot, move, communicate, and decide. These mechanisms have the potential to exploit the Soldier and Squad as the capability platform beyond materiel solutions provided to the individual and small unit. This project also conducts investigations to populate human performance models that enable trade space analysis for portions of doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF) analysis.

This Project supports key Army needs and leverages the technical research of several Program Elements (PEs) / Projects to include: PE 0602143A (Soldier Lethality Technology) / BE3 (Joint Service Combat Feeding Technology) and BE2 (Joint Service Combat Feeding Advanced Technology).

Work in this Project complements and is fully coordinated with the Medical Research and Development Command under the Military Operational Medicine Research Program as well as Defense Medical Research and Development Program under Military Operational Medicine (JPC-5) to include Projects in PE 0602787A (Medical Technology). 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: Protection, Sustainment, and Warfighter Performance. Work in this Project complements and is fully coordinated with research at the US Army Combat Capabilities Development Command Army Research Laboratory (ARL).

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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Human Performance Technology for Warfighter Enhancement *Description:* This effort investigates mechanisms for exploiting human physiology to develop safe and effective interventions that create smarter, faster, more lethal Close Combat Warfighters. This work will result in a Soldier's ability to shoot, move, communicate, and decide faster than an adversary. Findings from these investigations will leverage existing systems and platforms to get the greatest human performance return in training and operations.	1.348	-	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602143A I *Soldier Lethality Technology*	**Project (Number/Name)** BC6 I *Human Perf - Tech for Warfighter Enhancement*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Accomplishments/Planned Programs Subtotals	1.348	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602143A I Soldier Lethality Technology				Project (Number/Name) BC7 I Training Technology (Other than STE)			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BC7: Training Technology (Other than STE)	-	24.354	33.822	29.446	-	29.446	26.831	21.505	21.748	21.966	0.000	179.672

A. Mission Description and Budget Item Justification

This Project funds research into technologies and their applications that can inform and/or enhance the Army's live, virtual, and constructive training systems. This Project conducts research in immersive virtual, mixed, and augmented reality (AR) environments that stimulate human senses (e.g., sight, sound, and touch) and also conducts laboratory experiments to understand how users interface with the technology in order to improve the realism of simulation environments and therefore create enhanced immersion and more effective training systems. Models and simulations are designed are developed to allow realistic, fair fight engagements across all training environments and training devices, to include the cyberspace domain. Included in the investigations of this Project are also medical training systems (e.g., part-task trainers and physiological modeling).

Work in this Project supports key Army needs and complements efforts in Program Element (PE) 0603118A (Soldier Lethality Advanced Technology) / Project BC8 (Training Advanced Technology (Other than STE)).

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 Soldier Center (SC) and the Institute for Creative Technologies (ICT) University Affiliated Research Center (UARC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Medical Training Technology	3.111	3.599	3.363

Description: Included in this effort will be the development of new medical training simulations to train medical personnel across all levels of care. Improvements in haptic capabilities will ensure hyper bio-fidelity for all levels of care. Automated measures of student performance will support Army medical Individual Critical Task Lists (ICTLs). Research areas will also include more realistic tissue properties supporting part-task trainers and modular patient simulator systems. Initial exploration of Army ICTLs will result in early proof-of-concept development of proof-of concept training systems to support non-traditional medical areas, such as dental training simulations.

FY 2024 Plans:
Will mature the usability and training effectiveness of an integrated collective live, virtual, constructive medical training capability; design and develop optimum physiology engine(s) and haptic configuration leveraging modular manikin and haptic capabilities for defined scenarios that support Army medical training, such as extended care in an austere environment, gender care differences, and patient hand-off.

FY 2025 Plans:

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BC7 *I Training Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will implement/integrate physical and software solutions for prolonged care in support of Multi-Domain Operations (MDO) training environment; validate consolidated physiology engine and updated haptic hardware against more dynamic prolonged care use cases that support Army medical training, such as extended austere environment, gender care differences and patient handoff. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects completion of initial design and development for physiology engine and migration into validation testing for specific Prolonged Care use cases.			
Title: Warfighting M/S Concepts and Design (ICT) *Description:* This Project designs and develops photorealistic synthetic environments, multi-sensory interfaces, artificially intelligent agents, and human performance assessment technologies to create virtual, augmented, and mixed reality simulation environments for training. This Project uses advanced modeling, simulation, and leadership development techniques to leverage the emerging immersive technologies of industry and the research and development community to advance the Army's capabilities. *FY 2024 Plans:* Will mature automation techniques to develop individual agent and aggregate unit behaviors to represent friendly forces, hostile forces, and civilian groups in virtual training exercises; investigate methods for the realistic physical and mental representation of individual Soldiers; fund research to determine how to improve Soldier cognitive and experiential learning; investigate adaptive, multi-modal interfaces for Army-specific applications of augmented reality technologies; validate methods to synchronize light detection and ranging (LIDAR) and photogrammetry data collected in the real world to enhance the realism of simulation-based training. *FY 2025 Plans:* Will investigate novel educational, operational, and training applications of emergent artificial intelligence (AI) methods such as generative AI; develop military-relevant AI training methods to expand the utility of AI for generating educational-, training-, or operational-insights and recommendations; continue investigation of adaptive, multi-modal interfaces for Army-specific applications of augmented reality applications; fund research to study staff-specific learning outcomes to better deliver content and improving training outcomes. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease corresponds to starting fewer numbers of new innovation proposals.	6.995	7.360	5.399
Title: Digital Terrain for Live Training *Description:* This effort investigates technologies to enhance the fidelity and visual effects of digital terrain for live training systems, with an objective metric of reducing overall training time to gain proficiency in the live environment. It addresses live training needs for conducting force-on-force, combined arms exercises to enhance readiness at Army home stations and	5.478	6.970	6.545

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BC7 *I Training Technology (Other than STE)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Combat Training Centers by enhancing vertical terrain resolution, physics-based blast effects on terrain, and data compression technologies. *FY 2024 Plans:* Will mature existing physics-based algorithms for munitions effects;, design novel wireless data compression methods for feature attribution in live- synthetic training environments; design data model extensions for terrain accuracy metrics and digital terrain level of detail needs for live training; and design a layered and scalable terrain architecture to support dynamic Live training interactions. *FY 2025 Plans:* Will validate physics- based algorithms for munitions effects in live range environment, develop wireless data compression architecture for live/virtual/constructive training environments; develop data models that enable high fidelity engagements in live environment; and develop and implement layered and scalable terrain architecture for live range environment use cases. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned completion of component and architecture design.			
Title: Simulation Management Technologies *Description:* This effort aims to automate management of resources and equipment associated with the planning, preparation, execution, and assessment of individual through collective training exercises. This effort will inform requirements and research capabilities to enable a self-healing simulation architecture that can automatically architect, configure, detect, deploy, and manage resources to support individual and collective training use-cases. The design and development of fully autonomous constructive models will be leveraged within this architecture to further automate exercise execution and greatly increase time and effectiveness of training and readiness opportunities within the distributed training environment. *FY 2024 Plans:* Will investigate hardware acceleration and common platform components; design and develop dynamic behavior algorithms and fitness functions based on training use-cases; design and develop configuration and authoring components to support simulation execution; and conduct experiments aligned to training use-cases to validate architecture. *FY 2025 Plans:* Will design and develop hardware acceleration architecture; validate limited number of dynamic behavior algorithms for large scale training exercise use cases; validate configuration and authoring components in relevant planning pre-exercise use cases; and integrate component architectures into a single solution for implementation in execution phase of large scale collective simulated exercises. *FY 2024 to FY 2025 Increase/Decrease Statement:*	3.378	8.081	6.513

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BC7 *I Training Technology (Other than STE)*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding decrease reflects planned completion of design and development activities, as well as the beginning of architecture validation experiments.			
Title: Multi-Domain Environments for Training	5.392	7.812	7.626
Description: This effort will define a new, common MDO competency framework to drive machine-supported training performance data collection, tracking and readiness projections for current and new MDO use-cases. This effort also investigates emerging operational/training paradigms, including a detailed focus on modeling non-combat factors of operational environments and developing models necessary to train for Information Advantage. *FY 2024 Plans:* Will continue development of reusable Measures of Performance/Effectiveness (MOPs/MOEs); design MDO profiles and authoring tools/user interfaces aligned to knowledge, skills, abilities, and behaviors (KSABs) across identified MDO task structures; conduct experiments to validate first order effects in information warfare domain. *FY 2025 Plans:* Will develop architecture design leveraging mature/reusable Measures of Performance/Effectiveness (MOPs/MOEs); develop and implement MDO profiles and authoring tools/user interfaces aligned to knowledge, skills, abilities and behaviors (KSABs) across identified MDO task structures; begin limited design architecture to simulate first order effects in information warfare domain. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding change is consistent with the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	24.354	33.822	29.446

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** BD1 *I Adv Soldier Sensors/Displays Tech for Dismounts*	
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BD1: *Adv Soldier Sensors/ Displays Tech for Dismounts*	-	15.939	16.557	16.598	-	16.598	16.609	16.619	16.802	16.970	0.000	116.094

A. Mission Description and Budget Item Justification

This Project designs and develops low power, next generation modular sensor and display components for detection and identification of both threats and friendlies in all environments to increase situational awareness, decrease fratricide, and enable Soldiers to respond more quickly for greater lethality.

This Project complements s work done in Program Element (PE) 0603118A (Soldier Lethality Advanced Technology) / BC9 (Adv Soldier Sensors/Displays AdvTech for Dismounts).

Work in this Project is performed by the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Soldier Sensors/Displays Technology for Dismounts	15.939	16.557	16.598
Description: This effort models, simulates, investigates, designs, and develops novel low power, modular electro-optic / infrared (EO/IR), displays, augmented reality approaches and integrates aided/automatic target detection and recognition techniques to enable improved Soldier maneuver and lethality through greater information fidelity to increase Soldier probability of recognition/ identification and tracking of all threats. *FY 2024 Plans:* Will investigate mixed and augmented reality (MR/AR) content to Heads Up Displays (HUDs) for representation of threats via automated threat cueing from UAV sources; develop modular virtual prototype environments for expedited User feedback; develop image fusion optimization processes to improve target acquisition of sensor systems with multiple camera sources; conduct experiments to determine performance of Electro Optic/Infrared (EO/IR) sensor performance prediction models; investigate advanced materials and processing methods for improvement in operations within lowest lighting conditions with digital low light sensors; develop material and processing methods to design advanced, high definition longwave infrared (LWIR) sensors for tailorable SWaP and/or target acquisition performance. *FY 2025 Plans:* Will validate representation of autonomous unmanned aerial vehicle cues and operation for minimized cognitive burden to the Soldier. Will investigates optimal data fusion for digital low light and long-wave infrared imagers to improve situational awareness and reduce time to acquire threats. Will investigate degree of tolerable latency for fusion of disparate sensors versus dismounted tasks. Will develop methods to improve alternative advanced materials and processing for imaging during overcast starlight			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BD1 *I Adv Soldier Sensors/Displays Tech for Dismounts*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
performance. Will mature improved Complementary Metal-Oxide Semiconductor (CMOS) low light level sensors in clear starlight light levels to validate readiness for integration into host systems. Will mature Read Out Integrated Circuit (ROIC) design and develop reduced pixel pitch high-definition longwave infrared (LWIR) sensors for tailorable SWaP and/or target acquisition performance. Will investigate novel technologies/algorithms to enable next generation micro-displays. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	15.939	16.557	16.598

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 I 2					**R-1 Program Element (Number/Name)** PE 0602143A I *Soldier Lethality Technology*				**Project (Number/Name)** BD6 I *Soldier Sys Interfaces/Integration-Sensor Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BD6: *Soldier Sys Interfaces/ Integration- Sensor Tech*	-	0.237	0.301	0.401	-	0.401	0.802	0.802	0.902	0.601	0.000	4.046

Note

Project BD6 has realignments from Soldier System Interfaces & Integration (Sensor Technology) within this project and from task PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces Integration-Sensor Advanced Technology).

A. Mission Description and Budget Item Justification

This Project investigates, designs, and validates advanced technologies and algorithms for enhancing dismounted Soldier deployed robotics and autonomous systems used to improve the Small Unit's situational awareness, survivability, and lethality. Technologies to be investigated may include: algorithms for dismounted robotic systems to enable autonomous navigation, automated object recognition, persistent surveillance, launch and recovery from vehicles, networked lethality, manned-unmanned teaming, and collaborative behaviors; and advanced user interfaces to optimize human-robotic interaction during dismounted operations. These advanced technologies will enable Squad and Platoon level autonomous reconnaissance using robotic systems to minimize the operator's dedicated control of the systems and reduce their cognitive burden, thus allowing Soldiers to be more lethal and survivable.

Work in this Project supports key Army needs and leverages the technical research of several Program Elements (PEs) / Projects to include PE 0603118A (Soldier Lethality Technology) / Project BD7 (Soldier Sys Interfaces/Integration-Sensor Tech) and Project 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.

Work in this Project is performed by the Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Soldier System Interfaces & Integration (Sensor Technology)	0.237	0.301	-
Description: This effort will investigate, design, and validate advanced dismounted Soldier robotic and autonomous systems technologies to enable autonomous navigation, manned-unmanned teaming, and networked reconnaissance to improve Soldier lethality, situational awareness, and survivability during tactical operations.			
FY 2024 Plans:			

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Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD6 / *Soldier Sys Interfaces/Integration-Sensor Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will conduct experiments on autonomy and teaming technologies for resource constrained Small Unmanned Aerial Systems (SUAS) operating in complex environments to enhance navigation, search capabilities, and extend operations. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects administrative realignment to task Soldier Situational Awareness Advanced Technology within this project.			
Title: Soldier Situational Awareness Technologies ***FY 2025 Plans:*** Will investigate, design and develop, government owned, autonomy and teaming algorithms for resource constrained Army Squad and Platoon level Small Unmanned Aerial Systems (SUAS) to unburden the Small Unit and improve their situational awareness, lethality, and reconnaissance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects administrative realignment from Soldier System Interfaces & Integration (Sensor Technology) within this project and from task PE 0603118A (Soldier Lethality Advanced Technology) / Project BD7 (Soldier Sys Interfaces Integration-Sensor Advanced Technology).	-	-	0.401
Accomplishments/Planned Programs Subtotals	0.237	0.301	0.401

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602143A I *Soldier Lethality Technology*					Project (Number/Name) BD8 I *Soldier & Sm Unit Tactical Energy Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BD8: *Soldier & Sm Unit Tactical Energy Tech*	-	6.291	6.911	7.465	-	7.465	10.575	10.058	10.540	10.646	0.000	62.486

A. Mission Description and Budget Item Justification

This Project conducts applied research and development on materials and component level power and energy technologies in the areas of energy storage, power generation, alternative energy, and intelligent power distribution and thermal management designs that support Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) and Soldier power needs to include next generation squad weapons and advanced optical devices and sensors. Enables future Soldier lethality and mobility for longer mission durations at lighter weights to provide enhanced lethality and tactical overmatch of adversaries, and to reduce the burden on the Soldier.

This Project support key Army needs and complements the technical research of Program Element 0602184 (Soldier Applied Research) / Project CO1 (Soldier Power and Energy Concepts) and Program Element 0603118A (Soldier Lethality Advanced Technology) / BD9 (Soldier & Sm Unit Tactical Energy AdvTech).

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 Army Research Laboratory (ARL) and Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance Center (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Tactical Power for Soldier Lethality	5.341	5.946	6.491
Description: This effort investigates, designs, and develops innovative materials and component level power generation and energy storage technologies that support next generation weapons, sensors, radios, and human augmentation devices enabling Soldiers and Small Units to maximize probability of target hits, improve collective situational awareness, ensure multiple communication streams, and assist with tactical tasks in order to decrease Soldier load and power burden, and increase power capabilities by providing more energy to prolong mission run-time. *FY 2024 Plans:* Will mature safe, high voltage electrolyte materials paired with improved Si anode technologies to verify and validate performance of 2x increase for the Conformal Wearable Battery (CWB); design and develop Li-metal components that will enable a 2-3x increase in energy and pair it with safer, high voltage electrolyte materials; design and develop breadboard components for Soldier and Squad power generation technologies, such as fuel cells and solar, to provide battery recharge capability to sustain on-the-move operations and limit battery swaps to enable longer mission durations; investigate scaling 2x power density fuel cell			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BD8 / *Soldier & Sm Unit Tactical Energy Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
stacks to platoon power generation requirement; develop and validate family of Si-Anode based Small Tactical Universal Batteries (STUB) to support enabler and small handheld devices for the Soldier. *FY 2025 Plans:* Will continue to design and develop Lithium (Li)-metal rechargeable battery components that will enable a 2-3x increase in runtime over fielded batteries. Will mature and scale up Soldier fuel cell technologies for use in squad or platoon power generation to enable longer runtimes and decreased weight and logistical burden for the Soldier and Small Unit. Will investigate electrochemical material development of advanced non-rechargeable batteries materials, such as Lithium Carbon Monofluoride (Li/CFx) and Li/Sulfur (Li/S), to enable longer runtime at reduced weight for early entry operations. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Materials & Component Technologies for Energy Independence *Description:* The effort develops technologies to substantially reduce the number of batteries required to accomplish dismounted Soldier/Squad mission objectives by developing more efficient power and thermal management for small systems and harvesting energy and alternative energy technologies thereby significantly reducing Soldier-borne load and logistics requirements for Soldier/Squad power and energy. *FY 2024 Plans:* Will investigate compact heat recirculating burners, including models, designs, and fabrication of burners to increase heat transfer rates that increase power density and efficiency; explore thermophotovoltaic and thermionic designs and improvements that increase power density and efficiency of the thermal-to-electric conversion, and improve coupling efficiency with novel heat sources. *FY 2025 Plans:* Will design and develop compact heat recirculating burner components to increase heat transfer rates for higher radiative power density; develop test stands that couple the compact heat recirculating burner with improved thermophotovoltaic and thermionic designs and validate increased radiative power density and power generation efficiency *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	0.950	0.965	0.974
Accomplishments/Planned Programs Subtotals	6.291	6.911	7.465

C. Other Program Funding Summary ($ in Millions)
 N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BD8 *I Soldier & Sm Unit Tactical Energy Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602143A / *Soldier Lethality Technology*	Project (Number/Name) BE3 / *Joint Service Combat Feeding Technology*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BE3: *Joint Service Combat Feeding Technology*	-	4.627	4.074	4.081	-	4.081	4.328	4.980	5.034	5.084	0.000	32.208

A. Mission Description and Budget Item Justification

This Project investigates and develops nutrient compositions and stabilization techniques to maximize the Warfighter's physical and cognitive performance on the battlefield, investigates technologies to enhance detection and identification capabilities of chemical and biological threats in foods, and develops innovative ration and field feeding technologies to reduce resupply requirements for the multi-domain battlefield. 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.

Work in this Program Element (PE) is related to and fully coordinated with PE 0602787A (Medical Technology) / Project MK4 (Warfighter Health Applied Research Technology) to develop technologies and concepts; Army Additive Manufacturing Community of Practice to enable customization, increase readiness, and improve sustainment due to fabrication of end-use items at point of need; Defense Threat Reduction Agency to maximize protection of rations from contamination; Defense Health Agency (DHA) to transition and develop materiel solutions in the microbiome technical areas; and the Defense Health Agency (DHA) Joint Program Committee-5, which seeks to develop effective nutritional countermeasures against stressors and to maximize health, performance, and well-being.

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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Joint Service Combat Feeding Technology	4.627	4.074	4.081
Description: This effort investigates, designs, and develops nutrient compositions and stabilization techniques to maximize the Warfighter's physical and cognitive performance on the battlefield. The effort investigates technologies to enhance detection and identification capabilities of chemical and biological threats in foods and develops innovative ration and field feeding technologies to reduce resupply requirements. Work in this area results in increased performance, less food-borne illness, and overall increased readiness of the Warfighter. *FY 2024 Plans:* Will conduct mathematical analysis of lipid stability in nutrient dense rations; investigate compounds to promote protective potential for the probiotic strain during freeze- drying; develop nutritional intervention and placebo bars in support of human performance research in extreme environments; analyze theoretical/empirical data & characterize materials to examine			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BE3 / *Joint Service Combat Feeding Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
responsiveness of advanced insulating materials to various stimuli - electro/magneto/thermo/solar; conduct accelerated storage study to mature packaging reduction technologies for operational rations. *FY 2025 Plans:* Will investigate performance nutrition and the linkages to cognitive and physical performance; design and develop methodologies to apply both commercial off-the-shelf (COTS) and emerging technologies for the mitigation of food and water contaminants; investigate survey technologies for food contaminant sensors that reduce response time and reagent resupply; and determine assess performance of novel insulation materials for use in field feeding operations. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	4.627	4.074	4.081

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** BE8 *I Synthetic Training Environment (STE) Technology*		

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BE8: *Synthetic Training Environment (STE) Technology*	-	5.743	-	-	-	-	-	-	-	-	0.000	5.743

Note

In FY2024 funding realigned to PE 0602184A Project CN2 Intelligent Weapons Concepts and Technology

A. Mission Description and Budget Item Justification

This Project designs and develops technologies supporting the Army's Synthetic Training Environment (STE). The STE is the next generation holistic collective training capability that will train units where they will fight, with whom they will fight, and in complex operational environments to include dense urban and sub-terrain; within the entire range of combined arms maneuver tasks in support of Multi- Domain Operations. STE Information Systems (STE-IS) delivers the Common Synthetic Environment consisting of Global Terrain/One World Terrain (OWT), Training Simulation Software (TSS), and Training Management Tools (TMT). The STE will be available where training occurs (home station, combat training centers, armories, institutions, shipboard, deployed) and will include Air and Ground Reconfigurable Virtual Collective Trainers (RVCTs), a Soldier/Squad Virtual Training (S/SVT), and a live training capability. The STE will be cloud-enabled, compatible with the Army Enterprise Network, and service-based through the Common Operating Environment, including Live and Constructive. The STE will provide the realistic repetitions necessary to fight 25 bloodless battles before the first battle.

This Project is coordinated with work done in Program Element (PE) 0603118A (Soldier Lethality Advanced Technology) / Project BE9 (STE 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.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: STE One World Terrain *Description:* This effort investigates and designs tools and methods to improve the speed and fidelity of a terrain capability that provides a representation of the globe, fully accessible through the Army network and usable by all simulation trainers; develops complex representations (including megacities and subterranean) of the operational environment and the Multi-Domain battlefield in synthetic training environments.	3.744	-	-
Title: STE Training Management Tool *Description:* This effort investigates Adaptive Training (AT) methods to facilitate authoring, distribution, management, and evaluation of tailored instruction for both individuals and teams; and determines the impact of training and education tools/methods on comprehension, reasoning, learning, performance, retention, and transfer of knowledge and acquired skills to assess Training Effectiveness (TE) in Synthetic Training Environments.	1.999	-	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BE8 *I Synthetic Training Environment (STE) Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Accomplishments/Planned Programs Subtotals	5.743	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 I 2					R-1 Program Element (Number/Name) PE 0602143A I *Soldier Lethality Technology*				Project (Number/Name) BP9 I *Soldier Lethality Technologies (CA)*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BP9: *Soldier Lethality Technologies (CA)*	-	164.700	-	-	-	-	-	-	-	-	0.000	164.700

Note
Congressional Interest Item funding provided for Soldier Lethality Technologies.

A. Mission Description and Budget Item Justification
This Project is for congressional increases that support applied research in support of Soldier Lethality, where the Soldier and Squad are treated as an integrated combat platform.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
Congressional Add: Program increase - Pathfinder Airborne	8.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Pathfinder Airborne		
Congressional Add: Program increase - HEROES Program	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for HEROES		
Congressional Add: Program Increase - ADVANCED TEXTILES AND SHELTERS	6.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ADVANCED TEXTILES AND SHELTERS		
Congressional Add: Program Increase - Digital Night Vision Technology	9.700	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Digital Night Vision Technology		
Congressional Add: Program Increase - Military Footwear Research	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Military Footwear Research		
Congressional Add: Program Increase - Nanolayered Polymer Optics	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Nanolayered Polymer Optics		
Congressional Add: Program Increase - ADVANCED BALLISTIC PROTECTION TECHNOLOGY	25.000	-

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BP9 *I Soldier Lethality Technologies (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
FY 2023 Accomplishments: Congressional Interest Item funding provided for ADVANCED BALLISTIC PROTECTION TECHNOLOGY		
Congressional Add: Program Increase - ARTIFICIAL INTELLIGENCE - ENHANCED EDUCATIONAL TECHNOLOGY AND LEARNING	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ARTIFICIAL INTELLIGENCE - ENHANCED EDUCATIONAL TECHNOLOGY AND LEARNING		
Congressional Add: Program Increase - ENHANCED BALLISTIC PROTECTIVE EYEWEAR	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ENHANCED BALLISTIC PROTECTIVE EYEWEAR		
Congressional Add: Program Increase - ENHANCING SOLDIER BALLISTIC TECHNOLOGIES	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ENHANCING SOLDIER BALLISTIC TECHNOLOGIES		
Congressional Add: Program Increase - FLAT PANEL TECHNOLOGY	2.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Flat Panel Technology		
Congressional Add: Program Increase - FUTURE FORCE REQUIREMENTS EXPERIMENTATION	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for FUTURE FORCE REQUIREMENTS EXPERIMENTATION		
Congressional Add: Program Increase - INNOVATIVE TRAINING TECHNOLOGIES	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Innovative Training Technologies		
Congressional Add: Program Increase - LITHIUM-ION BATTERY CELL RESEARCH PILOT	9.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for LITHIUM-ION BATTERY CELL RESEARCH PILOT		
Congressional Add: Program Increase - PATHFINDER ADAPTIVE EXPERIMENTATION FORCE	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for PATHFINDER ADAPTIVE EXPERIMENTATION FORCE		
Congressional Add: Program Increase - PATHFINDER CYBER INITIATIVES	12.000	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602143A / *Soldier Lethality Technology*	**Project (Number/Name)** BP9 / *Soldier Lethality Technologies (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
FY 2023 Accomplishments: Congressional Interest Item funding provided for PATHFINDER CYBER INITIATIVES		
Congressional Add: Program Increase - REGIONAL WORKFORCE PILOT	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Regional Workforce Pilot		
Congressional Add: Program Increase - SOLDIER & SMALL UNIT TACTICAL ENERGY TECHNOLOGY	3.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SOLDIER & SMALL UNIT TACTICAL ENERGY TECHNOLOGY		
Congressional Add: Program Increase - Extended Range and Hybrid Gun Launched Unmanned Aerial Systems	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Extended Range and Hybrid Gun Launched Unmanned Aerial Systems		
Congressional Adds Subtotals	164.700	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*				**Project (Number/Name)** BR9 *I Personnel & Airdrop Safety Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BR9: *Personnel & Airdrop Safety Technology*	-	3.337	3.092	3.097	-	3.097	3.742	3.745	3.785	3.823	0.000	24.621

A. Mission Description and Budget Item Justification

This Project funds the research and investigation of component technologies to enhance cargo and personnel airdrop capabilities for global precision delivery, rapid deployment, and insertion for force projection into hostile regions. Areas of emphasis include parachute technologies, parachutist injury reduction, precision offset aerial delivery, soft landing technologies, and airdrop simulation. Technologies support the Soldier Lethality Army Modernization Priority. New operational concepts call for increased precision of personnel and cargo in austere environments in which small units are dispersed and logistical supply is limited. The Army requires enhanced payload extraction and other increased capabilities to support the airdrop requirement for current and future vehicles exceeding aircraft payload weight capacity.

Work in this Project supports key Army needs and complements the technical research of several Program Elements (PEs) to include PE 0601102A (Defense Research Sciences), PE 0602143A (Soldier Lethality Technology) / Project BD6 (Soldier Sys Interfaces/ Integration- Sensor Tech), and PE 060311SA (Soldier Lethality Advanced Technology) / Project BE5 (Personnel & Airdrop Safety 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 Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Personnel & Airdrop Safety Technology	3.337	3.092	3.097
Description: This effort investigates technologies that enhance payload extraction, which will allow current vehicles to be dropped with more armor and support equipment, and reduce the design constraint on future vehicles that have airdrop as an operational requirement, increase parachute gliding capabilities, and mature delivery accuracy of cargo aerial delivery systems that support varying payload weights. Research in the area of novel parachute materials will provide increased capabilities for cargo and personnel aerial delivery systems. This effort will support an investigation of new Modeling and Simulation (M&S) tools to develop validation methods for airdrop concepts. This effort also investigates technologies that advance airborne personnel insertion safety requirements to modernize the Airborne Soldier and provide the ability to effectively execute the airborne mission through reducing safety risk and increasing capabilities. *FY 2024 Plans:* Will investigate non-traditional delivery approaches and platforms to support resupply methods in dispersed, contested environments; design and develop personnel infiltration/exfiltration system fuselage to increase reliability with optional autonomous guidance and flight control for a soldier and their supplies; design and develop technologies to facilitate autonomous			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602143A *I Soldier Lethality Technology*	**Project (Number/Name)** BR9 *I Personnel & Airdrop Safety Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
long distance precision aerial delivery of multiple effects with expanded Global Positioning System (GPS) - degraded/denied capabilities (to include inclement weather, nighttime) and enhanced mission planning algorithms; mature models/simulation in support of cargo resupply methods and atmospheric constraints by analyzing and comparing with flight test data; *FY 2025 Plans:* Will investigate novel materials and design configurations for parachute components in support of weight and volume reductions; investigate survey technologies for establishing paratrooper situational awareness in operational scenarios; conduct investigations and maturation to advance developed Guidance Navigation and Control (GN&C) strategies in support of GPS degraded/denied resupply operations. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	3.337	3.092	3.097

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

PE 0602143A: *Soldier Lethality Technology*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

| Appropriation/Budget Activity
2040: Research, Development, Test & Evaluation, Army I BA 2: Applied Research | | | | | R-1 Program Element (Number/Name)
PE 0602144A I Ground Technology | | | | | | |

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	256.916	60.005	66.707	-	66.707	80.755	84.493	90.308	90.477	0.000	729.661
BK7: Robotics for Engineer Operations Technology	-	1.802	6.459	5.436	-	5.436	3.505	2.093	6.574	5.238	0.000	31.107
BL1: Materials and Manufacturing Research Technology	-	4.249	4.321	7.779	-	7.779	10.245	10.581	10.762	10.874	0.000	58.811
BL2: Explosives Forensics Technology	-	1.612	1.707	1.025	-	1.025	1.026	1.729	1.747	1.765	0.000	10.611
BL5: Expedient Passive Protection Technology	-	4.303	2.957	2.726	-	2.726	4.194	4.168	3.464	3.264	0.000	25.076
BL7: Power Projection in A2AD Environments Technology	-	1.844	2.963	2.161	-	2.161	3.618	2.572	1.952	1.849	0.000	16.959
BL9: Protection from Advanced Weapon Effects Technology	-	5.037	5.211	5.033	-	5.033	4.818	5.523	7.205	6.798	0.000	39.625
BN8: Ground Technology Materials(CA)	-	204.900	-	-	-	-	-	-	-	-	0.000	204.900
CG6: Ground Vehicle Power and Energy Concepts and Tech	-	2.504	2.605	4.678	-	4.678	6.061	6.015	6.061	6.121	0.000	34.045
CG7: Ground Protection Concepts and Technologies	-	12.194	10.473	8.328	-	8.328	10.264	11.548	11.702	11.819	0.000	76.328
CG8: Human Autonomy Teaming	-	8.952	9.263	9.284	-	9.284	9.345	9.352	9.467	9.562	0.000	65.225
CI2: Ground Enabling University Applied Research	-	3.548	3.906	5.533	-	5.533	4.630	4.633	4.684	4.731	0.000	31.665
CV3: Engineer Enablers Maneuver, LOG, & Sustainment Apl	-	2.426	2.195	1.257	-	1.257	4.179	4.030	6.082	7.375	0.000	27.544
DA1: SAFR Alternatives for Readiness Applied Research	-	3.545	5.171	4.025	-	4.025	6.545	6.681	6.808	6.876	0.000	39.651

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army										**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*				**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*						
DG1: *Development of Obscurants*	-	-	2.774	2.807	-	2.807	2.811	2.813	2.815	2.844	0.000	16.864
DI7: *Environmental Security Resilience Tech*	-	-	-	6.635	-	6.635	9.514	12.755	10.985	11.361	0.000	51.250

Note

In FY2025, project DI7 / Environmental Security Resilience Tech is a new effort realigned within PE0602144A /Ground Technology from project DA1 / SAFR Alternatives for Readiness Applied Research.

A. Mission Description and Budget Item Justification

This Program element (PE) executes research that support and enable the Army's modernization priority for the Next Generation of Combat Vehicles including systems for the deployment and sustainment of ground movement and maneuver. This PE designs and validates technologies that are necessary and foundational for enduring and future ground movement, maneuver and protection of Soldiers and systems.

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

Work is performed by the Army Research Laboratory (ARL); the Chemical Biological Center (CBC); the Data and Analysis Center (DAC); the University Technology Development Division; the Armaments Center (AC); the Aviation and Missile Center (AVMC); the Soldier Center (SC); the Ground Vehicle Systems Center (GVSC); the Environmental Laboratory; and the Cold Regions Research and Engineering Laboratory; the Construction Engineering Research Laboratory; the Information Technology Laboratory; the Geotechnical and Structures Laboratory.

Work in this PE complements PE 0602145A (Next Generation Combat Vehicle Technology), PE 0603119A (Ground Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0602143A (Soldier Lethality Technology) and PE 0603118A (Soldier Lethality Advanced Technology).

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*		

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	264.523	60.005	69.110	-	69.110
Current President's Budget	256.916	60.005	66.707	-	66.707
Total Adjustments	-7.607	0.000	-2.403	-	-2.403
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-6.998	-			
• SBIR/STTR Transfer	-0.609	-			
• Adjustments to Budget Years	-	-	-2.403	-	-2.403

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BN8: *Ground Technology Materials(CA)*		
Congressional Add: *Program increase - INTEGRITY OF TRANSPARENT ARMOR*	4.400	-
Congressional Add: *Program increase - ENVIRONMENTAL QUALITY ENHANCED COATINGS*	5.000	-
Congressional Add: *Program increase - MATERIALS RECOVERY TECHNOLOGIES FOR DEFENSE SUPPLY RESILIENCY*	10.000	-
Congressional Add: *Program increase - RAPID ADVANCED DEPOSITION*	10.000	-
Congressional Add: *Program Increase - RARE EARTH INITIATIVE*	10.000	-
Congressional Add: *Program Increase - VERIFIED INHERENT CONTROL*	10.000	-
Congressional Add: *Program Increase - ADVANCED CERAMIC TECHNOLOGIES*	2.000	-
Congressional Add: *Program Increase - ALTERNATIVE ENERGY RESEARCH*	20.000	-
Congressional Add: *Program Increase - AUTONOMOUS DIGITAL DESIGN*	5.000	-
Congressional Add: *Program Increase - CARBON NANOMATERIALS AS FUNCTIONAL ADDITIVES*	6.500	-
Congressional Add: *Program Increase - COLD REGION RESEARCH*	5.000	-
Congressional Add: *Program Increase - DEFENSE RESILIENCY AGAINST EXTREME COLD WEATHER*	11.000	-
Congressional Add: *Program Increase - DEFENSE RESILIENCY PLATFORM ADDRESSING EXTREME COLD WEATHER*	10.000	-
Congressional Add: *Program Increase - DETECTION AND DEFEAT OF BURIED MUNITIONS*	4.000	-
Congressional Add: *Program Increase - EARTHEN STRUCTURES SOIL ENHANCEMENT*	4.000	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Program Increase - ELECTROLYZER*	7.000	-
Congressional Add: *Program Increase - EXTREME BATTERY TECHNOLOGIES*	10.000	-
Congressional Add: *Program Increase - FLEXIBLE HYBRID ELECTRONICS*	15.000	-
Congressional Add: *Program Increase - FUNCTIONAL POLYMERIC MATERIALS AND COMPOSITES FOR EXTREME TEMPERATURE ENVIRONMENTS*	5.000	-
Congressional Add: *Program Increase - GROUND TECHNOLOGY FOR CHEMICAL AND BIOLOGICAL DEFENSE*	1.000	-
Congressional Add: *Program Increase - HIGH PERFORMANCE POLYMER COMPOSITES AND COATINGS*	10.000	-
Congressional Add: *Program Increase - LIGHTWEIGHT HIGH ENTROPY METALLIC ALLOY DISCOVERY COLLABORATION*	5.000	-
Congressional Add: *Program Increase - LOGISTICS OVER-THE-SHORE CAPABILITIES*	10.000	-
Congressional Add: *Program Increase - POLAR PROVING GROUND*	5.000	-
Congressional Add: *Program Increase - PROTECTIVE COATINGS*	10.000	-
Congressional Add: *Program Increase - ULTRA-HIGH DENSITY STORAGE*	10.000	-
Congressional Add Subtotals for Project: BN8	204.900	-
Congressional Add Totals for all Projects	204.900	-

Change Summary Explanation

FY 2025 changes are due to reprioritization of resources across the Science and Technology portfolio.

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BK7 / *Robotics for Engineer Operations Technology*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BK7: *Robotics for Engineer Operations Technology*	-	1.802	6.459	5.436	-	5.436	3.505	2.093	6.574	5.238	0.000	31.107

A. Mission Description and Budget Item Justification

This research investigates and develops standoff robotic capabilities to reduce Soldier/Combat Engineer risks and fatalities while conducting activities essential to shaping the environment. It will close the gaps between commercial construction equipment and the requirements of the future Engineer Force to support maneuver, movement, and sustainment. This research will develop the capability to generate a near real-time site model with appropriate engineering details to allow unmanned system shaping of the environment through physical interaction (e.g., push, pull, lift, or dig). This effort will also develop the requisite mission planner and task execution controller that accepts input from the user and provides suggestions and feedback based on updates to the site model, reporting from hardware agents, and resource allocation logic. The end state goal is the development of beyond line of sight teleoperation and semiautonomous capabilities allowing Engineer robotic support to match pace in future combat environments. This effort will support the development, testing, and evaluation of prototypical robotic Combat Engineer equipment. This Project develops modeling and simulation tools that represent realistic states for Engineer robotic operations and develops and assesses semi-autonomous and autonomous construction equipment technologies needed for remote control Engineer operations.

Work in this Project complements Program Element (PE) 0603119A (Ground Advanced Technology) / Project BK8 (Robotics for Engineer Operations Advanced Technology).

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

Work in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology).

Work in this Project is performed by the United States Army Engineer Research and Development Center Construction Engineering Research Laboratory, Information Technology Laboratory, and Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Semi-Autonomous Engineer Operations	1.802	6.459	5.436
Description: This effort investigates and develops robotic machine tools and behaviors to perform semi-autonomous shaping of the terrain through physical interaction with the environment (push, pull, lift, and dig). The effort develops the necessary decision-making, data fusion, localization, and inter-platform communication to allow semi-autonomy on commercial off the shelf (COTS) equipment. *FY 2024 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BK7 *I Robotics for Engineer Operations Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will adapt and validate autonomous path planning and movement control algorithms, developed during previous efforts, to apply to heavy Engineer equipment. Will enhance simulation environment with the design and development of machine-learning based terrain shaping algorithms to enable autonomous execution of a simple repetitive Combat Engineer task using single type of heavy Engineer equipment. *FY 2025 Plans:* Will develop expanded autonomy algorithms for heavy Engineer equipment manipulation of terrain (e.g., blade and bucket). Will validate negative obstacle detection and characterization implemented on heavy Engineer equipment. Will conduct experiments on automated terrain shaping operations to remove negative obstacles. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects the planned reduction of workflows as technologies are transitioned for maturation and demonstration.			
Accomplishments/Planned Programs Subtotals	1.802	6.459	5.436

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*				Project (Number/Name) BL1 / *Materials and Manufacturing Research Technology*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BL1: *Materials and Manufacturing Research Technology*	-	4.249	4.321	7.779	-	7.779	10.245	10.581	10.762	10.874	0.000	58.811

A. Mission Description and Budget Item Justification

This Project links materials research, manufacturing processes, and design to enable high quality additive manufacturing products for Army applications through the development of high-performance feedstock materials (polymers, metals, and ceramics), physics-based process models, and in-situ process monitoring. Integration of these tools with process models enables real-time control and manipulation of material structure and properties to produce three-dimensional hybrid electronics packaging, power and energy sources and converters and new materials/structures for protection. The goal of this work is to develop robust physics-based models to optimize material properties, structures, and manufacturing processes for Army applications in protection, maneuver, power, sensing, and signature management necessary to rapidly respond to emerging and unknown threats in a battlefield environment.

This work is done in coordination with Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology), 0602143A (Soldier Lethality Technology) and 0603118A (Soldier Lethality Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Additive Manufacturing Research	3.348	3.382	3.383

Description: This effort Investigates new additive manufacturing (AM) capabilities that enable production of lightweight materials for protection, survivability, and maneuverability that cannot be produced through traditional manufacturing methods. Efforts include the design and development of new feedstock materials engineered specifically for low-volume additive processes to produce net-shape materials with desired properties and functionalities; integrated process models and real-time monitoring for closed-loop control and production of lightweight materials with optimal architectures, property gradients, and interfaces; and design optimization capabilities that connect materials and manufacturing to access the full design space enabled by additive manufacturing.

FY 2024 Plans:
Will validate machine learning guided process control for metal AM builds of munition components; design printed munition casings with microstructure driven fragmentation schemes using novel next generation alloys; validate modeling tools that predict the fragmentation behavior of printed metals based on process specific thermal history for precision control of lethality; validate

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*		**Project (Number/Name)** BL1 *I Materials and Manufacturing Research Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
full 3-Dimensional electronic processes, milled circuit traces, conductive traces, circuit component placement in microcontroller, and seeker circuits for Army-relevant applications; validate high accelerative loading conditions on printed electronics to determine that AM conformal electronics can withstand accelerative loading; finalize development of integrated circuits, fuze, and initiators for high g-force reliability. *FY 2025 Plans:* Will assess printed fragmenting munition casing of novel metal alloys for active protection and explore improved conversion of casing-to-fragmentation to increase lethality; develop advanced manufacturing feedstock alloys and explore recycled feedstocks for advanced manufacturing; investigate controlled warhead fragmentation methods and develop methods to tailor fragmentation patterns; assess ultra-high strength steel and high strength/lightweight alloys for vehicle protection; investigate novel methods of creating controlled warhead fragmentation for higher energy density munition propulsion and consistent burn performance; develop and mature materials and processes for cost effective light weighting of combat vehicles for indirect fire platforms; assess 3D printed electronics for fuzing, guidance, navigation, and control (GNC), and communication links for high g-force survivability; optimize tailored fragmentation pattern utilizing computational optimization of tailored fragmentation utilization advanced manufacturing techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Energy Sources and Storage *Description:* This effort focuses on the design and characterization of chemistries, materials, and components for advanced batteries, fuel reformers, and fuel cells. Potential Army applications include hybrid power sources, smart munitions, hybrid power vehicles, and soldier power applications. This effort also investigates the applicability of photosynthesis to provide fuel and electricity for Soldier power applications and investigates silicon carbide power module components that could enable compact, high-efficiency, high-temperature, and high-power density converters for motor drive and pulse power applications. *FY 2024 Plans:* Will identify most promising compositions and methods for chemical modification of silicon as high capacity Li-ion battery anode; characterize the nature, quality, and robustness of the solid electrolyte interface layer forming at the silicon anode-electrolyte interface to determine its ability to provide necessary passivation (chemical process) of the Li-ion battery anode, and its impact on charge rate, temperature, and cycle life performance; explore Li-ion battery safety, through thermal, electrical short, and penetration assessments; investigate spinel, garnet, and monolithic solid electrolyte interphase (SEI), and complementary electrode integration for high energy Li-ion batteries; explore low-cobalt or cobalt-free, high-voltage, and high-capacity battery cathodes. *FY 2025 Plans:*	0.901	0.939	0.945

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL1 *I Materials and Manufacturing Research Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will identify and assess electrolytes compatible with silicon anode batteries to optimize cycle life, charge rate, thermal stability, and low temperature performance; determine the failure modes of chemically modified silicon anodes and the stability as a function of utilization and pressure; investigate the origin of safety issues in both graphite and silicon anode high energy battery cells that are new and have been recharged many times; investigate thermal behavior of Lithium (Li)-ion battery cells at elevated temperatures; investigate the thermal stability of low cobalt or cobalt free high energy battery cathodes; assess Li-ion battery cells using oxide and rock-salt based anodes; investigate fast ion conductors for monolithic solid electrolytes, and complementary electrode integration for high energy Li-ion batteries. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Novel Armor Materials and Processes for Vehicle Protection ***Description:*** This effort designs, develops, fabricates, and assesses a variety of materials (e.g. metals, ceramics, polymers, and composites) to enable more survivable, lighter weight armor, protection, and electronics for vehicle structures. Research focuses on novel material properties, developing physics-based models, materials characterization techniques, non-destructive testing methods, and traditional and advanced fabrication/processing methods to transition candidate solutions for maturation, scale-up, and integration into Army systems. ***FY 2025 Plans:*** Will continue work restructured from PE 0602145A, Project BI4 Materials Application and Integration Tech, to develop lightweight, low cost, damage resistant transparent armor glass/polymer laminates with optical transmissivity at wavelengths suitable for personnel and sensor protection; assess transparent armor material processing methodologies; develop new materials or laminates for vehicle and sensor protection; assess performance of dissimilar material joints (welded, solid state, adhesively joined) under high rate/complex loading conditions; design and develop weldable high toughness, high hard steel armor plate; assess novel metals for ground vehicle propulsion systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding restructured from Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BI4 (Materials Application and Integration Tech).	-	-	3.451
Accomplishments/Planned Programs Subtotals	4.249	4.321	7.779

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL1 *I Materials and Manufacturing Research Technology*

D. Acquisition Strategy
  N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** BL2 *I Explosives Forensics Technology*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BL2: *Explosives Forensics Technology*	-	1.612	1.707	1.025	-	1.025	1.026	1.729	1.747	1.765	0.000	10.611

A. Mission Description and Budget Item Justification

This Project investigates and develops analytical methods for the trace detection of military explosives, homemade explosives (HME), and solid chemical hazards found on contaminated surfaces. This project pursues research in signatures and algorithms required to provide improved trace analysis of chemical hazards to enable integration and augmentation into chemical and explosive detection equipment for the warfighter.

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

Work in this Project is performed by the Chemical Biological Center (CBC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Forensic Analysis of Explosives Signatures Applied Research	1.612	1.707	1.025
Description: This effort investigates forensics analytical methods for military explosives, homemade explosives (HME), HME precursors, and residue analysis for attribution. *FY 2024 Plans:* Will further mature collimated Raman system for real time detection of liquid and solid visual and non-visual contaminated surfaces; continue to examine surface-enhanced Raman spectroscopy nano-metallic substrates to augment normal Raman handheld devices for trace level detection of explosives and opioids, and continued development of chemical depositions systems for quantifiable test standards for point and standoff sensors. *FY 2025 Plans:* Will continue to investigate candidate new technology phenomenon to improve and enhance the location and detection of trace level solid explosive contamination on surfaces, focusing on bio-inspired explosive and chemical sensing technology, implementation of machine learning techniques, and impedance-based spectroscopy. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding change is consistent with the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	1.612	1.707	1.025

C. Other Program Funding Summary ($ in Millions)
N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL2 *I Explosives Forensics Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 **/** 2					**R-1 Program Element (Number/Name)** PE 0602144A **/** *Ground Technology*				**Project (Number/Name)** BL5 **/** *Expedient Passive Protection* *Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BL5: *Expedient Passive Protection Technology*	-	4.303	2.957	2.726	-	2.726	4.194	4.168	3.464	3.264	0.000	25.076

A. Mission Description and Budget Item Justification

This Project designs and develops rapidly deployable passive protective solutions; algorithms for decision support applications and software; and tactics, techniques, and procedures to increase the survivability of personnel, critical assets, and facilities. Through experimental and computational investigation and design, this project develops force protection technologies for complex and urban environments. This Project also develops expedient solutions and decision support applications for protection against advanced energetic threats and large caliber rockets, missiles, and other emerging weapons.

Work in this Project complements Program Element (PE) 0603119A (Ground Advanced Technology) / Project BL6 (Expedient Passive Protection Advanced Technology).

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

Work in this Project is performed by the United States (US) Army Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Assessments of Solutions for Survivability from Emerging Threats (ASSET)	4.303	2.957	-
Description: This effort investigates emerging threat weapon effects on critical assets, theater of operation facilities, and existing protection technologies; designs and develops rapidly deployable passive protective solutions; algorithms for decision support applications and software; and tactics, techniques, and procedures to increase the survivability of personnel, critical assets, and facilities against emerging threats, such as high trajectory large caliber rockets and missiles as well as Unmanned Aircraft Systems (UAS) threats. This effort integrates experimental and computational analysis. *FY 2024 Plans:* Will conduct experiments of newly designed rapidly deployable protection systems against emerging threats, such as large caliber rockets and missiles and will enhance high-fidelity models and fast-running algorithms to predict emerging threat effects. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned completion of this effort and transition to PE 0603119 / Project BL6 (Expedient Passive Protection Advanced Technology).			
Title: Deliberate Expedient Protection for Large-scale Operations Yielding Survivability (DEPLOYS)	-	-	2.726

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024		
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL5 *I Expedient Passive Protection Technology*		

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort investigates expedient survivability solutions for large-scale combat operations; designs and develops expediently employed operationally feasible protective solutions; develops algorithms for decision support applications to incorporate multiple aspects of survivability; and develops tactics, techniques, and procedures (TTPs) to increase the survivability of personnel and assets at critical sites such as logistical supply locations with considerations for operations in varying climate, vegetation, and terrain environments. *FY 2025 Plans:* Will investigate the protection requirements for logistic supply locations associated with large-scale combat operations with considerations for multiple aspects of survivability, and investigate the variability of blast and ballistic response of protection materials when employed in relevant operational environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	4.303	2.957	2.726

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** BL7 *I Power Projection in A2AD Environments Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BL7: *Power Projection in A2AD Environments Technology*	-	1.844	2.963	2.161	-	2.161	3.618	2.572	1.952	1.849	0.000	16.959

A. Mission Description and Budget Item Justification

This Project designs and develops remote assessment technologies to determine entry and maneuver corridors, develops 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 projection platform assessments and provide all season capacity predictions to ensure air and ground battlespace entry and maneuver. This Project also designs and develops 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 (A2/AD).

Work in this PE complements PE 0603119A (Ground Advanced Technology) / Project BL8 (Power Projection in A2AD Environments Adv Tech).

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

Work in this Project is performed by the United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Engineering for Battlespace Maneuver	1.844	2.963	-
Description: This effort develops the capability to rapidly repair and upgrade damaged infrastructure along mobility corridors and restaging areas to maintain and enhance freedom of maneuver achieving tactical advantage in contested complex environments. **FY 2024 Plans:** Will develop a framework for automated decision support tools that will determine requirements for planning tools to task route repair and upgrades; will develop optimization routine for selecting equipment and materials to perform repair missions. **FY 2024 to FY 2025 Increase/Decrease Statement:** Funding decrease reflects planned completion of this effort and transition to PE 0603119A / Project BL8 (Power Projection in A2AD Environments Adv Tech).			
Title: Force Projection in Multi-Domain Operations	-	-	2.161
Description: This effort develops capabilities for maneuver across air/land/sea domains using Combat Engineer assets to assess, modify, and upgrade transitional regions (such as beaches and coastal swamps) critical to force projection. Develops new methodologies for reconnaissance and analysis methods to provide predictive capabilities for selecting and prioritizing maneuver			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL7 *I Power Projection in A2AD Environments Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
corridors for ground forces. Develops technologies that enable movement and maneuver through expanded terrain environments (i.e., soil stabilization) for distributed operations. *FY 2025 Plans:* Will conduct site investigations in multiple littoral environments and determine vehicle mobility performance limitations; will develop scaled designs of site stabilization material or loose sand soils; will complete laboratory testing of geotextile materials (strong permeable fabrics used in construction and soil stabilization) available for fabrication. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	1.844	2.963	2.161

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** BL9 *I Protection from Advanced Weapon Effects Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BL9: *Protection from Advanced Weapon Effects Technology*	-	5.037	5.211	5.033	-	5.033	4.818	5.523	7.205	6.798	0.000	39.625

A. Mission Description and Budget Item Justification

This Project designs and develops structural hardening, high-performance computing capabilities, and force protection technologies to enhance survivability of personnel and critical assets. This project investigates and develops advanced materials for protection against blast, fragmentation, and penetration through physical experiments and modeling and simulation. Additionally, this project investigates, designs, and develops passive protection technologies and protective design criteria to mitigate attack from emerging advanced threats.

Work in this Program Element (PE) complements PE 0603119A (Ground Advanced Technology) / Project BM1 (Protection from Advanced Weapon Effects Adv Tech).

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

Work in this Project is performed by the United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Materials and Modeling for Force Protection *Description:* This effort designs and develops capabilities in the use of poorly-understood and indigenous materials. This effort develops multi-scale material modeling frameworks incorporating physics of deformation and damage mechanisms; a 3D multi-physics material modeling capability to allow for weapons effects models to be informed by remote sensing; and advanced material technologies for force protection. *FY 2024 Plans:* Will implement thermodynamics-based geomaterial modeling into multi-scale modeling framework; investigate advanced composite, metal, and hybrid materials developed through materials-by-design approaches; and will investigate system-level integration of advanced materials into force protection systems. *FY 2025 Plans:* Will mature component-level materials-by-design tools to further advance materials and manufacturing approaches . Will focus on materials inspired by geological systems (e.g., rock, clay, granular materials) for structural hardening as well as lightweight and small form factor materials for force protection requirements. *FY 2024 to FY 2025 Increase/Decrease Statement:*	1.548	1.595	1.598

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BL9 *I Protection from Advanced Weapon Effects Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase is an economic adjustment.			
Title: Protection from Advanced Penetrators	3.489	3.616	3.435
Description: This effort designs and develops protective material solutions and enhances modeling and simulation (M&S) tools for designing, analyzing and improving these advanced protective materials to be used in large hardened protective structures; investigates and validates computational models and passive protective solutions for large hardened structures from advanced precision penetrating threat weapons. *FY 2024 Plans:* Will design, develop and conduct sub-scale experiments to predict weapon effects from advanced penetrators on protective structures. Will update M&S based on experiments. *FY 2025 Plans:* Will develop and validate efficient modeling and simulation (M&S) tools to support planning, designing, constructing, and maintaining hardened protective structures to mitigate the weapons effects of advanced penetrators of peer and near peer adversaries. Will enhance the M&S tools for high fidelity analyses and damage prediction of hardened protective structures from increased velocity advanced penetrators. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned milestones for this effort.			
Accomplishments/Planned Programs Subtotals	5.037	5.211	5.033

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 I 2					**R-1 Program Element (Number/Name)** PE 0602144A I *Ground Technology*				**Project (Number/Name)** BN8 I *Ground Technology Materials(CA)*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BN8: *Ground Technology Materials(CA)*	-	204.900	-	-	-	-	-	-	-	-	0.000	204.900

Note
 Congressional Interest Item funding provided for Ground Technology Materials.

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding provided for Ground Technology Materials.

 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 2023	FY 2024
Congressional Add: Program increase - INTEGRITY OF TRANSPARENT ARMOR	4.400	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Integrity of Transparent Armor		
Congressional Add: Program increase - ENVIRONMENTAL QUALITY ENHANCED COATINGS	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Environmental Quality Enhanced Coatings		
Congressional Add: Program increase - MATERIALS RECOVERY TECHNOLOGIES FOR DEFENSE SUPPLY RESILIENCY	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Materials Recovery Technologies for Defense Supply Resiliency		
Congressional Add: Program increase - RAPID ADVANCED DEPOSITION	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Rapid Advanced Deposition		
Congressional Add: Program Increase - RARE EARTH INITIATIVE	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Rare Earth Initiative		
Congressional Add: Program Increase - VERIFIED INHERENT CONTROL	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Verified Inherent Control		
Congressional Add: Program Increase - ADVANCED CERAMIC TECHNOLOGIES	2.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602144A / *Ground Technology*	Project (Number/Name) BN8 / *Ground Technology Materials(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Advanced Ceramic Technologies		
Congressional Add: Program Increase - ALTERNATIVE ENERGY RESEARCH	20.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Alternative Energy Research		
Congressional Add: Program Increase - AUTONOMOUS DIGITAL DESIGN	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Autonomous Digital Design		
Congressional Add: Program Increase - CARBON NANOMATERIALS AS FUNCTIONAL ADDITIVES	6.500	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Carbon nanomaterials as Functional Additives		
Congressional Add: Program Increase - COLD REGION RESEARCH	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Cold Region Research		
Congressional Add: Program Increase - DEFENSE RESILIENCY AGAINST EXTREME COLD WEATHER	11.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Defense Resiliency Against Extreme Cold Weather		
Congressional Add: Program Increase - DEFENSE RESILIENCY PLATFORM ADDRESSING EXTREME COLD WEATHER	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Defense Resiliency Platform Addressing Extreme Cold Weather		
Congressional Add: Program Increase - DETECTION AND DEFEAT OF BURIED MUNITIONS	4.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Detection and Defeat of Buried Munitions		
Congressional Add: Program Increase - EARTHEN STRUCTURES SOIL ENHANCEMENT	4.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Earthen Structures Soil Enhancement		
Congressional Add: Program Increase - ELECTROLYZER	7.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Electrolyzer		
Congressional Add: Program Increase - EXTREME BATTERY TECHNOLOGIES	10.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BN8 *I Ground Technology Materials(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Extreme Battery Technologies		
Congressional Add: Program Increase - FLEXIBLE HYBRID ELECTRONICS	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Flexible Hybrid Electronics		
Congressional Add: Program Increase - FUNCTIONAL POLYMERIC MATERIALS AND COMPOSITES FOR EXTREME TEMPERATURE ENVIRONMENTS	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for FUNCTIONAL POLYMERIC MATERIALS AND COMPOSITES FOR EXTREME TEMPERATURE ENVIRONMENTS		
Congressional Add: Program Increase - GROUND TECHNOLOGY FOR CHEMICAL AND BIOLOGICAL DEFENSE	1.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for GROUND TECHNOLOGY FOR CHEMICAL AND BIOLOGICAL DEFENSE		
Congressional Add: Program Increase - HIGH PERFORMANCE POLYMER COMPOSITES AND COATINGS	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for High Performance Polymer Composites and Coatings		
Congressional Add: Program Increase - LIGHTWEIGHT HIGH ENTROPY METALLIC ALLOY DISCOVERY COLLABORATION	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Lightweight High Entropy Metallic Alloy Discovery Collaboration		
Congressional Add: Program Increase - LOGISTICS OVER-THE-SHORE CAPABILITIES	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Logistics Over-The-Shore Capabilities		
Congressional Add: Program Increase - POLAR PROVING GROUND	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Polar Proving Ground		
Congressional Add: Program Increase - PROTECTIVE COATINGS	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Protective Coatings		
Congressional Add: Program Increase - ULTRA-HIGH DENSITY STORAGE	10.000	-

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** BN8 *I Ground Technology Materials(CA)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
FY 2023 Accomplishments: Congressional Interest Item funding provided for Ultra-High Density Storage		
Congressional Adds Subtotals	204.900	-

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** CG6 *I Ground Vehicle Power and Energy Concepts and Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CG6: *Ground Vehicle Power and Energy Concepts and Tech*	-	2.504	2.605	4.678	-	4.678	6.061	6.015	6.061	6.121	0.000	34.045

A. Mission Description and Budget Item Justification

This Project investigates and develops advanced power and energy technologies for combat ground vehicles that are necessary for parallel hybrid, series hybrid, and all- electric vehicle systems. This Project investigates, designs, and develops electric conversion technologies to reduce size and weight of military vehicles while increasing performance and capabilities to support current and future mission loads and provide improved military vehicle mobility.

Work in this Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology) / PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL) and Data and Analysis Center (DAC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Distributed Power for Autonomous Systems	2.504	0.955	0.449
Description: This effort designs and develops technologies for electrification of both manned and unmanned Next Generation Combat Vehicle platforms. Electrification of these platforms will enable advanced lethality and protection systems, reduced battlefield fuel consumption, and provide new capabilities such as burst acceleration, extended silent mobility, and silent watch. The effort investigates, designs, and develops electric conversion technologies to reduce size and weight while increasing performance and capabilities to support current and future mission loads and provide improved military vehicle mobility. Research focuses on high power/ temperature power electronics, magnetic gears, electric drive motors, and adaptive device and component level control that optimized operation in real time. Investigation of advanced control methods at the module and conversion component levels provides an understanding of the impact real time optimization and energy tracking can have on power conversion optimization and mission effectiveness. The research enables the integration of component state and behavior into system level management algorithms that support non-autonomous and autonomous operations while providing modular and scalable electrification architectures. Efforts will also investigate non-contact magnetic gear technologies coupled with electrical motors and generators to reduce size and weight with an increase in reliability and performance through increased torque and speed operational range. Results of the research inform PE 0602145A (Next Generation Combat Vehicle Technology) / BH5 (Platform Electrification and Mobility Tech). ***FY 2024 Plans:***			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** CG6 *I Ground Vehicle Power and Energy Concepts and Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will experimentally validate battery charger and characterize battery charger performance. Will validate battery management concepts and characterize effect of battery management concepts. ***FY 2025 Plans:*** Will validate battery charger performance against military relevant metrics; enhance charger models based on performance analysis. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Power Conversion for Platforms	-	1.650	2.204
Description: This effort investigates, designs, and assesses technologies for platform electrification that will reduce Army impact to the environment through electrified systems that more effectively utilize energy and improve resiliency. Transitioning to hybrid electric and all electric platforms provides improved energy utilization while reducing emissions providing the Warfighter increased capabilities. Reduction in impact to the environment also improves Warfighter survivability by reducing emissions that can be used for tracking and locating. Research focuses on material and design concepts for compact high-power transformers required by power conversion components, fabrication of new power semiconductor packaging, and advances in control and component power management methods. ***FY 2024 Plans:*** Will utilize co-design and co-engineering methodologies and laboratory experiments to validate performance of advanced power packaging concepts to increase efficiency, power transfer, and reliability. Will experimentally validate component level monitoring and control concepts and determine performance of prediction and optimization control algorithms. Will validate advanced transformer designs and thermal performance under high power. ***FY 2025 Plans:*** Will mature thermo-mechanical co-design and co-engineering models through the addition of circuit and electrical analysis capabilities; investigate high voltage power packaging concepts that utilize active material control to vary material properties in-situ; investigate energy-informed mission optimization methods to better manage energy distribution; develop transformer models based on experimental validation. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Prognostics and Predictive Maintenance Data Science and Analytics	-	-	2.025
Description: This effort investigates Predictive Logistics capabilities to enable the Army to execute Unified Action in Multi-Domain Operations (MDO) by 2030. The effort also develops Predictive Logistics methodologies and analytics to inform the design of			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** CG6 *I Ground Vehicle Power and Energy Concepts and Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Army 2040 by delivering Decision Dominance through the integration of Mission Command and Readiness to provide capabilities ahead of need to generate and sustain combat power. As part of the overall Predictive Logistics efforts, research focuses on the tasks, conditions, and standards required to achieve Prognostics and Predictive Maintenance and development of accurate predictions of component and system failures within Army systems. The outcomes provide the Army with greater understanding of when equipment/system performance is degraded or about to be degraded, optimizing Readiness and maximizing combat power. *FY 2025 Plans:* Will investigate the taxonomy for components of Prognostics and Predictive Maintenance associated or beginning with Army ground systems; Will begin to develop ground system/component algorithms using advanced Artificial Intelligence and Machine Learning techniques; Will identify performance metrics for maturation of ground system health assessment methodologies, diagnostic requirements, and component and/or platform life prediction techniques and standards. *FY 2024 to FY 2025 Increase/Decrease Statement:* Increase in FY2025 reflects initiation of ground system/component algorithms development and investigation of the taxonomy for components of Prognostics and Predictive Maintenance.			
Accomplishments/Planned Programs Subtotals	2.504	2.605	4.678

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** CG7 *I Ground Protection Concepts and Technologies*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CG7: *Ground Protection Concepts and Technologies*	-	12.194	10.473	8.328	-	8.328	10.264	11.548	11.702	11.819	0.000	76.328

A. Mission Description and Budget Item Justification

This Project investigates advanced materials and mechanisms to defeat the most common and most dangerous threats that are expected to be encountered by our ground forces in near-, mid-, and far-term. This Project also designs and develops experimental and computational tools and techniques (high resolution instrumentation to observe impact events, theories, and algorithms to explain these phenomena and numerical implementation of these algorithms) for the development of mass-efficient armor mechanisms. This project designs and develops armor mechanisms that will be integrated to create multi-threat armor technologies and form the building blocks for Adaptive and Cooperative Protection Technologies in the Advanced Concepts for Active Defense Project (Program Element (PE) 0602145A Next Generation Combat Vehicle Technology). Additionally, research will focus on subcomponent/component models to predict performance of early concepts and the means to assess effectiveness on ground platforms. The Project will balance designs and developments of active threat defeat measures with the necessary advanced passive and reactive components that will ultimately provide for full system solutions which meet the requirements of current and next generation ground tactical and combat vehicles.

This Project is coordinated with and transition to Projects in PE 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0602145A (Next Generation Combat Vehicle Technology), and builds upon weapon target interaction research in PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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

Work in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Armor and Protection Technologies	7.136	5.241	3.101
Description: This effort designs and develops the next generation of lightweight protective concepts and technologies for defeat of current and future threats by combining real-time information and threat knowledge to provide increased protection. This effort investigates the fundamental physics of new terminal effects concepts and provides an understanding of interaction between the platform's defeat mechanism and the threat. The effort also investigates the ability to analytically simulate complex threat interactions. Experiments will be conducted to validate the efficacy of the designs. *FY 2024 Plans:*			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will validate the predictive modeling capability of advanced armor with an emphasis on hybrid armor systems and armor efficiency; incorporate machine learning (ML) / high-throughput data directly into simulations to design new materials for specific threats; explore coupling laser shock experiments to reduce uncertainty in material behavior. *FY 2025 Plans:* Will design layered armor systems with unique heat treatments configured for a range of threats; design dynamic indentation apparatus and associated simulation framework to assess strength, strain hardening, strain rate, and temperature performance of materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decreased in Fiscal Year (FY) 2025 to support research in Decisive Lethality in PE 0602145A (Next Generation Combat Vehicle Technology) Project BK5 (Adv Direct In-Direct Armament Sys (ADIDAS) Tech).			
Title: Computational and Experimental Capability *Description:* This effort will design and develop computational design tools along with diagnostic and experimental capabilities that support the development of advanced protection systems. Such systems include passive, active, and hybrid solutions for defeating (multiple) anti-armor threats and exploit solid-dynamic, explosive-driven, and magneto-hydrodynamic target interactions. This work allows for predicting armor performance and understanding mechanisms regardless of vehicle platform, with improved and quantified confidence. This effort leverages the Department of Defense and Department of Energy (DOE) Technical Coordination Group Memorandum of Agreement and directly leverages DOE investments in computational platforms for problems in solid dynamics and impact mechanics. *FY 2024 Plans:* Will design and develop combined explosive effects mechanism software which, coupled with experimental data, will enable the rapid assessment of threats against existing and future armor designs; explore experimental diagnostics for explosive effects to improve understanding of threat loading on armor solutions; conduct computational studies of armor mechanisms to assess the defeat of current and future shape charge threats; develop multi-physics model enhancements to continue to improve the capability to assess threats and armor mechanisms to defeat those threats. *FY 2025 Plans:* Will design and develop enhanced computational modeling and simulation tools to assess threat explosives, running on High Performance Computing systems to shorten development times for new advanced armor concepts; develop techniques to measure electromagnetic fields during dynamic experiments and enhance material models to improve fundamental understanding of complex armor designs. *FY 2024 to FY 2025 Increase/Decrease Statement:*	5.058	5.232	5.227

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	12.194	10.473	8.328

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602144A / Ground Technology				Project (Number/Name) CG8 / Human Autonomy Teaming		
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CG8: *Human Autonomy Teaming*	-	8.952	9.263	9.284	-	9.284	9.345	9.352	9.467	9.562	0.000	65.225

A. Mission Description and Budget Item Justification

This Project performs applied research for capabilities that support teams of Soldier and Artificial Intelligence (AI)-enabled systems to execute missions in complex, dynamic, multi-domain operations environments. Centered on ground vehicle mission planning and operations, this Project is focused on core technologies to enable Soldiers and AI-enabled systems to function as a team, to perform at high levels, and to adapt to adversarial actions and new mission requirements. This Project will enable future Soldiers with AI-enabled systems to perform complex missions with increasingly sophisticated technologies, and in increasingly complex, dynamic, sociotechnical environments. The applied research will provide the fundamental technologies to enable scalable Soldier-AI teams and team-centered dynamic tasking to effectively utilize the full capabilities of team and technologies. The research will include considerations to reduce data requirements for AI adaptation, increasing appropriate Soldier trust and use of technology, and ensuring ethical behavior by teams of Soldier and AI-enabled systems. The capabilities created by this research will lead to increased overall Soldier-AI team mission performance, improved Soldier-centric situation awareness technologies, and units that can effectively integrate within a multi-domain battlefield.

Work in this Project is coordinated with PE 0602145A (Next Generation Combat Vehicle Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology) and PE 0602143A (Soldier Lethality 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 supports the Army Science and Technology Ground and Next Generation Combat Vehicle portfolios.

Work in this Project is performed by the Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Soldier-AI Team Mission Planning for Dynamic Complex Environments	1.313	1.357	-
Description: Planning in multi-domain operations environments is complex and has increased temporal and spatial sensitivities for Soldiers to integrate with AI-enabled systems to plan and execute missions. This effort investigates the fundamental concepts and technologies to enable Soldier and AI to team together to plan for multidomain operations from a ground vehicle perspective. This effort determines planning enablers to maximize manned-unmanned team performance across squads and platoons and includes mid- to far-term crew station-based emerging technologies in the areas of human interaction with AI technologies and human-guided machine intelligence. Designs and develops models of both Soldier and AI capabilities and their limitations as a function of the mission environment and mission requirements and apply those models to form mission plans.			
FY 2024 Plans:			

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will design and develop route/mission planning tools that incorporate operator load and autonomous system interaction cost functions to improve performance from mission to mission. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects administrative realignment to Soldier AI-Team Operational Planning within this project.			
Title: Dynamic Soldier-AI Team Resource Allocation *Description:* This effort designs and develops the concepts and technologies necessary to dynamically allocate Soldiers and unmanned systems during missions to adapt mission plans to adversarial actions and other events at a squad and platoon level, including responding to degradation or loss of team capabilities, changes in mission goals or priorities, and responding to adversarial actions. The effort investigates the allocation of Soldiers, platforms, and platform sub-system capabilities with the focus to ensure that future AI and automation capabilities are focused on the circumstances and conditions where they are most likely to be successful, and to ensure that the Soldier's cognition is focused appropriately to ensure mission success. *FY 2024 Plans:* Will investigate approaches to mitigate performance penalties due to task switching in a human-autonomy team to enable rapid team reconfiguration and improve team performance in dynamic environments; refine methodology and algorithms designed to provide a Commander with suggested courses of action to reconfigure the team based on changes in operator or agent state, mission requirements, and environment. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects administrative realignment to Soldier AI-Team Operational Planning within this project	2.562	2.638	-
Title: Soldier Cognition-Centric Interface Technologies *Description:* This effort designs and develops cognitive-centric displays that ensure Soldiers are focused on aspects of situational awareness, mobility, target engagements, and communications that are critical to mission performance as future crew stations and displays provide vast amounts of multi-domain information that has the potential to distract, overwhelm, and mislead Soldiers. This effort ensures that our systems do not capture and misdirect Soldier attention and/or cognition, maximizing the utility of AI enabled systems to the Soldier. This effort also enables Soldiers to better understand the actions, goals, intents, and general reasoning of the AI systems to ensure they are effectively used, but not inappropriately relied upon. *FY 2024 Plans:* Will conduct experiments to assess the effectiveness and impact of integrating Soldier-trained autonomous systems into reconfigurable human-autonomy teams; create and empirically validate team assessment toolkit for measuring human-autonomy team trust and cohesion from data collected during the mission. *FY 2024 to FY 2025 Increase/Decrease Statement:*	1.677	1.772	-

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects administrative realignment to Soldier AI-Team Operational Planning within this project.			
Title: Enabling Soldier-AI Technology Adaptation	3.400	3.496	3.520
Description: This effort designs and develops technologies to rapidly adapt and upgrade AI-enabled system capabilities in response to advancements in AI in the commercial and adversary environments. Focus areas include enabling rapid technology adaption during Soldier experimentation and enabling data to be collected during these events for rapid development of technology updates and modifications. This effort has four goals: 1) increasing the ability of Soldier-AI teams to rapidly adapt to adversarial actions, new technologies, environmental changes, and mission requirements; 2) decreasing the data requirements to train and adapt AI-enabled systems; 3) increasing appropriate Soldier trust and use of technology; and 4) ensuring ethical decisions by using Soldiers to guide the actions and in-field adaptations of Soldier-AI team behaviors. *FY 2024 Plans:* Will design and develop capability to use unobtrusively-sensed information from Soldier-based sensors to adapt autonomy behavior; validate autonomy adaptation methods leveraging multiple forms of Soldier interactions. Will mature and validate the effectiveness of algorithms that infer Soldier intent from natural Soldier-system interactions in order to adapt team dynamics. *FY 2025 Plans:* Will investigate approaches for within and across-mission adaptation of autonomous system behaviors; explore scalability of machine learning techniques to echelons above the platoon level; design and develop simulation environment for training multi-agent coordinated autonomous behaviors. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Soldier-AI-Enabled System Team Operational Planning	-	-	2.656
Description: This effort focuses on complementary Soldier and machine capabilities that support the rapid planning and replanning of higher-echelon distributed operations. This effort will provide capabilities for distributed Soldier-AI-enabled system teams to rapidly adapt within complex, dynamic, multi-domain environments and identify fleeting windows of opportunity. This effort has four goals: (1) enable Soldier-AI-enabled system teams to rapidly generate mission plans, (2) enable Soldier-AI-enabled system teams to assess mission plans, (3) enable Soldier-AI-enabled system teams to continuously analyze mission progress and predict outcomes and the potential need to re-plan, and (4) identify necessary changes to operational structure and skills caused by the introduction of AI-based systems and tools. *FY 2025 Plans:*			

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will investigate capabilities to enable Soldiers and AI-enabled systems to team together to rapidly generate operational plans for multi-domain operations; create approaches to rapidly assess multiple mission plans; explore methods to predict effectiveness of mission plans within a single domain of operation. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects administrative realignment from Dynamic Soldier-AI Team Resource Allocation within this project.			
Title: Soldier-AI-Enabled System Team Tactical Planning	-	-	3.108
Description: This effort focuses on complementary Soldier and machine capabilities that support rapid adaptive command and control (C2) of lower-echelon distributed operations. This effort designs and develops capabilities that support teams of Soldiers and AI-enabled systems to conduct tactical C2 in complex, dynamic, multi-domain environments. Focused on ground vehicle centric missions, this effort will research core technologies to enable Soldiers and AI-enabled systems to lead isolated units capable of exploiting narrow windows of opportunity by creating and adapting coordinated team behaviors across mission phases. This effort will focus on four goals: (1) enabling coordinated Soldier-AI-enabled system pre-mission planning within constraints of higher echelon plans, (2) enabling within-mission adaptation of mission plans, (3) developing tools and techniques for after-action review-based adaptation of coordinated Soldier-AI-enabled system team behaviors, and (4) identifying necessary changes to team structure and skills caused by the introduction of AI-based systems and tools. *FY 2025 Plans:* Will design a capability to leverage Soldier feedback and previous mission-data to enable mission-to-mission adaptation of coordinated Soldier-AI team behaviors; explore approaches to assess trust across multiple Soldiers, AI-enabled systems, as well as teams that cross echelon; assess capability of Soldier-AI-enabled system tactical teams to rapidly adapt to changing operational plans. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects administrative realignment from Soldier Cognition-Centric Interface Technologies and Soldier-AI Team Mission Planning for Dynamic Complex Environments within this project			
Accomplishments/Planned Programs Subtotals	8.952	9.263	9.284

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602144A / Ground Technology					**Project (Number/Name)** CI2 / Ground Enabling University Applied Research		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CI2: *Ground Enabling University Applied Research*	-	3.548	3.906	5.533	-	5.533	4.630	4.633	4.684	4.731	0.000	31.665

A. Mission Description and Budget Item Justification

The Project leverages applied research from academia, in the focus areas of ground autonomy, Artificial Intelligence/Machine Learning (AI/ML) and robotics, occupant/vehicle survivability and other ground platform technologies of importance to the Army. This Project performs discovery research efforts to focus more on mid to far-term Army modernization priorities while also maintaining delivery of near-term technologies critical to the next generation combat vehicles. This Project focuses on employment of research technologies originating from extramural applied research in academia pertaining to navigation/routing, autonomous robotic vehicles with the use of artificial intelligence and machine learning as applied to ground mobility and maneuver, and other innovative ground enabling applied research technologies. This effort conducts applied research and development leading to potential emerging technologies in areas of strategic importance to the Army in autonomy, robotics and AI/ML, protection of both platform and occupant, and other ground platform technologies in propulsion, survivability, powertrain, etc., by bringing competitively selected Universities with research and development teams into Technical Alliances.

Work in this Project complements Program Element (PE) 0603119A (Ground Advanced Technology), PE 0602145A (Next Generation Combat Vehicle Technology) and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Robust autonomous capabilities for ground vehicles	1.879	2.059	3.608
Description: This effort investigates AI/ML and autonomous mobility-enabled ground vehicles to conduct off-road maneuvers to transition from tele-operated to either autonomous, or semi-autonomous scenarios. This effort improves autonomous behaviors and reduces the need for human interaction during operation. Research is conducted in collaboration with university partners to advance autonomous mobility and protection of both occupant and platform in optionally manned and autonomous ground vehicles. *FY 2024 Plans:*			

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will continue to investigate and develop multi-robot long-term autonomy, ML for autonomous navigation, off-road autonomy software. Will investigate and develop multi-layered situational awareness, cooperative tactical reasoning, and communication frameworks solutions for multiple autonomous air and ground vehicles used for route and area reconnaissance. *FY 2025 Plans:* Will design and develop capability models for unified air/ground scene representations and demonstrations in a fleet of unmanned ground and air vehicles; designs and develops reasoning-based cooperative maneuvers, such as bounding over-watch, with multiple vehicles; mature a second phase of marsupial robotic deployment and recovery technologies; research software to quickly enable Soldiers to customize robotic assets in the field for varied mission requirements; design and develop a modular software tool that interfaces with existing Army software to combine terrain layers to create mobility maps that support autonomous ground vehicle route planning; research emerging technology for autonomous ground vehicles and ground-air teaming. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned milestones and increase research to support Robotic Technical Kernel development.			
Title: Human-robot/AI interactions *Description:* This effort designs and develops systems involving physical and cognitive levels of interactions between humans and robots, with the use of reinforcement learning (an area of ML research) from human feedback, learning from demonstration, and safe human-aware controllers. Work is conducted in collaboration with university partners to advance autonomous mobility as well as other areas of ground platform technologies in propulsion, survivability, powertrain, etc. The benefit of this effort is improvements to machine learning and artificial intelligence with human-robot interactions. *FY 2024 Plans:* Will continue to investigate AI/ML research for robust autonomous capabilities, real-time basic feature extraction, multi-robot long-term autonomy, human-AI collaboration, human-in-the-loop ML for autonomous navigation. *FY 2025 Plans:* Will research sensing, contact-capable navigation, and activity recognition for vehicles to move without stopping among crowds; continues to investigate AI/ML research for robust autonomous capabilities, real-time basic feature extraction from sensor data, multi-robot long-duration autonomy, human-AI-enabled system collaboration, and human-in-the-loop ML for autonomous navigation. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	1.669	1.847	1.925
Accomplishments/Planned Programs Subtotals	3.548	3.906	5.533

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
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C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CV3: *Engineer Enablers Maneuver, LOG, & Sustainment Apl*	-	2.426	2.195	1.257	-	1.257	4.179	4.030	6.082	7.375	0.000	27.544

A. Mission Description and Budget Item Justification

This effort designs and develops software tools to modernize the Army's logistics planning capability. The project will research planning of logistics resupply via distributed supply routes through complex terrain and environmental conditions within a contested environment, while also improving the efficiency of logistics planning, enabling planners to develop and compare courses of action, and simulate logistics activities using complex algorithms. This effort links the engineer applications into a geospatial framework and enables planners to better understand the dynamic scenario development providing a simple and clear critical vulnerabilities assessment, easy visual comparison of inventories available, supply needs within the battlespace, and the logistics options to mitigate potential issues.

Work in this Project complements Program Element (PE) 0603119A (Ground Advanced Technology) / Project CV5 (Engineer Enablers Maneuver, LOG, & Sustainment Adv).

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

Work is performed at the United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory, Coastal and Hydraulics Laboratory, and Information Technology Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Planning Logistics Analysis Network System Applied Research *Description:* This effort will design and develop new engineering applications and methodologies that support improved logistics planning via distributed networks, investigate methods to link existing data describing complex environmental features that impact planning into the engineer applications, and design new automated algorithm technologies to improve the efficiency and effectiveness of the planning decision making. *FY 2024 Plans:* Will design and develop transportation throughput options for feasible nodes and routes and investigate routing options based on weather and terrain concerns, and investigate cross-country movement options within the transportation network. *FY 2025 Plans:*	2.426	2.195	1.257

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will mature components of routing algorithms for distributed logistics planning for multiple transportation modalities (i.e., road, watercraft, train) incorporating unique elements associated with military convoy traffic, weather impacts, and intermodal transfer. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects the transition of technologies for maturation and demonstration to PE 0603119A Project CV5 Engineer Enablers Maneuver, LOG, & Sustainment Adv.			
Accomplishments/Planned Programs Subtotals	2.426	2.195	1.257

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DA1: *SAFR Alternatives for Readiness Applied Research*	-	3.545	5.171	4.025	-	4.025	6.545	6.681	6.808	6.876	0.000	39.651

A. Mission Description and Budget Item Justification

This Project will develop safer alternative technologies that enable Army readiness, support supply chain resilience, improve Soldier and worker safety and reduce environmental impacts, including reduction of greenhouse gas emissions. The Project investigates alternatives for cross-cutting materials, undergoing or threatened by regulatory scrutiny, found in ground vehicles and all other types of Army weapon systems. Research areas of focus include alloys, ceramics, composites, textiles, maintenance fluids, propellants, explosives, and pyrotechnics. This work addresses increasing threats to readiness associated with carcinogenic, toxic, and restricted materials such as lead, beryllium, perchlorates, volatile organic compounds and per- and polyfluoroalkyl substances (PFAS) (forever chemicals), which can diminish Soldier and community health, restrict training and interrupt critical maintenance activities. Future liabilities and risks are characterized early in the life cycle of material development to ensure truly sustainable alternatives. This Project also investigates, develops and designs technologies to allow Soldiers to rapidly prioritize risk for PFAS to enable informed, timely and cost-effective solutions.

This Project complements and transitions technologies to Program Element (PE) 0603119A (Ground Advanced Technology) / Project DA2 (SAFR Alternatives for Readiness Advanced Tech).

Work in this Project is performed by the Army Research Laboratory (ARL); the Armaments Center (AC); the Aviation and Missile Center (AVMC); the Soldier Center (SC); the Ground Vehicle Systems Center (GVSC); and the U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: PFAS Risk Reduction Applied Research *Description:* This effort will design and develop a novel rapid risk characterization framework that will be validated with a rapid fate and transport screen, a breakthrough toxicity screening, and treatment approaches. *FY 2024 Plans:* Will develop a rapid risk prioritization database tool validated with per- and polyfluroroalkyl substance (PFAS) case studies. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding administratively realigned to PE 0602144A (Ground Technology) / Project DI7 (Environmental Security Resilience Tech).	0.729	1.201	-
Title: Safer Alternatives for Readiness (SAFR) Applied Research *Description:* Design and develop novel cross-cutting solutions to eliminate Soldier and worker exposure to airborne lead from energetic materials; efficiently and safely demilitarize materiel; support the next generation of enhanced and sustainable munitions; reduce the use of toxic and hazardous chemicals in cleaners, degreasers, lubricants and fluids to ensure Soldier	2.816	3.970	4.025

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
and ground vehicle readiness; and minimize the life cycle health and safety risks associated with emerging high-performance materials. *FY 2024 Plans:* Will research PFAS-free surface treatment for coatings and textile applications; investigate material alternatives for critical energetic materials; and explore lead-free rocket propellants. *FY 2025 Plans:* Will investigate PFAS-free engineering fluids for energetics formulation; research reduced solvent energetic primer coating formulations; and optimize lead-free energetic primers and initiators. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	3.545	5.171	4.025

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*			**Project (Number/Name)** DG1 *I Development of Obscurants*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DG1: *Development of Obscurants*	-	-	2.774	2.807	-	2.807	2.811	2.813	2.815	2.844	0.000	16.864

A. Mission Description and Budget Item Justification

This project will investigate and evaluate obscurants (i.e., materials) and obscurant technologies that are designed to degrade threat force surveillance sensors and defeat the enemy's target acquisition devices, missile guidance, and directed energy weapons. This project investigates advanced, infra-red, and multi-spectral obscurant materials that will provide effective, safe, and efficient screening of deployed units and platforms.

Work in this project compliments Program Element (PE) 0602144A (Ground Technology) / Project DG2 (Advanced Development of Obscurants).

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

Work in this Project is performed by the Chemical Biological Center (CBC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Obscuration Enabling Technologies	-	2.774	2.807
Description: This effort investigates new materials and compounds to enable safe and effective screening of personnel and equipment across the electromagnetic spectrum. This effort also provides vulnerability assessments against enemy threat targeting systems. ***FY 2024 Plans:*** Will explore medium range obscurant systems and work towards using novel materials to maximize performance; explore the potential of medium range obscurant systems to disseminate counter unmanned aerial obscurant-based materials; provide further enhancement and support for screening and obscuration module systems. ***FY 2025 Plans:*** Will research millimeter wave obscurant materials and dissemination methodologies. Will integrate obscurant material into safe and effective dissemination technology through the Screening and Obscuration Module. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	-	2.774	2.807

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** DG1 *I Development of Obscurants*
C. Other Program Funding Summary ($ in Millions)		
Remarks		
D. Acquisition Strategy N/A		

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*				**Project (Number/Name)** DI7 *I Environmental Security Resilience Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DI7: *Environmental Security Resilience Tech*	-	-	-	6.635	-	6.635	9.514	12.755	10.985	11.361	0.000	51.250

Note

In FY2025, project DI7 / Environmental Security Resilience Tech is a new effort realigned within PE0602144A /Ground Technology from project DA1 / SAFR Alternatives for Readiness Applied Research.

A. Mission Description and Budget Item Justification

This Project will focus on investigating environmental, meteorological and other supply-chain security threats that impact Army operations, personnel, and weapon systems (OPW) as well as operational energy generation and demand reduction to gain environmental security resilience. This Project will provide foundational knowledge of the impact of meteorological and climatological processes to feed decision-makers, in particular, boundary layer and complex terrain atmospheric processes at both meteorological and climatological timeframes.   This Project also investigates and develops capabilities to inform Army Environmental Security Resilience decisions and support tools, providing new information on environmental factors to include emerging contaminates, biotechnology, extreme weather events, and natural stressors which that impact operations or present security concerns. Project capabilities span the functional domains of strategic support area management, emergency preparedness, environmental protections, climate resilience, and analysis of future operational environment and environmental threats. This effort will inform new models and decision support tools which provide actionable information that affect missions to Army installation managers for operational planning and risk management.

Work in this Project complements Program Element (PE) 0603119A (DI8) / Project (Environmental Security Resilience Adv Tech).

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 Army Research Laboratory (ARL); the Engineer Research and Development Center (ERDC) Environmental Laboratory, Construction Research Engineering Laboratory, and the Cold Regions Research and Engineering Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Atmospheric Impacts for Lethality Overmatch	-	-	2.304
Description: This effort conducts Army-centric applied research in atmospheric impacts and effects on DoD systems and operations. Technology development includes decision support systems for mission commanders, ensuring interoperability, and enhancing the ability to conduct air-ground reconnaissance and combined arms maneuver.			
FY 2025 Plans:			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** DI7 *I Environmental Security Resilience Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will conduct field tests using the Distributed Virtual Proving Ground - Multi-Sensor Array in relevant scenarios and conditions to collect and investigate meteorological and other operational data to understand the impact of atmospheric phenomena on energy propagation; develop physical and numerical models that are representative of atmospheric effects; investigate sensing algorithms and strategies informed by atmospheric impacts on multi-modal (acoustic/radio frequency (RF)/optical/electromagnetic (EM)) sensors applicable to detection, localization, and tracking; develop techniques, methods, and models for the characterization of ambient atmospheric and threat aerosols (intentional/unintentional release) exploiting primarily optical techniques. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding restructured from Program Element (PE) 0622144A Ground Technology / Project CG7 (Ground Protection Concepts and Technologies)			
Title: Environmental Security Applied Research - Assessing and Mitigating Climate Risk ***Description:*** This effort conducts Army-focused environmental security applied research and collaborations within climatological time frames, to include dynamics and changes in the atmospheric boundary layer in complex Multi-Domain Operations (MDO) environments (complex terrain and dense urban) with particular emphasis on the atmospheric surface layer and the land-surface processes that effect the environmental state. Technology development includes decision support systems for mission commanders, ensuring interoperability, and enhancing the ability to plan air-ground reconnaissance and combined arms maneuver. ***FY 2025 Plans:*** Will investigate climate relationships between teleconnection patterns (causal connections or correlations between meteorological or other environmental phenomena which occur a long distance apart) and the evapo-transporation cycle (i.e. flash drought) for the purpose of designing computational tools to predict the magnitude and impact of climate change on operations, weapon systems, and personnel. Some examples of impacts include effects on resources in areas the US Army provides stability operations. Resource competition hampered by drought lead to resource competition and conflict vulnerability. Additionally, flash drought affects erosion and dust lofting - particles that significantly effect Directed Energy (DE) weapon system propagation/ operation and Hypersonic operations. Effects on the decision-making process of personnel in drought-stricken areas with increased heat and dust ladened atmosphere also need to be understood. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding restructured from Program Element (PE) 0622144A Ground Technology / Project CG7 (Ground Protection Concepts and Technologies)	-	-	1.915
Title: Interagency Council for the Advancement of Meteorological Services Program	-	-	0.166

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** DI7 *I Environmental Security Resilience Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort supports the Army's collaboration in the Interagency Council for Advancing Meteorological Services (ICAMS), which was chartered in 2020 per the "Weather Research and Forecasting Innovation Act of 2017" (Public Law 115-25, April 18, 2017). *FY 2025 Plans:* Will conduct weather research and forecast innovation based on Army operational environments om coordination with the ICAMS Program. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding restructured from Program Element (PE) 0622144A Ground Technology / Project CG7 (Ground Protection Concepts and Technologies).			
Title: Building Installation Resilience Carbon Sequestration and Reduction *Description:* This effort will develop and provide validated models for carbon accounting across Army natural lands to include the use of those lands. These models will not only provide a baseline of current carbon sequestration, but also provide a means to quantify improvement or changes in sequestration capacity. *FY 2025 Plans:* Will investigate effects of Army training on soil carbon fluxes and identify key ecosystem processes influencing soil carbon fluxes. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.	-	-	1.047
Title: PFAS Risk Reduction Applied Research *Description:* This effort will develop a per- and polyfluorinated substances (PFAS) risk-based decision framework to enable rapid PFAS communication and risk decisions on Army installations. This effort will also establish a communications hub to provide distribution of PFAS decisions to Army installation managers. *FY 2025 Plans:* Will conduct experiments with the initial version of the communication hub and decision framework using mesocosm case studies and will start to develop PFAS small scale computational chemistry models. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding administratively realigned from Program Element (PE) 0622144A Ground Technology / Project DA1 (SAFR Alternatives For Readiness).	-	-	1.203
Accomplishments/Planned Programs Subtotals	-	-	6.635

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602144A *I Ground Technology*	**Project (Number/Name)** DI7 *I Environmental Security Resilience Tech*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army I BA 2: Applied Research						R-1 Program Element (Number/Name) PE 0602145A I Next Generation Combat Vehicle Technology					

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	273.166	166.500	149.108	-	149.108	155.296	154.184	144.152	154.477	0.000	1,196.883
BF3: *Combat Vehicle Robotics Tech*	-	20.332	17.443	18.659	-	18.659	19.393	18.540	16.313	15.968	0.000	126.648
BF6: *Crew Augmentation and Optimization Tech*	-	10.761	11.664	10.890	-	10.890	9.820	10.128	10.237	10.339	0.000	73.839
BF8: *Artificial Intelligence & Machine Learning Tech*	-	19.573	20.329	15.007	-	15.007	15.027	16.642	16.835	17.212	0.000	120.625
BF9: *Sensors for Autonomous Operations and Surv Tech*	-	22.666	25.327	24.772	-	24.772	24.939	25.689	25.969	26.229	0.000	175.591
BG2: *Modeling and Simulation for MUMT Technology*	-	5.591	5.526	4.142	-	4.142	3.851	3.988	3.649	5.286	0.000	32.033
BG6: *Advanced Concepts for Active Defense Technology*	-	33.399	32.668	30.206	-	30.206	34.367	33.620	24.762	28.748	0.000	217.770
BG8: *Obscuration Technology*	-	2.722	-	-	-	-	-	-	-	-	0.000	2.722
BH5: *Platform Electrification and Mobility Tech*	-	14.206	13.763	15.160	-	15.160	18.885	15.544	14.426	14.570	0.000	106.554
BI2: *Sensor Protection Technology*	-	6.100	5.532	5.782	-	5.782	7.295	7.749	7.834	7.912	0.000	48.204
BI4: *Materials Application and Integration Tech*	-	7.651	7.505	-	-	-	-	-	-	-	0.000	15.156
BJ2: *Tactical and Navigation Lasers Sensors Technology*	-	5.596	5.790	5.863	-	5.863	5.865	5.868	5.933	5.992	0.000	40.907
BK2: *Virtual Prototyping Technology*	-	7.022	9.910	7.042	-	7.042	7.255	8.063	8.070	8.135	0.000	55.497
BK5: *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*	-	13.054	11.043	11.585	-	11.585	8.599	8.353	10.124	14.086	0.000	76.844
BP5: *Ground Vehicle Technology (CA)*	-	103.500	-	-	-	-	-	-	-	-	0.000	103.500

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*						**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*					
CU5: *Platform Agnostic Armaments Applied Technology*	-	0.993	-	-	-	-	-	-	-	-	0.000	0.993

A. Mission Description and Budget Item Justification

This Program element (PE) line is directly aligned to the Next Generation Combat Vehicle (NGCV) Army Modernization Priority. This PE researches, designs, and evaluates combat vehicle technologies that enable the Army to have a smarter, faster, more lethal, more precise, more protected, and more adaptable force. The focus is on building 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. The research conducted will provide technologies to 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 0602146A (Network C3I Technology), PE 0603116A (Lethality Advanced Technology), PE 0603119A (Ground Advanced Technology), PE 0603462A (Next Generation Combat Vehicle Advanced Technology), and PE 0603463A (Network C3I Advanced Technology).

Work in this PE will transition to PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Priority focus areas.

Work is performed by the Ground Vehicle System Center (GVSC); the Army Research Laboratory (ARL); the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center; the Geotechnical and Structures Laboratory; the Data and Analysis Center (DAC); and the Armaments Center (AC).

Overseas Operations Costs (OOC) funds this requirement in the amount of $1,041 thousand for FY 2025 Budget Estimate. Overseas Operations Costs (OOC) are those financed with former Overseas Contingency Operations (OCO) funding.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*		

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	277.445	166.500	166.523	-	166.523
Current President's Budget	273.166	166.500	149.108	-	149.108
Total Adjustments	-4.279	0.000	-17.415	-	-17.415
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-2.598	-			
• SBIR/STTR Transfer	-1.681	-			
• Adjustments to Budget Years	-	-	-17.415	-	-17.415

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BP5: *Ground Vehicle Technology (CA)*		
Congressional Add: *Program Increase - Silicon Carbide Electronics*	6.000	-
Congressional Add: *Program Increase - Highly Electrified Vehicles*	3.000	-
Congressional Add: *Program Increase - Prototyping Energy Smart Autonomous Ground Systems*	10.000	-
Congressional Add: *Advanced Materials Development for Survivability*	10.000	-
Congressional Add: *Program Increase - Digital Design and Simulated Testing*	5.000	-
Congressional Add: *Program Increase - Fast-Refueling Fuel Cell Engines*	7.000	-
Congressional Add: *Program Increase - Hydrogen Technologies*	15.000	-
Congressional Add: *Program Increase - Machine Learning Optimized Power Electronics*	3.000	-
Congressional Add: *Program Increase - Zero Emission Combat Vehicles*	3.000	-
Congressional Add: *Program Increase - ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT*	2.000	-
Congressional Add: *Program Increase - ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT*	8.000	-
Congressional Add: *Program Increase - MOBILITY MATERIALS RESEARCH*	5.000	-
Congressional Add: *Program Increase - MODULAR ELECTRIC MOTORS*	5.500	-
Congressional Add: *Program Increase - SMALL UNIT TECHNOLOGY ADVANCEMENTS*	10.000	-
Congressional Add: *Program Increase - SOLID OXIDE FUEL CELL DEVELOPMENT*	5.000	-

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Congressional Add: *Program Increase - STRUCTURAL THERMOPLASTICS*	6.000	-
Congressional Add Subtotals for Project: BP5	103.500	-
Congressional Add Totals for all Projects	103.500	-

Change Summary Explanation

Funding realigned to PE0602146A/ Network C3I Technology, Project AO4/Energy Efficient Devices and 0602150A/Air and Missile Defense Technology, Project SU1/Counter Small Unmanned Aircraft System.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BF3 / *Combat Vehicle Robotics Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BF3: *Combat Vehicle Robotics Tech*	-	20.332	17.443	18.659	-	18.659	19.393	18.540	16.313	15.968	0.000	126.648

A. Mission Description and Budget Item Justification

This Project designs, develops, and evaluates a variety of innovative 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.). This Project focus areas include autonomous architecture, autonomous behaviors and perception, and soldier machine Interface. Autonomous Behaviors efforts focus on enhancing the performance of autonomy such as obstacle detection and avoidance. Soldier Machine interface efforts focus on design and development of technologies to become more efficient and effective for a robotic operator to complete missions on government owned Warfighter Machine Interface (WMI) software.

This work is done in coordination with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics).

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

Work in this Project is performed by Ground Vehicle System Center (GVSC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Autonomous Behaviors and Perception	13.034	9.827	10.886
Description: This effort contributes to the NGCV Robotic Autonomous Strategy (RAS) to advance the mobility performance of autonomous systems within complex environments/ operations to allow for the completion of mission goals in separate and teaming configurations at varying levels of autonomy. *FY 2024 Plans:* Will develop and validate complex obstacle detection and obstacle avoidance at operationally relevant speeds and over rough terrain, enabling autonomous vehicles to successfully navigate in unstructured environments. Further develop, validate, and certify the object classification and scene understanding created in FY 2023, resulting in a matured framework for customized and trusted reactions to specific situations. Will investigate teaming and tactical behaviors for multi-vehicle goal negotiation, using the enhanced scene understanding from FY 2023 with a focus on human-understandable autonomy within the Army's Robotic Technology Kernel (RTK) autonomy stack (system). Will develop methods for using map data merged with current sensor data to increase situational awareness and conduct reconnaissance maneuvers with an emphasis on autonomous implementation and tools. Will continue to mature the Autonomous Ground Vehicle Reference Architecture (AGVRA) framework by building additional large and small team mission models and task decomposition within the operational reference models. Will mature ground vehicle			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF3 *I Combat Vehicle Robotics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
robotics architecture and associated model profile, library, and views, advancing current technologies within a model-based systems engineering environment. Will continue to develop interface model definition and tools to facilitate model integration. Will continue to develop and mature the Robot Operating System - Military (ROS-M) to support the ability to register and distribute concepts, specifications, requirements, standards and architectures, in addition to autonomous software solutions and supporting tools. *FY 2025 Plans:* Will research adaptable motion control, enabling autonomous vehicles to respond to changes in the operating environment and mission context. Will research frameworks to enable behavior switching and mobility adjustment based on terrain awareness, sensing, and object classification. Will investigate passive perception techniques to supplement or replace light detection and ranging (LIDAR) as the perception capability for the RTK to reduce the detectability of the system during operations. Will research methods for a-priori map ingestion to enable better path planning in complex environments. Mature the commercial Robotic Operating System (ROS)-2 standard for components of RTK. Will continue to research and validate complex obstacle detection and avoidance at operationally relevant speeds and over rough terrain, started in FY 2024. Mature the Autonomous Ground Vehicle Reference Architecture (AGVRA) framework by developing mission models and associated test plan models to support engineering evaluation tests (EETs). Will mature and advance the robotics and autonomous architecture and associated digital engineering model profile, library and views advancing current technologies within a model-based systems engineering (MBSE) environment. Will develop interface model definition and tools to facilitate digital engineering model integration. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned milestones for development of advanced manned-unmanned teaming and includes advancements in degraded environments.			
Title: Human Robotic Interaction *Description:* This effort contributes to the Next Generation Combat Vehicle Robotic Autonomous Strategy (NGCV RAS) to implement a focused approach to deliver optimized unmanned system and manned-unmanned system performance through reduced cognitive burden for the Soldier while maintaining real-time unmanned system status/activity, overall mission effectiveness, and predictive capability of the system's intended activity. *FY 2024 Plans:* Will continue to design robotic warfighter machine interface (WMI) technologies to become more efficient and effective for a robotic operator to demonstrate the ability to complete mission in a combat scenario. Will continue to investigate improved language control with tactical commands for robotic operations to bring a more natural implementation of teaming within a command and control scenario, improving mission time and overall mission success. Will investigate improved methodologies	5.296	3.423	3.965

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army				Date: March 2024	
Appropriation/Budget Activity 2040 / 2		R-1 Program Element (Number/Name) PE 0602145A / *Next Generation Combat Vehicle Technology*		Project (Number/Name) BF3 / *Combat Vehicle Robotics Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
to express autonomy systems' decision process and intent to the operator. Will investigate ways for the operator to influence autonomous decisions through the WMI tools. *FY 2025 Plans:* Will design more efficient and effective robotic warfighter machine interface (WMI) technologies for a robotic operator to demonstrate the ability to complete missions in a combat scenario. Will investigate improvements of data fusion across multi-asset formations with routes, multi-phase mission plans and natural language processing. Will investigate ways for the operator to influence autonomous decisions through the WMI tools. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding is increased in FY 2025 for Human Robotic Interaction to enable new technologies anticipated within industry, academia and other government agencies.			
Title: M&S for Autonomy Enabled Ground Systems *Description:* This effort contributes to the NGCV RAS program by designing and developing modeling and simulation (M&S) tools for the development and evaluation of autonomy technologies. The effort designs and develops tools necessary to virtually evaluate Combat Vehicle Robotics (CoVeR) program autonomy algorithms. . The capabilities and contents of the M&S tools will emulate the CoVeR Engineering Evaluation Test (EET) events conducted in PE 0603462A (Next Generation Ground Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics Adv Tech) and allowing these tools to scale on other Army and Department of Defense compute platforms. *FY 2024 Plans:* Will enhance and develop Robotic Technology Kernel (RTK), Robotic Vehicle Integration and Safety (RVIS) and Warfighter Machine Interface (WMI) M&S started in FY 2023. Will use M&S to ensure readiness of the various technologies to be incorporated in the FY 2025 EET. *FY 2025 Plans:* Will mature CoVeR M&S capability through targeted model developments in line with autonomous capability increments supporting CoVeR evaluations, specifically the FY 2026 virtual EET. Will enhance the architecture to maintain stable integration and interoperability with updated releases of CoVeR technologies to include the RTK, Robotic Vehicle Integration and Safety (RVIS) and Warfighter Machine Interface (WMI). Will develop M&S models focusing on real-time improved sensors, vehicle dynamics, and communications enabling autonomy development. Will develop simulations focusing on CoVeR platforms operating in off-road terrain and operational mission scenarios to stimulate robotic and autonomous capabilities in the FY 2026 EET. Will validate technologies through a virtual EET to assess technology readiness prior to participation in the EET. *FY 2024 to FY 2025 Increase/Decrease Statement:*	2.002	2.081	2.095

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF3 *I Combat Vehicle Robotics Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase is an economic adjustment.			
Title: Small Unmanned Ground Vehicle (UGV) as Deployable Sensor	-	2.112	1.713
Description: This effort advances teaming between autonomous small Unmanned Ground Vehicles (UGVs) and Next Generation Combat Vehicles (NGCV) to execute collaborative mission tasks in support of reconnaissance and clearing missions. ***FY 2024 Plans:*** Will continue to develop and further advance autonomous behaviors to enable small robot autonomy teaming with NGCV systems. Will update and expand the task-distribution architecture as well as autonomy behaviors to optimize small UGVs and NGCV teaming in support of mission tasks such as route and area reconnaissance, Listening Post/Observation Post (LP/OP), and clearing missions. In addition, the effort will advance Artificial Intelligence (AI) enabled sensing and communication Modular Mission Payloads (MMPs) to support the mission tasks. Will validate these enhancements through Engineering Evaluation Testing (EET) to ensure the autonomy teaming technology and integrated MMPs are fully evaluated for performance and safety. ***FY 2025 Plans:*** Will design and develop behaviors for unmanned systems with emphasis on quadruped (legged) robots for increased to evaluate reconnaissance applications in rough terrain. Will design and develop an optimized system control architecture to overcome size, weight, and power (SWaP) limitations of small unmanned platforms enabled with sensors to perform complex and long duration mission tasks. Will further research and develop supporting autonomous behaviors identified during previous EETs. Will validate newly developed enhancements to autonomous teaming, AI-enabled sensing, and Modular Mission Payloads (MMPs) through EETs to evaluate performance and system safety. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding is decreased in FY25 due to transition of mature technologies to PE 0603462A/BF4 Combat Vehicle Robotics Advanced Tech.			
Accomplishments/Planned Programs Subtotals	20.332	17.443	18.659

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*						**Project (Number/Name)** BF6 *I Crew Augmentation and Optimization Tech*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BF6: *Crew Augmentation and Optimization Tech*	-	10.761	11.664	10.890	-	10.890	9.820	10.128	10.237	10.339	0.000	73.839

A. Mission Description and Budget Item Justification

This Project designs capabilities for reduced vehicle crew sizes to successfully operate a larger number of closed-hatch manned and remote unmanned vehicles in a complex multi-domain operations environment. This Project will enable future crews to perform missions with increasingly sophisticated technologies, and in increasingly complex, dynamic socio-technical environments. The applied research will provide the fundamental technologies to enable integrated performance improved learning - Warfighter Machine Interfaces (WMIs) that are scalable to multiple crew hardware and functional configurations; reconfigurable frameworks and simulation for concept experimentation and exploration; and team-centered dynamic tasking by machine intelligence to effectively utilize full capabilities of crew and technologies. The research will generate Soldier-informed data, reports, and analysis to support operational use in future vehicles through Soldier experimentation and assessment of technical concepts in simulation and in-field WMIs. The capabilities created by this research will increase overall crew and team performance; improved Soldier safety due to fewer Soldier per vehicle, closed-hatch operations, and improved standoff from effective control; and vehicles that can effectively conduct multiple domain operations.

Work in this Project complements Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) and PE 0602143A (Soldier Lethality Technology).

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC) and Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Crew Capability Enhancement	3.397	3.447	2.668
Description: This effort focuses on the dynamic interaction of Soldiers, responsible for both manned and unmanned ground vehicles, working together within a platoon formation. The project funds research on the simultaneous use of multiple technologies by Soldiers including transparent multi-modal user interfaces, commander's tools for maintaining and enhancing situation awareness, decision aids for enabling dynamic resource allocation and orchestration, and tools to interact with and adapt vehicle based autonomy. Products will include artificial intelligence algorithms, information display technologies, and team-centric design principles.			
FY 2024 Plans:			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 *I Crew Augmentation and Optimization Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will design and implement a component-level Warfighter-Machine Interface-embedded capability allowing autonomous systems to learn from multiple forms of Soldier interaction; implement automatic team re-tasking components for dynamic task allocation based on operator workload, mission, or personalization. *FY 2025 Plans:* Will research autonomous systems capabilities to learn from in Soldier behavior observed during the conduct of a mission; develop algorithms to dynamically allocate tasks between Soldiers and autonomous systems during missions based on communication and sensing of Soldier behavior and workload. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Title: Characterize Soldier-Adaptive AI Interactions *Description:* This effort develops approaches for characterizing Soldier interactions and overall human-system performance of mixed Soldier and intelligent-agent teams to enable robust human system performance for manned and unmanned teams. This effort will focus on flexible, tailorable methodologies for laboratory-grade, high-resolution characterization of Soldier and Artificial Intelligence (AI) enabled intelligent-agent adaption in complex environments. *FY 2024 Plans:* Will develop and implement Next Generation Combat Vehicle (NGCV) Dashboard tool for subject matter experts to conduct performance assessments of Soldier-Autonomous System Teams using data collected during the mission; augment visualizations of dynamic systems-based measures of crew-autonomous system effectiveness with subject matter expert-derived labels to improve observer understanding of team states; conduct experiments on intelligent signal management techniques to improve predictive model accuracy. *FY 2025 Plans:* Will conduct experiments to determine the effectiveness of Next Generation Combat Vehicle (NGCV) Dashboard tool for assessing and improving Soldier-Autonomy team performance; investigate initial data management and evaluate autonomous system interventions associated with increased Soldier span of control. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	2.569	2.608	2.626
Title: Human Augmentation for Collective Training *Description:* This effort investigates assessment techniques of crew performance to inform the development of individual and collective training for military vehicles. Assessment techniques will be applicable across a variety of vehicle platforms, training tasks and vehicle crew roles. This effort will support training and increased force readiness of vehicle crews in complex	1.890	1.918	1.932

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 *I Crew Augmentation and Optimization Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
environments by developing accurate and efficient performance assessment techniques evaluated in complex Operational Environments (OE) enabled by the latest advances in simulation and training technology. *FY 2024 Plans:* Will mature subcomponents of an embedded training architecture to facilitate crew-to-section training and conduct software validation experiments for whole system performance within applicable simulation or platform environments; conduct experiments to determine ground platform operator roles supported by the embedded training architecture, training modes for effective instruction within or outside the immersive training environment, and continued functional architecture development which will enable manned-unmanned platform teaming concepts; investigate digital terrain considerations pertinent to effective team training and operation of robotics or autonomous systems. *FY 2025 Plans:* Will design and develop embedded training architectural subcomponents for crew and collective operation of Next Generation Combat Vehicle (NGCV) platforms; conduct experiments to determine multi-modal interface considerations for task training, investigate adaptive training modes for effective machine learning and retention, explore simulated and simulation environment conditions required for embedded training to support full spectrum embedded training. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Platoon Teaming Capability	2.905	3.691	-
Description: This effort focuses on the design, development and validation of intelligent, real-time, within-vehicle task management; data-driven allocation of situational awareness (SA) across platforms within the platoon; coordinated platoon-level manned-unmanned teaming (MUM-T) semi-autonomous maneuver with complex formations; and on-the-fly, platoon-level task optimization. This effort includes WMI modification to conduct experiments with these capabilities in application of intelligent task management and data-driven prediction of crew to support changing mission goals. *FY 2024 Plans:* Will further develop, integrate at system level, and validate intelligent technology aids and embedded training software to increase platoon-level crew situational awareness and enable soldier adaptation of autonomous systems; integrate software algorithms at system level and validate approaches to automatically re-task critical tasks based on workload, mission requirements and operator strengths/weaknesses, across a mixed manned-unmanned platoon-level formation. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort in FY24.			
Title: Crew Interaction Interfaces and Technologies	-	-	3.664

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF6 *I Crew Augmentation and Optimization Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort focuses on the design and development of crew interaction interfaces and intelligent technologies. It includes Warfighter Machine Interface modification to improve cross-platform situational awareness and enables real-time, data-driven prediction of the crew to support changing mission goals. *FY 2025 Plans:* Will design and evaluate crew interaction interfaces, crew augmentation and embedded training technologies, and optimize these hardware and software interfaces based on warfighter feedback and performance data; improve Warfighter Machine Interface to refine cross-platform situational awareness and enable data-driven augmentation to optimize crew task loading during multiple mission scenarios. *FY 2024 to FY 2025 Increase/Decrease Statement:* Increase reflects the initiation of design and development of crew interaction interfaces and intelligent technologies efforts.			
Accomplishments/Planned Programs Subtotals	10.761	11.664	10.890

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 *I Artificial Intelligence & Machine Learning Tech*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BF8: *Artificial Intelligence & Machine Learning Tech*	-	19.573	20.329	15.007	-	15.007	15.027	16.642	16.835	17.212	0.000	120.625

A. Mission Description and Budget Item Justification

This Project develops and characterizes artificial intelligence and machine learning software and algorithms to team with soldiers in support of fully autonomous maneuver of the Next Generation Combat Vehicle (NGCV) and other autonomous systems, both physical and non-embodied. Efforts develop capabilities for NGCV and other autonomous agents that increase autonomy, unburdening the soldier operator, with a high degree of survivability and lethality in a highly contested environment. This work also investigates power distribution and conversion technologies to provide compact, efficient, and high-power capabilities for electrical and electro-mechanical loads supporting both mobile and stationary unmanned platforms. Research enables combat vehicles to rapidly learn, adapt, and reason faster than the adversary; accomplish missions in contested, austere and congested environments, characterized by lack of structure, adversarial actions, and minimal a priori knowledge; and provide force reduction through self-learning vehicles that can operate in complex militarily relevant environments. This Project also matures emerging research leading to potential technology development in areas of strategic importance to the Army by bringing competitively selected Universities with research teams into Technical Alliances.

Work in this Project is done in coordination with PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF7 (Crew Augmentation and Optimization Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Scalable, Adaptive, and Resilient Autonomous Systems	8.066	8.484	5.590
Description: This effort develops emerging research in Autonomous Vehicle intelligence and decision making, human agent teaming, scalable and collaborative behaviors, embodied and embedded intelligence, and autonomous operations for next generation Army platforms in dynamic Army relevant environments, architectures, and missions. Specific focus will be on the application of Artificial Intelligence/Machine Learning (AI/ML) to autonomous systems and human-intelligent agent teaming; scalable and collaborative behaviors in support of heterogeneous air and ground manned-unmanned teaming (MUM-T) operations; methods for embodied and embedded intelligence for increased understanding, manipulation, and reflexive maneuver through and interaction with dynamic environments; techniques for improved perception, decision making, and adaptive behaviors in contested environments for MUM-T; and new methods for testing and evaluating emerging technologies for intelligent and autonomous systems under Army relevant constraints and environments and in Army relevant architectures.			

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2024 Plans: Will design and develop methods to rapidly identify and adapt on the fly to changing ground vehicle terrain; create methods and techniques that allow for longer-duration ground vehicle autonomy, measured by time between human interventions; conduct experiments to increase operational speed and mission distances in complex terrain; continue to identify methods to integrate terrain awareness and platform capability into tactical decision-making process; validate methods to advance cooperation with multiple air and/or ground autonomous systems for improved vehicle perception, learning, reasoning, navigation and physical maneuver in complex terrain. *FY 2025 Plans:* Will explore methods to incorporate human-guided input and learning methods into real-time task adaptation and shifts in autonomous behaviors; investigate approaches for scaling and increasing mission complexity for heterogenous air and ground robot teaming; develop methods and applications to increase small unmanned systems ability to traverse complex and varying terrains. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects the support of a higher priority artificial intelligence effort being executed by the Army Futures Command Artificial Intelligence Integration Center (AI2C).			
Title: Context-Based Information Dynamics *Description:* This effort investigates techniques that integrate on-board and external information sources, and it applies ML analytic approaches to support automated intelligence analysis and decision making. The goal is to enable tactical agents to cooperatively share relevant and timely tactical information within a distributed environment. *FY 2024 Plans:* Will develop computer vision algorithms that can provide enhanced estimates of objects of relevance when operating with limited or missing information; investigate rule-based and machine learning approaches for intelligent systems that interpret multisource information to infer meaning, create shared understanding, and support decision-making; define inferencing algorithms to derive context from multi-modal multi-source information for automated decision-making and course of action generation. *FY 2025 Plans:* Will validate enhanced object estimation algorithms and automated autonomous maneuver reasoning tools; investigate algorithms and machine learning approaches to enable autonomous systems to collaborate through context-informed dialogue; investigate limited set of computational linguistics-based semantic approaches to augment deep learning language models. *FY 2024 to FY 2025 Increase/Decrease Statement:*	2.561	2.640	1.056

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects partial realignment to Program Element (PE) 0602146A (Network C3I Technology) / Project AO4 (Energy Efficient Devices Technology) to develop machine processing capabilities for AI-enabled systems.			
Title: Heterogeneous Computing and Computational Sciences *Description:* This effort funds research to develop algorithms and architectures that allow adaptable, energy efficient information processing across different computing hardware platforms. The goal of this research is to provide high performance computing and processing capabilities to the Soldier on the battlefield. *FY 2024 Plans:* Will explore automated data and model optimization and reduction methods for advanced intelligence, surveillance, reconnaissance (ISR) algorithms to be executed on low size, weight, and power (SWaP) computing devices; investigate combined optimization of heterogeneous datasets and measure performance and increase efficiency through implementing scalable task scheduling methods on networked edge devices; develop methods that are applied in centralized, distributed, and decentralized agent environments and schedule routines to enable processing in tactical environments and under associated constraints. *FY 2025 Plans:* Will investigate scalable computing methods for complex inference tasks and methods for model partitioning; explore novel strategies for adaptive and efficient execution of analytic models in extremely resource constrained, heterogenous environments; investigate methods to optimize analytic performance and accuracy. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.	1.888	1.943	1.055
Title: Machine Learning with Constrained Resources *Description:* This effort will research new ML and reinforcement learning methods to address issues of statistically mismatched and incomplete information which must be annotated, collected, classified, and used for rapid decisions by joint intelligent agent-Human teams. In addition, multi-modal human interaction approaches will be investigated to ensure effective Soldier interactions and understanding of intent. The goal of this research is to enable joint human-intelligent agent decision making, optimizing the strengths of each in the decision process and creating an adaptive, agile team. This work applies research conducted in PE 0611102A (Defense Research Sciences) / AA6 (Robotics and Mobile Energy) and AA9 (Information and Networking). *FY 2024 Plans:* Will conduct experiments to assess the ability of novel navigation techniques to effectively plan routes in environments that include partially observable elements, such as obscured terrain features; investigate rule-based algorithms and data-driven machine learning methods for interpreting multi-source information to capture meaning, support cross-domain event detection, and enable effective automated text generation for knowledge and information management tasks; investigate computer vision	4.434	4.570	4.602

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
algorithm and machine learning methods that can quantify uncertainty, rank, and prioritize visual information in ways that are consistent with human judgment; develop computational models of human behavior to predict soldier attention and biases in different contexts, detect camouflaged, obscured, or non-obvious objects, and detect rare and novel cases using contextual information. *FY 2025 Plans:* Will assess ground vehicle autonomy performance using modular navigation, perception, and state estimation; mature autonomous navigation components to sustain performance while adapting to environmental features optimize and assess route planning capability for autonomous systems in partially obscured complex environments; validate simulation-based coordination techniques for multiple autonomous systems using research platforms; investigate automated extraction of full scene information based on autonomous system sensor data; experiment with automated optimization methods for perception algorithms under constraints including network bandwidth, computer memory, and compute capacity; develop inference algorithms for artificial reasoning systems for automated decision making and course of action recommendations for autonomous maneuver; develop fundamental methods for enhanced deep learning language models to create intelligent systems with increased effectiveness; investigate computational models to detect camouflaged, obscured, or non-obvious objects, and detect rare and novel conditions using contextual information from sensor fusion. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Intelligence for High Operational Tempo Maneuver *Description:* Applied research on intelligence for cognitive learning and control architectures to enable efficient and full use of embodied physical capabilities and create the machine intelligence required of autonomous systems to understand physical limitations. Investigates the means through which robotic physical performance attributes (e.g. speed, agility) will be coupled with artificial intelligence to enable resilient maneuver in high operational tempo missions in complex environments. *FY 2024 Plans:* Will continue to explore how novel models and algorithms function with design features of biologically inspired robotics to advance the efficiency of maneuver over or through complex terrain at high operational tempos; mature architectures and models that provide predictable performance appropriate for tactical multi-agent teaming. *FY 2025 Plans:* Will continue to investigate novel models, artificial intelligence algorithms, and architectures that enable autonomous systems to operate at operationally relevant speeds and agility; conduct research focused on increasing complexity for autonomous	1.603	1.652	1.663

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF8 *I Artificial Intelligence & Machine Learning Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
navigation and planning related to natural environmental conditions such as dust, snow, and rain; develop performance prediction models for autonomous systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Operational Assessment of Artificial Intelligence Developmental Systems **Description:** This effort supports the Combatant Commander's needs by performing operational assessments of AI-intense developmental weapon systems. ***FY 2024 Plans:*** Will continue to optimize results from ongoing studies to support Combatant Commander identified needs. ***FY 2025 Plans:*** Will continue to optimize results from ongoing studies to support Combatant Commander identified needs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	1.021	1.040	1.041
Accomplishments/Planned Programs Subtotals	19.573	20.329	15.007

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BF9 *I Sensors for Autonomous Operations and Surv Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BF9: *Sensors for Autonomous Operations and Surv Tech*	-	22.666	25.327	24.772	-	24.772	24.939	25.689	25.969	26.229	0.000	175.591

A. Mission Description and Budget Item Justification

This Project designs and develops modular and adaptive sensor components, novel embedded processing approaches, innovative threat cueing solutions and novel multi-function sensor payloads integrated with novel signal image processing techniques tools to provide improved manned and unmanned ground vehicle situational understanding that enables aided target recognition (AiTR) and autonomous navigation in all environments.

This research is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology), 0603118A (Soldier Lethality Advanced Technology), 0602143A (Soldier Lethality Technology), 0602148A (Future Vertical Lift Technology) and 0603465A (Future Vertical Lift Advanced Technology).

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

Work in this Project is performed by the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Sensors with Embedded Processing	17.991	16.339	16.325
Description: Designs and develops advanced, automated multi-spectral and multi-function sensor components, and image processing techniques with improved performance in all environments and against all threats to include low-contrast targets in camouflage or in degraded conditions to enable combined arms maneuvers in complex environments for NGCV via manned, optionally manned, and robotic platform applications.			

FY 2024 Plans:
Will validate feasibility of on-chip compression capabilities on digital readout integrate circuits (DROICs) to enable lower data rates for high-resolution sensing, enabling more information content for down-stream processors; design and develop DROIC architectures for uncooled longwave infrared (LWIR) microbolometer detectors at new, smaller pixel pitches to enable size, weight, power, and cost (SWAP-C) and resolution improvements; continue developing cooled DROICs for integration with avalanche photodiode (APD) detectors at smaller pixel pitches for increased resolution to enable covert threat and target ranging; begin development of an extensible core software module, using a selected reasoning approach, to fuse contextual scene information or additional metadata to reduce false alarms of transitioned target detection algorithms; mature targeting and navigation sensors capable of operating on-the-move while providing far-target location and target tracking; mature and demonstrate modular sensor assemblies optimized for use in detection of threats at increased ranges; begin design of at-sensor processing hardware components to improve performance and SWAP-C of image processing and inferencing; investigate whether emerging

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 *I Sensors for Autonomous Operations and Surv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
neuromorphic processing architectures could be utilized to enable more complex processing at the sensor; determine how on-sensor processing can best conform with Modular Open System Approaches (MOSA) to reduce lifecycle costs. ***FY 2025 Plans:*** Will develop dual-band, high dynamic range digital readout integrate circuits (DROICs) with enhanced sensitivity at smaller semiconductor foundry processing nodes that contain standardized control and output formats for all-digital sensor system solutions; continue to develop full resolution cooled DROICs for integration with avalanche photodiode (APD) detectors at smaller pixel pitches (size), capable of enhanced sensitivity at faster frame rates to enable covert target geo-location capabilities. Will validate preliminary design and mature a detailed design of at-sensor processing hardware components to improve performance and size, weight, power, and cost (SWAP-C) of image processing for Army sensor applications. Will investigate board-level Modular Open System Approaches (MOSA) configurations for the advanced processing components to enable more complex processing at the sensor. Will investigate suitability of other emerging commercial processing technologies for low-SWAP-C sensors. Will validate a reasoning software module using scene information and meta-data to reduce high-confidence false alarms. Will mature the reasoning software module framework and hardware components, ensuring compliance with a transitioning Aided Target Detection and Recognition (AiTDR) Interface Control Document (ICD). Will develop additional capabilities for the reasoning software module that enhance target confidence and battlefield context using external sources of data or meta-data (e.g., blue force tracking). Will design and develop mid-wavelength infrared (MWIR) capable microbolometer sensor hardware through semiconductor processes for hostile fire detection. Will investigate pixel size, resolution, noise parameters, and thermal time constant specifications in MWIR and long-wavelength infrared (LWIR) microbolometer sensors for counter-unmanned aircraft systems (C-UAS) applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Multi-Mission Payload ***Description:*** Description: Investigates, designs and develops sensor payloads for ground vehicle based unmanned aerial system to detect line of sight, and beyond line of sight threats and complex obstacles such as personnel and vehicles in all environments.	2.403	-	-
Title: Automated Threat Cueing ***Description:*** Investigates, matures and validates novel image processing and threat recognition and detection methods to enable automated search and detection of open and concealed threats for cueing and target hand-off to maintain overmatch via speed in cluttered environments.	2.272	-	-
Title: Sensors, Electronics and Processing Approaches for Threat Overmatch	-	8.988	8.447

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 *I Sensors for Autonomous Operations and Surv Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort design, develops, matures and validates novel electro-optic/infrared (EO/IR), radar and other sensor components, sensor payloads and image processing approaches to enable enhanced detection of line of sight and beyond line-of-sight threats and complex obstacles in all environments via manned, optionally manned and robotic platforms. It will enable cueing and target hand-off to maintain overmatch while on-the-move, at speed, in cluttered environments. *FY 2024 Plans:* Will complete validation of sensor performance and exploitable target signatures to improve target detection performance in adverse conditions; complete experiments and validate the use of polarized electro-optic/infrared (EO/IR) sensors to suppress clutter and improve detection performance across environments, times-of-day/night, weather conditions, and targets; investigate and mature small form-factor multispectral sensors and assess performance improvements for targets obscured by vegetation or camouflage; complete data collections and an assessment of the effectiveness of using high resolution polarized sensor components for dismounted soldier and unmanned aerial system (UAS) applications to reduce the effects of clutter while providing a wider field of view, improved ability to detect smaller targets, and at greater range; investigate and mature approaches and processing techniques to exploit scene features and target signatures to enable improved detection of targets in varying environmental conditions using concealment penetrating radar; validate processing approaches and methods using additional data from multispectral and high definition polarized EO/IR sensor components and position sensing information to improve target detection and tracking from a moving platform; validate image formation and processing techniques to help assess target detection performance using compact ground and concealment radar antennas mounted on a small UAS. *FY 2025 Plans:* Will conduct experiments using multiple sensor modalities to support the development and training of algorithms to improve automated threat detection. Will investigate and develop new processing approaches and methods using location and position data from multi-spectral and high definition polarized EO/IR sensor components to improve target detection and location accuracy from an unmanned aerial system (UAS). Will develop new image formation and processing techniques to improve target detection performance using radar antennas mounted on a small UAS. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	22.666	25.327	24.772

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BF9 *I Sensors for Autonomous Operations and Surv Tech*

D. Acquisition Strategy
 N/A

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| **Appropriation/Budget Activity**
2040 *I* 2 | | | | | **R-1 Program Element (Number/Name)**
PE 0602145A *I Next Generation Combat Vehicle Technology* | | | **Project (Number/Name)**
BG2 *I Modeling and Simulation for MUMT Technology* | | | |

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BG2: *Modeling and Simulation for MUMT Technology*	-	5.591	5.526	4.142	-	4.142	3.851	3.988	3.649	5.286	0.000	32.033

A. Mission Description and Budget Item Justification

This Project develops Modeling and Simulation (M&S) tools and technologies to assess and improve freedom of movement for ground forces and supports vehicle developers by addressing challenges for robotic and ground vehicles. Through investigation and design, this project develops obstacle detection and classification algorithms for dynamic mobility hazards in urban and complex environments. This project develops tools to evaluate system performance reducing the need for physical testing including: real-time mobility decision support tools, vehicle-terrain interactive 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 in a wide variety of weather and terrain conditions. These M&S technologies can be integrated across Army vehicle platforms as required.

Work in this Project complements Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BG3 (Modeling and Simulation for MUMT Advanced Tech).

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

Work in this Project is performed by the Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Simulation Tools for Combat Vehicle Robotics (CoVeR) *Description:* This effort develops M&S capabilities to evaluate hardware and software technologies enabling battlefield autonomy in complex environments and adaptive learning algorithms for predicting mobility performance in challenging environments.	3.345	-	-
Title: Autonomous Vehicle/Terrain Interactions *Description:* This effort develops Modeling and Simulation (M&S) capabilities to evaluate autonomous vehicle formation performance on mission-relevant terrain and environments (i.e., soft soil, gap crossing, obstacle override, cold regions, low-light, etc.). This effort develops algorithms for improved manned/unmanned and air/ground teaming for off-road tactical behaviors. *FY 2024 Plans:* Will develop advanced vehicle terrain interface for vehicle platforms operating in highly altered terrain and enhance Virtual Autonomous Navigation Environment (VANE) M&S tool for evaluating ground vehicle formations in various operational	2.246	5.526	4.142

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG2 *I Modeling and Simulation for MUMT Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
environments, such as degraded sensor performance environments. Will develop methods to support the identification of vulnerabilities directly related to vehicle maneuver in various operational environments. ***FY 2025 Plans:*** Will develop physics-based environment modeling capabilities to support autonomy performance evaluations and predictions in low-light emission and nighttime environments. Will mature advanced M&S tools for evaluating ground vehicle formations and human / machine interactions in complex operational environments. Will mature advanced vehicle-terrain interface algorithms to support mobility performance evaluations and predictions of ground vehicle systems operating in cold weather environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects the planned completion of work for this effort as technologies are transitioned for maturation and demonstration.			
Accomplishments/Planned Programs Subtotals	5.591	5.526	4.142

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks
 N/A

D. Acquisition Strategy
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BG6 *I Advanced Concepts for Active Defense Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BG6: *Advanced Concepts for Active Defense Technology*	-	33.399	32.668	30.206	-	30.206	34.367	33.620	24.762	28.748	0.000	217.770

A. Mission Description and Budget Item Justification

This Project funds research for advanced materials and mechanisms to defeat the most common and most dangerous threats that are expected to be encountered by our ground forces in the near, mid and far term. Work conducted in this Project will result in concepts for Adaptive and Cooperative Protection of ground combat vehicles. Additionally, research will focus on subcomponent/component models to predict performance of early concepts and the means to evaluate effectiveness on ground platforms. The Project will balance developments of active threat defeat measures with the necessary advanced passive and active components to provide solutions which will help meet the requirements of current and next generation ground tactical and combat vehicles.

This Project is coordinated with and transitions to Projects in PE 0603462A (Next Generation Combat Vehicle Advanced Technology) and builds upon weapon target interaction research in PE 0602144A (Ground Technology) and PE 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics).

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

Work in this Project is performed by the Army Research Laboratory (ARL), Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance Center (C5ISR), Data and Analysis Center (DAC), Ground Vehicle Systems Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Multi-Threat Armor Technologies ***Description:*** This effort develops multi-threat hybrid armor technologies incorporating both active and passive mechanisms for ground vehicle systems that are effective against future conventional weapons and evolving improvised threats including kinetic and chemical energy as well as blast threats. ***FY 2024 Plans:*** Will validate armor protection mechanism for Medium Caliber (Med-Cal), Explosively Formed Projectiles (EFP), and Shaped Charged Jet (SCJ) threats, as well as Active Protection System (APS) residual effects; design and develop lab-scale solutions for more efficient, cost-effective tools and methodologies to provide data to improve vehicle protection technologies; conduct virtual experiments to assess complex warhead-penetrator orientations; finalize the development of vehicle spall protection requirements for shaped charge threats for both manned and unmanned systems. ***FY 2025 Plans:***	8.413	8.245	6.754

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 *I Advanced Concepts for Active Defense Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will develop vulnerability mapping of threats to emerging and proliferated chemical energy weapons; enhance armor protection mechanisms for medium caliber KE threats utilizing novel armor mechanisms including multi-threat and multi-hit armor mechanisms to improve vehicle protection technologies; develop and validate protection capability for future threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Title: Adaptive and Cooperative Protection *Description:* This effort pursues a holistic approach toward achieving significant weight reduction and protection from future threats by utilizing real-time information, combined with threat knowledge, to provide ever-increasing protection. This approach includes integrating individual vehicle capabilities of armor, underbody blast protection, active protection systems, and advanced soft kill methods into one layered solution to maximize survivability and minimize weight for combat and tactical vehicles. This effort will investigate modern protective technologies that implement complex kinematic mechanisms in order to bend, break and disperse threat projectiles before they can injure crew or disable vehicles. ***FY 2024 Plans:*** Will validate a collaborative multi-platform defense mechanism; explore the use of novel armor mechanisms to provide hemispherical protection against a variety of rocket propelled grenade (RPG) and Anti-Tank Guided Munitions (ATGM) threats; mature a statistical computational model for adaptive protection systems; explore alternate lasers for ATGM soft-kill active protection system. ***FY 2025 Plans:*** Will enhance statistically based computational models for adaptive technologies to include hemispherical protection concepts; conduct experiments on advanced adaptive concepts to counter emerging threats; enhance numerical models to explore the kinematics of multiple adaptive protective technologies and establish optimal defeat range of incoming threats with increased protection. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.	6.520	6.793	6.163
Title: Emerging Overmatch Technologies *Description:* This effort designs, develops, and conduct experiments to validate the lethality and protection concepts that re-establish overmatch for the next generation of manned and unmanned combat platforms. It will tightly couple scientific research within a campaign of learning to form technology concepts for battlefield domination against current and future threats. This research will heavily leverage other efforts within PE 0602145A (Next Generation Combat Vehicle Advanced Technology) and PE 0603462A (Next Generation Combat Vehicle Advanced Technology).	2.405	2.459	2.475

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 *I Advanced Concepts for Active Defense Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2024 Plans: Will continue to develop technology to enable concepts of cooperative protection and collaborative lethality, emphasizing autonomous distributed task assignment across a team of robotic and autonomous systems acting in opposition to numerous surrogate threat systems; perform experiments on both simulation and physical systems in pseudo-tactical scenarios. *FY 2025 Plans:* Will validate collaborative protection technologies against real threats in field experiments; document proof-of-concept for cooperative protection and collaborative lethality and evaluate preliminary performance based on a limited set of simulation runs; assess residual technology risk and document recommendations for transition partners. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Survivability/Lethality/Vulnerability Analysis Tools and Methodology *Description:* This effort devises state-of-the-art survivability/lethality/vulnerability methodologies to dynamically model the interaction of conventional ballistic threats against future weapon systems. *FY 2024 Plans:* Will research and conduct analysis of autonomous unmanned ground vehicle systems and teamed manned and unmanned systems against multi-domain threats in a common framework while applying time-dependent failures from consumables like fuel/electric; complete development of communications linkage map between vehicle system, assistive automation, artificial intelligence, and the Soldier; expand survivability/lethality/vulnerability methodologies and proof-of-concept analyses of vehicle protection system technologies against multi-discipline threats and attacks in a common framework; conduct experiments to inform improved methodology, analytical techniques, and modeling capability to assess lethality of next generation combat vehicle fragmenting and high explosive munitions. *FY 2025 Plans:* Will research human machine teaming methodology and develop vulnerability analysis capability with combined voice and data communication focusing on cognitive burden and network traffic impact over time; develop vulnerability analysis capability of Aided Target Recognition to small Unmanned Aerial Systems (UAS) obscuration of target; develop direct fire analysis capability for advanced medium caliber munitions against moving vehicle targets; continue development of UAS target vulnerability to advanced medium caliber munitions and active protection technologies; improve methodology for assessing capabilities of advanced active, reactive, passive, and roof armors; improve methodology for collaborative protection of multiple vehicles	5.440	5.734	5.488

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / Next Generation Combat Vehicle Technology	Project (Number/Name) BG6 / Advanced Concepts for Active Defense Technology

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
in a formation and sensor assessment, as well as improve intercepted munition residual characterizations in support of next generation combat vehicle protection. **FY 2024 to FY 2025 Increase/Decrease Statement:** Funding decrease reflects planned lifecycle of this effort.			
Title: Ground Systems Active Defense Technology Research **Description:** This effort contributes to the Army's ground vehicle survivability by developing technologies which electronically or physically defeat an incoming threat before it contacts the vehicle. These technologies involve sensors and effectors interacting with an incoming threat to disrupt or destroy in while it is in flight or before it is even fired at a vehicle. This effort designs and develops modern armors that directly complement and are optimized to work with active defense technologies in order to implement sophisticated mass efficient mechanisms and leverage investments in materials to act as a system for the defeat of advanced threats and active protection system residuals. This effort designs and develops active blast mitigation technologies to counter the effects of underbody attacks to ground vehicles. This effort will also design and develop the required advanced structures required to accommodate active blast mitigation technologies into vehicles. The design of the structure and active defense technology is critical to an effective blast survivability solution.	6.631	-	-
Title: Advanced Threat APS Radar Technology **Description:** This effort develops ground combat vehicle survivability technologies including radar techniques to support hard-kill countermeasures as a part of an integrated survivability suite for ground combat platforms in all-weather, day or night conditions with 360 degree situational awareness and Kinetic Energy threat defeat. **FY 2024 Plans:** Will finalize studies to provide signature management improvements and optimization; develop resource management techniques to counter threats while maintaining radar search modes; assess sensor resource management techniques and algorithm performance via experiments. **FY 2024 to FY 2025 Increase/Decrease Statement:** Funding decrease reflects planned completion of this effort in FY 2024.	3.374	2.209	-
Title: Detection Avoidance Applique Technology Research **FY 2024 Plans:** Will build upon FY 2023 effort by down-selecting component technologies based on experimental results; design and develop a technology concept for ground vehicles that integrates multiple signature management component technologies into a system in	0.616	0.728	-

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 *I Advanced Concepts for Active Defense Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
order to create a holistic solution to avoid detection across spectrums of interest; conduct system-level modeling and simulation to refine the concept. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects work being shifted to Project Element 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BG7 (Ground Systems Active Defense (GSAD) Advanced Tech) to focus on maturing the technology.			
Title: Collaborative Defense ***Description:*** This effort expands the capability of the US Army to protect ground vehicles. This is done by conducting research into technologies that can enable the sharing of protection resources across multiple platforms in real time, allowing for the expansion of the zone of protection on the battlefield beyond a single vehicle and its protection system. These technologies include components such as sensors which can be used to identify and track incoming threats, radios/networks which will allow local sharing of threat detection and tracking information, and effectors which can disrupt or destroy threats before terminal engagement with the platform. In order to enable collaboration across multiple platforms, including integration factors such as size, weight, power consumption, and cost impacts to the platform, this effort will study various system-level approaches to integrating these aforementioned technologies. Additionally, this effort will validate performance of the system in the laboratory environment. ***FY 2024 Plans:*** Will research technology approaches for the application of a distributed, autonomous countermeasure for ground vehicle formations; conduct component and system-level modeling of collaborative countermeasure concepts to explore feasibility; conduct experiments into vehicle-to-vehicle threat sensing and response; investigate feasibility of system-level concepts for integration with the Army's modular active protection system architecture. ***FY 2025 Plans:*** Will continue investigation of collaborative countermeasure concepts through advanced modeling and simulation tools and system-level trade studies. Will down-select and mature the most-promising technology concept through computational analysis and physical experiments. Will develop system-level model for selected approach and develop hardware components. Will begin detailed design of countermeasure system architecture for Modular Active Protection Framework compliance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** This funding increase reflects the cost of developing hardware components in accordance with project plans.	-	6.500	9.326
Accomplishments/Planned Programs Subtotals	33.399	32.668	30.206

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BG6 *I Advanced Concepts for Active Defense Technology*
C. Other Program Funding Summary ($ in Millions) N/A **Remarks** **D. Acquisition Strategy** N/A		

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BG8 *I Obscuration Technology*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BG8: *Obscuration Technology*	-	2.722	-	-	-	-	-	-	-	-	0.000	2.722

A. Mission Description and Budget Item Justification

This Project investigates and evaluates obscurant technologies that degrade threat force surveillance sensors and defeat the enemy's target acquisition devices, missile guidance, and directed energy weapons. This Project focuses on advanced infra-red and multi-spectral obscurant materials that provide effective, affordable, and efficient screening of deployed forces, while being safe and environmentally acceptable.

The cited work is consistent with the Under Secretary of Defense for Research and Engineering Priority focus areas.

Research in this Project is related to and fully coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Obscuration Enabling Technologies	2.722	-	-
Description: This effort investigates new materials and compounds to enable safe, effective screening of personnel and equipment across the electromagnetic spectrum. This effort also provides vulnerability assessments against enemy threat systems.			
Accomplishments/Planned Programs Subtotals	2.722	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BH5 *I Platform Electrification and Mobility Tech*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BH5: *Platform Electrification and Mobility Tech*	-	14.206	13.763	15.160	-	15.160	18.885	15.544	14.426	14.570	0.000	106.554

A. Mission Description and Budget Item Justification

This Project researches and develops advanced power and energy technologies for tactical and combat ground vehicles that are necessary for parallel or series hybrid-electric drive. Research energy storage, distribution and battlefield charging technologies to enable future plug-in hybrid-electric drive and all electric tactical vehicle systems.

This Project researches and develops advanced power and energy technologies for combat ground vehicles that are necessary for parallel hybrid, series hybrid and all-electric vehicle systems.

Work in this Project complements PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Scalable Electrification & Control Architecture	1.977	1.999	-
Description: This effort designs and develops the power distribution and control components to implement a common, scalable, electrified vehicle power architecture to enable advanced lethality and protection capabilities, fast vehicle charging from the grid, and silent mobility on combat platforms across light to heavy weight classes. This power architecture enables the hybrid electric, fuel cell electric, and all-electric powertrains. *FY 2024 Plans:* Will validate the high voltage power converter developed in FY 2023, allowing integration of high voltage batteries and range extending technologies. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort in FY 2024.			
Title: Platform Electrification Research	10.519	6.374	0.963

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 *I Platform Electrification and Mobility Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort designs and develops the electric power generation, energy storage and electrified components and sub-systems required to electrify combat vehicles across light to heavy weight classes. *FY 2024 Plans:* Will mature design of the high-power density in-hub electric sprocket module; mature designs for electrified cooling components; mature battery cell concept for extreme high-energy storage system; perform component optimization and maturation for multi-cell module for high voltage energy storage system. *FY 2025 Plans:* Will validate the electric motor/power generation system for mobility power and power generation for future warfighter electrical loads. Validate the integration of the motor/generator and inverter sub-system. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort with only motor/generator work continuing in FY 2025			
Title: Robotic Combat Vehicle Silent Watch and Mobility Range Extension *Description:* This effort designs and develops the Jet Propellant 8 (JP8) reformer based silent watch and mobility extension subsystem required to electrify robotic combat vehicles. The Army's robotic combat vehicles are expected to have increased silent watch and silent mobility requirements that are not met by current technologies. *FY 2024 Plans:* Will validate the component level performance of JP8 fuel reformer based silent watch and mobility extension subsystem; explore higher power density technologies for range extension subsystem. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort in FY 2024.	1.710	3.340	-
Title: Battlefield Electric Vehicle Recharge Technology *Description:* This effort develops technologies to enable highly mobile Electric Vehicle (EV) rechargers that are essential to allow highly electrified tactical and combat platforms to be fielded by the Army to enable capabilities such as persistent silent mobility.? Effort includes highly mobile power generation and wireless power transfer to the tactical and combat platforms. *FY 2024 Plans:* Will design components of a wireless recharge system. *FY 2025 Plans:*	-	2.050	2.204

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 *I Platform Electrification and Mobility Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will design and build components for mobile power generation and battlefield recharge technology. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** This increase is an economic adjustment.			
Title: Advanced Running Gear and Suspension Research ***Description:*** This effort develops an advanced track and suspension system for heavy combat vehicle applications and will offer significantly reduced system weight, maintenance, noise and vibration over conventional systems, as well as increased operational effectiveness on- and off-road and lower platform fuel consumption. ***FY 2025 Plans:*** Will design and conduct experiments on critical suspension height management and adjustable damping components and critical track components, materials and joints to validate performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase reflects initiation of Advanced Running Gear and Suspension Research efforts.	-	-	1.786
Title: Electric Propulsion System Research ***Description:*** This effort designs and develops the propulsion system and sub-systems required to power heavy hybrid-electric drive combat vehicles. It also develops the support hardware and auxiliary systems to allow integration and thermal management of electrified components and energy storage for heavy hybrid-electric drive combat vehicles. ***FY 2025 Plans:*** Will design and develop the compact electrified combat transmission and electric machine required to power heavy combat vehicles. Will investigate supporting architecture and thermal management for electrified component and energy storage. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase reflects initiation of Electric Propulsion System Research efforts.	-	-	8.062
Title: Extreme Energy Density Energy Storage Research ***Description:*** Develop and validate Extreme Energy Density battery cell performance for fast recharge. Design battery components to enable militarized Extreme Energy Density battery packs. ***FY 2025 Plans:*** Develop and validate high energy cell technologies with improved safety for combat vehicle applications. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	-	-	2.145

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BH5 *I Platform Electrification and Mobility Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Increase reflects initiation of Extreme Energy Density Energy Storage Research efforts.			
Accomplishments/Planned Programs Subtotals	14.206	13.763	15.160

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*					**Project (Number/Name)** BI2 *I Sensor Protection Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BI2: *Sensor Protection Technology*	-	6.100	5.532	5.782	-	5.782	7.295	7.749	7.834	7.912	0.000	48.204

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops techniques for masking friendly force capabilities and intentions. The Project pursues technologies to reduce the susceptibility of sensor systems to detection and targeting by threat forces, as well as to inform the development of next generation signature reduction schemas. This Project also designs, investigates, fabricates, evaluates and characterizes advanced sensor protection technologies, components, and concepts that will enable the future soldier to see and operate through a laser directed energy weapon attack. Both active and passive protection technologies will be investigated to protect Army sensors that operate in the visible, short-wave infrared, mid-wave infrared, and long-wave infrared spectra from battlefield laser threats. Areas of research include passive optical limiters such as nonlinear organic dyes, semiconductors, and meta-materials, as well as fast active switches and tunable filters. Technologies investigated include novel optics designs combined with signal processing, spectral filtering, and threat sensing algorithms.

Work in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology), PE 0603118A (Soldier Lethality Advanced Technology), PE 0603465A (Future Vertical Lift Advanced Technology), and PE 0602143A (Soldier Lethality Technology)

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

Work in this Project is performed by the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Sensor Protection Technology	6.100	5.532	5.782
Description: This effort will design and develop component technology to improve protection of sensors and sensor electronics from threats via techniques to harden optics, reduce sensor optical cross sections, novel coating approaches, filter improvements, and emerging signature reduction schemas.			
FY 2024 Plans: Will validate the interactions and effects of ultra-short pulsed lasers (USPL) on current higher performance sensors and optical materials; develop new USPL protection techniques for high performance cooled electro-optical / infrared sensorsystems; investigate enhanced laser identification techniques to improve the speed and accuracy of protective responses; investigate and report on emerging spectrally agile filter approaches for the visible and infrared (speed, transmission, and blocking ability) for protection.			
FY 2025 Plans:			

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Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602145A / *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BI2 / *Sensor Protection Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will conduct experiments on spectrally agile filters in the visible and infrared waveband to determine which filter device(s) are applicable to military applications. Will validate commercial spectrally agile filter performance. Will investigate the interactions and effects of out-of-band stressing laser threats on infrared optical materials. Will begin development of a filter, coating, or new material to provide out-of-band protection for high performance cooled infrared systems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects an economic adjustment.			
Accomplishments/Planned Programs Subtotals	6.100	5.532	5.782

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BI4 *I Materials Application and Integration Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BI4: *Materials Application and Integration Tech*	-	7.651	7.505	-	-	-	-	-	-	-	0.000	15.156

A. Mission Description and Budget Item Justification

This Project designs, develops, fabricates and evaluates a variety of materials (e.g. metals, ceramics, polymers and composites) to enable more survivable, lighter weight vehicle armor, chemical and biological protection, armaments and electronics for the next generation combat vehicle. Research focuses on unique and /or novel materials properties, developing physics-based models, materials characterization techniques, non-destructive testing methods and advanced fabrication/processing methodologies to transition candidate solutions for maturity, scale-up, and integration into systems.

This Project also continues the Advanced Vehicle Power Technology Alliance between the Department of Energy and the Department of the Army with a focus on materials, providing an emphasis on developing advanced technologies that enable military ground vehicles to become significantly more energy efficient. The Alliance is chartered to accelerate the conceptualization and transition into deployment of inventive and creative energy-saving concepts that the Nation needs to achieve energy security. This Project matures and integrates lightweight materials and joining technologies in support of lighter military vehicles which are more fuel-efficient and expeditionary with superior mobility and protection of both vehicles and occupants.

Work in this Project leverages research from Program Element (PE) 0601102A (Defense Research Sciences) / Project AA7 (Mechanics and Ballistics) and 0602144A (Ground Technology) / Project BL1 (Materials and Manufacturing Research Technology). This work is also coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology).

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

Work in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)

	FY 2023	**FY 2024**	**FY 2025**
Title: Novel Armor Materials and Processes for Vehicle Protection	7.651	7.505	-
Description: Develop novel metal alloys and associated processes through the scale-up and exploitation of revolutionary new metal alloys, which have demonstrated capabilities to overcome traditional engineering trade-offs (e.g., strength and ductility) with exceptional high temperature stability.			
FY 2024 Plans: Will develop lightweight, low cost transparent glass/polymer laminates with optical transmissivity at wavelengths suitable for personnel and sensor protection; conduct experiments to maximize the thickness for weldable high toughness, low cost, high hard steel armor alloy for structural and armor applications for vehicle assessment; develop service temperature-time-mechanical			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BI4 *I Materials Application and Integration Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
property map for aluminum alloys to understand service properties of platform alloys and inform selection and development of alternative materials; design and develop scalable extreme environmental coatings that provide enhanced camouflage reflectance and chemical agent resistivity; develop capabilities for characterizing and modeling performance of dissimilar material joints (welded, solid state joined, adhesively joined) under extreme loading conditions.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects planned conclusion of this effort in FY24.			
Accomplishments/Planned Programs Subtotals	7.651	7.505	-

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 I 2					**R-1 Program Element (Number/Name)** PE 0602145A I *Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BJ2 I *Tactical and Navigation Lasers Sensors Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BJ2: *Tactical and Navigation Lasers Sensors Technology*	-	5.596	5.790	5.863	-	5.863	5.865	5.868	5.933	5.992	0.000	40.907

A. Mission Description and Budget Item Justification

This Project designs and develops novel laser sensor technologies which provide improved maneuver, lethality, and survivability capabilities via manned and autonomous navigation, adversary sensor threat detection, and target detection and designation in all environments. It will deliver novel laser technologies which will provide low size, weight, and power (SWaP) laser sources and receivers for optical augmentation detection systems; and compact Laser Detection and Ranging (LADAR) sources for situational awareness and air and ground vehicle operations and navigation in all environments. This Project is a critical enabler for autonomous operations in environments where other imaging technologies are not sufficient.

This Project is coordinated with PE 0603462A (Next Generation Combat Vehicle Advanced Technology), 0603118A (Soldier Lethality Advanced Technology), 0603465A (Future Vertical Lift Advanced Technology), and 0602143A (Soldier Lethality Technology).

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

Work in this Project is performed by the Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Tactical and Navigation Lasers Sensors Technology	5.596	5.790	5.863
Description: This effort designs and develops novel low SWaP, compact, high peak power pulsed laser sources and receivers for optical augmentation detection systems; and compact LADAR sources for situational awareness and manned and unmanned air and ground vehicle operations and navigation in all environments. Effort delivers component technologies needed to support future Army autonomous, covert targeting approaches. *FY 2024 Plans:* Will investigate pixel pitch optimization of high-sensitivity laser detectors for enhanced resolution capabilities of the arrays; investigate dark current optimization of the high-sensitivity laser detectors through detector short loops to increase detection ranges when coupled with the short-pulse laser sources; begin development of a physics-based optical link error budget and laser detector model to guide development and predict future system performance. *FY 2025 Plans:* Will design high-sensitivity laser detectors with optimized pixel pitch (size) and dark current (sensitivity) and optimize advanced laser sources to increase array resolution and detection ranges. Will model laser detector components to predict performance			

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Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602145A / Next Generation Combat Vehicle Technology	Project (Number/Name) BJ2 / Tactical and Navigation Lasers Sensors Technology

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
based on design specifications of high-sensitivity laser detectors. Will begin validation of laser detector model using laboratory test results of components and update models based on validation testing to guide development and predict future system performance. **FY 2024 to FY 2025 Increase/Decrease Statement:** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	5.596	5.790	5.863

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602145A / Next Generation Combat Vehicle Technology				Project (Number/Name) BK2 / Virtual Prototyping Technology		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BK2: *Virtual Prototyping Technology*	-	7.022	9.910	7.042	-	7.042	7.255	8.063	8.070	8.135	0.000	55.497

A. Mission Description and Budget Item Justification

novel ground vehicle design concepts that will be analyzed and evaluated through modeling, simulation, and virtual experimentation to provide engineering data and operational feedback to inform NGCV requirements to strengthen and accelerate acquisition decisions. This Project designs and analyzes novel NGCV system level ground vehicle concepts by integrating advanced mobility, survivability, lethality, sensing and electrical/electronic technologies to address emerging and future advanced threats. This Project provides system level ground vehicle design concepts and performance analysis, assesses cost and performance trades, and provides real-time soldier feedback on technology performance for the Army's NGCVs. Technologies to be evaluated include high efficiency advanced powertrains, power generation, vehicle electrification, active protection systems, active blast, advanced lethality and robotic control and autonomy technologies. The NGCV Virtual Prototypes include Virtual Soldier Operational Experiments (VSOE) with System Integration Labs (SILs) to give warfighters an understanding into how behaviors and tactics change given emerging Operation concepts based on new technologies and capabilities. Future integration of VSOEs with software and hardware SILs with realistic interfaces and utilizing mixed reality technology will provide higher fidelity Soldier evaluations, without the time and cost associated with physical prototypes. The Virtual Prototyping results provide critical inputs to the Army's NGCV program by providing independent technical and operational performance results for the Army's next generation of ground combat vehicles while reducing risk and accelerating transition to physical prototypes.

Work in this Project is coordinated with Program Element (PE) 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotic

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

Work in this Project is performed by the Ground Vehicle System Center (GVSC)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Virtual Prototyping	7.022	9.910	7.042
Description: This effort utilizes virtual prototyping to address technical and integration challenges in the areas of mobility, survivability, lethality, vehicle architecture, and systems integration for the Army's next generation of ground combat vehicles. Specifically, this effort focuses on developing integrated design concepts, performance analysis, identifying and assessing trade space, and conducting virtual operational experiments for the NGCV. The combination of technical performance and operational feedback provides insights that will inform designs and reduce development and testing time. **FY 2024 Plans:**			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK2 *I Virtual Prototyping Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will continue modeling and simulation to virtually design, develop, and assess new Next Generation Combat Vehicle (NGCV) manned and unmanned systems that include projected lethality, mobility, sensing, protection, and autonomous vehicle technologies. Will integrate technologies into multiple combat vehicle concepts with a focus on Robotic Combat Vehicle (RCV) design approaches that are then analyzed for performance, cost, and traceability of NGCV requirements. Inform S&T and NGCV plans with knowledge and analyses. Will conduct Soldier-in-the-loop virtual experiments and build an initial virtual soldier operational exercise capability including system integration labs with realistic hardware/software interfaces and mixed reality technology to provide higher fidelity Soldier evaluations. Will assess ground vehicle concepts for military utility, mission performance, Soldier preference, and to explore Soldier derived Tactics, Techniques, and Procedures (TTPs). *FY 2025 Plans:* Will continue modeling and simulation to virtually design, develop, and assess new NGCV manned and unmanned systems that include projected lethality, mobility, sensing, protection, and autonomous vehicle technologies. Will integrate technologies into multiple combat vehicle concepts with a focus on robotic combat platform design approaches and integration of autonomous technologies into Virtual Soldier Operational Experiments (VSOE) to enable evaluation of human machine teaming (HMT) capabilities and requirements. Will continue to inform S&T and NGCV plans with knowledge, M&S analyses, and Soldier feedback. Will develop simulation environment to include system integration labs with realistic hardware/software interfaces and mixed reality technology to provide higher fidelity Soldier evaluations. Will assess ground vehicle concepts, autonomous technologies and HMT capabilities for military utility, mission performance, and Soldier preference to inform NGCV capabilities and requirements. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned completion of virtual designs.			
Accomplishments/Planned Programs Subtotals	7.022	9.910	7.042

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army							Date: March 2024			
Appropriation/Budget Activity 2040 I 2				**R-1 Program Element (Number/Name)** PE 0602145A I Next Generation Combat Vehicle Technology			**Project (Number/Name)** BK5 I Adv Direct In-Direct Armament Sys (ADIDAS) Tech			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BK5: *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*	-	13.054	11.043	11.585	-	11.585	8.599	8.353	10.124	14.086	0.000	76.844

A. Mission Description and Budget Item Justification

This Project matures and conducts experiments on component technologies for large caliber direct fire light-weight armament systems that will exceed the current capability of 120mm direct fire and be optimized for future operational environment with cross-domain engagement capability. This Project also researches large caliber direct fire munitions to project overwhelming lethality while ensuring maneuver forces remains mobile and sustainable during close-combat engagements at extended ranges.

Research in this Project is related to and fully integrated with the efforts funded in PE 0603462A (Next Generation Combat Vehicle Advanced Technology) / Project BK6 (Advanced Technology Direct In Direct Armament Sys (ADIDAS) Advanced Technology).

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

Research in this Project is performed by the Armaments Center (AC) and Army Research Laboratory (ARL)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Lethality - Kinetic Energy (AL-KE) *Description:* This effort designs and develops component technologies for large caliber direct fire light-weight armament systems that will exceed the current 120mm direct fire cannon performance for future operational environments, including dense urban, with multi -domain engagement capability. The component technologies that support rapid fire on-the-move (direct & indirect) engagements include: compact ammunition design with advanced ignition, reduced gun impulse on platform through advanced recoil mitigation techniques, fire control and automated ammunition handling and reloading.	1.614	-	-
Title: NGCV Penetrator Technology for Decisive Lethality *Description:* This effort develops energy-efficient lethal mechanism technologies for next-generation warheads and projectiles for large-caliber ammunition launched from direct fire weapon systems that maximize the lethality against an array of targets and provide tactical advantage at extended ranges for next generation threats. The results of this research will provide the basis for the lethality required for the next generation of combat vehicles and enable the development of the next generation of ammunition to ensure lethal overmatch throughout the operational environment.	3.340	-	-
Title: Advanced Lethality Armament System- Large Caliber (ALAS-LC)	8.100	4.564	2.945

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602145A I *Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK5 I *Adv Direct In-Direct Armament Sys (ADIDAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Investigate increased lethality solutions for next generation large caliber direct fire armament systems that will ensure battlefield dominance of US ground forces. Design reduced recoil armament systems capable of increased rate of fire enabled by a compact autoloader with performance that exceeds current state of the art 120mm direct fire cannons for current and future Army platforms. *FY 2024 Plans:* Will develop modeling and simulation to assess armament system component technologies for future large caliber direct fire systems. Will validate models of large caliber system and component technologies to increase direct fire lethal overmatch. Will design and develop concepts for component hardware and software to reduce recoil and increase rate of fire of next generation large caliber direct fire armament systems. *FY 2025 Plans:* Will mature armament system component technologies that increase lethality for future large caliber direct fire systems. Will conduct experiments on armament system component technologies to inform future integration tasks. Will investigate technologies to reduce large caliber target defeat timeline via enhanced direct fire automation. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Title: Decisive Lethality	-	6.479	8.640
Description: This effort develops energy-efficient lethal mechanism technologies for the next-generation of large-caliber ammunition launched from direct fire weapon systems to maximize the lethality against an array of targets and provide tactical advantage at extended ranges against current and future threats. This includes research and development to produce a compact, high energy density propelling charge, engineered aerodynamics for improved accuracy, a novel kinetic penetrator with next generation lethal mechanism, and the ability to defeat advanced and smart armors. *FY 2024 Plans:* Will investigate robust penetrators for greater lethality; explore the development of compact, high-energy propellant charges for direct fire which provide increased energy as well as advanced ignition technologies; conduct research into accuracy improvements needed for future large-caliber weapon systems; investigate approaches to survive, counter, and defeat smart armor technologies such as active protection system. *FY 2025 Plans:* Will evaluate concepts for robust large caliber penetrators for increased lethality; mature compact, high-energy propellant charges for direct fire which provide increased energy as well as advanced ignition safety or timelines?; explore the interaction between			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BK5 *I Adv Direct In-Direct Armament Sys (ADIDAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
ignition and propellant to ensure controllable, repeatable combustion; evaluate technologies to improve accuracy necessary for future large-caliber weapon systems; evaluate system viability of counter-countermeasure technologies against projected threat systems for defeat of advanced protection technologies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding realigned in FY 2025 from Advanced Armor and Protection Technologies in PE 0602144A Project CG7 Ground Protection Concepts and Technologies to support additional research in the area of the interaction between ignition and propellant for repeatable combustion.			
Accomplishments/Planned Programs Subtotals	13.054	11.043	11.585

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** BP5 *I Ground Vehicle Technology (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BP5: *Ground Vehicle Technology (CA)*	-	103.500	-	-	-	-	-	-	-	-	0.000	103.500

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Ground Vehicle Technology.

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

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
Congressional Add: Program Increase - Silicon Carbide Electronics	6.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Silicon Carbide Electronics		
Congressional Add: Program Increase - Highly Electrified Vehicles	3.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Highly Electrified Vehicles		
Congressional Add: Program Increase - Prototyping Energy Smart Autonomous Ground Systems	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Prototyping Energy Smart Autonomous Ground Systems		
Congressional Add: Advanced Materials Development for Survivability	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Materials Development for Survivability		
Congressional Add: Program Increase - Digital Design and Simulated Testing	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Digital Design and Simulated Testing		
Congressional Add: Program Increase - Fast-Refueling Fuel Cell Engines	7.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Fast-Refueling Fuel Cell Engines		
Congressional Add: Program Increase - Hydrogen Technologies	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Hydrogen Technologies		
Congressional Add: Program Increase - Machine Learning Optimized Power Electronics	3.000	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BP5 *I Ground Vehicle Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
FY 2023 Accomplishments: Congressional Interest Item funding provided for Machine Learning Optimized Power Electronics		
Congressional Add: Program Increase - Zero Emission Combat Vehicles	3.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Zero Emission Combat Vehicles		
Congressional Add: Program Increase - ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT	2.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ADVANCED MANUFACTURING FOR COMBAT LOGISTICS SUPPORT		
Congressional Add: Program Increase - ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT	8.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ENTERPRISE AND CROSS-FUNCTIONAL LVC FOR ACCELERATED DEVELOPMENT		
Congressional Add: Program Increase - MOBILITY MATERIALS RESEARCH	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for MOBILITY MATERIALS RESEARCH		
Congressional Add: Program Increase - MODULAR ELECTRIC MOTORS	5.500	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for MODULAR ELECTRIC MOTORS		
Congressional Add: Program Increase - SMALL UNIT TECHNOLOGY ADVANCEMENTS	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SMALL UNIT TECHNOLOGY ADVANCEMENTS		
Congressional Add: Program Increase - SOLID OXIDE FUEL CELL DEVELOPMENT	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SOLID OXIDE FUEL CELL DEVELOPMENT		
Congressional Add: Program Increase - STRUCTURAL THERMOPLASTICS	6.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for STRUCTURAL THERMOPLASTICS		
Congressional Adds Subtotals	103.500	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*	**Project (Number/Name)** BP5 *I Ground Vehicle Technology (CA)*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602145A *I Next Generation Combat Vehicle Technology*				**Project (Number/Name)** CU5 *I Platform Agnostic Armaments Applied Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CU5: *Platform Agnostic Armaments Applied Technology*	-	0.993	-	-	-	-	-	-	-	-	0.000	0.993

A. Mission Description and Budget Item Justification

This Project investigates technologies that holistically maximize armament performance, minimize target engagement timelines, reduce crew workloads, enhance responsiveness and enable collaborative lethal effectiveness on target across distributed platforms & missions. This project researches cross caliber weapon, munition & fire-control technologies to enhance Remote Weapon Systems (RWS) responsiveness and single or combined platform lethality in Multi-Domain Operations (MDO) environments.

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

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Platform Agnostic Armaments Technology	0.993	-	-
Description: This effort designs and develops technologies that enables platform performance by increasing range without degrading accuracy, reducing size, weight, and power and impact to lighter platforms, enhancing weapon, munitions, fire control, and agnostic remote weapon automation tech to reduce the kill chain timeline. This effort enables Army Modernization and Multi-Domain Operations (MDOs) in support of the Army's future and planned vehicles.			
Accomplishments/Planned Programs Subtotals	0.993	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040: Research, Development, Test & Evaluation, Army I BA 2: Applied Research					R-1 Program Element (Number/Name) PE 0602146A I Network C3I Technology						

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	221.293	81.618	84.576	-	84.576	82.597	81.884	85.162	98.578	0.000	735.708
AM6: Modular RF Communications Technology	-	-	5.986	8.335	-	8.335	-	-	3.507	12.835	0.000	30.663
AM8: Protected SATCOM Technology	-	-	6.599	6.510	-	6.510	3.659	2.238	6.513	12.023	0.000	37.542
AN3: Non Traditional Waveforms Technology	-	3.290	14.000	10.069	-	10.069	7.545	2.614	-	-	0.000	37.518
AN7: COE - Every Receiver is a Sensor Technology	-	2.450	1.044	-	-	-	-	2.124	2.147	2.168	0.000	9.933
AN9: UNT - Every Receiver is a Sensor Technology	-	1.998	2.115	4.624	-	4.624	11.045	8.129	6.713	6.141	0.000	40.765
AO4: Energy Efficient Devices Technology	-	5.280	5.589	7.159	-	7.159	9.377	11.385	11.948	11.013	0.000	61.751
AP5: Electronic Warfare Technology	-	5.230	5.355	5.400	-	5.400	2.879	2.880	2.912	2.941	0.000	27.597
AQ2: EW Techniques Technology	-	0.513	0.541	3.701	-	3.701	3.706	-	-	-	0.000	8.461
AQ7: High Tempo Data Driven Decision Tools Technology	-	1.242	1.306	-	-	-	2.359	4.165	3.839	3.879	0.000	16.790
AR5: Understanding the Environment as a Threat Technolo	-	1.297	-	-	-	-	-	-	-	-	0.000	1.297
AT7: Network-Enabled GeoSpatial-GEOINT Services Tech	-	3.137	2.555	4.045	-	4.045	3.103	3.014	8.924	8.480	0.000	33.258
AT9: Tactical GeoSpatial Information Capabilities Techn	-	0.499	2.717	2.069	-	2.069	2.962	2.225	4.155	2.955	0.000	17.582
AV3: Foundational S&T for Network C3I Technology	-	0.001	-	-	-	-	-	-	-	-	0.000	0.001

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*						
AV5: *Protective Technologies*	-	6.236	6.553	5.307	-	5.307	5.312	5.315	5.373	5.428	0.000	39.524
AV9: *Advanced PNT for GPS Independent Environments Tech*	-	8.829	9.022	8.062	-	8.062	8.020	8.776	8.871	8.960	0.000	60.540
AW1: *Autonomous Navigation Technology*	-	1.977	-	1.002	-	1.002	2.848	5.921	3.006	1.904	0.000	16.658
AW5: *Modular GPS Independent Sensors Technology*	-	-	-	4.546	-	4.546	6.896	7.297	3.782	6.532	0.000	29.053
BP2: *Sensor and Electronic Network Initiatives (CA)*	-	155.000	-	-	-	-	-	-	-	-	0.000	155.000
CG3: *Assured PNT Communications Applied Research*	-	9.833	5.652	4.158	-	4.158	2.867	4.231	4.283	4.332	0.000	35.356
CI3: *Mobile and Survivable Command Post (MASCP) Tech*	-	5.540	3.268	2.375	-	2.375	2.378	2.380	-	-	0.000	15.941
CU6: *Adaptive Information Mediation and Analytics*	-	6.830	7.226	5.957	-	5.957	5.964	7.301	7.380	7.454	0.000	48.112
CV4: *Pathfinder 3D Applied Technology*	-	2.111	2.090	1.257	-	1.257	1.677	1.889	1.809	1.533	0.000	12.366

Note

In Fiscal Year (FY) 2025, a portion of funding from PE 0602146A / Network C3I Technology, Project AV5 /Protective Technologies realigned to 0603042A/C3I Advanced Technology, Project DI6/Anti-Tamper Advanced Tech Development) to support maturation to Technology Readiness Level 6 (TRL6) and transition of anti-tamper technologies into DoD and Army weapons systems.

In FY2025, funding realigned from PE0603463A /Network C3I Advanced Technology, Project AW6/ Modular GPS Independent Sensors Advanced Tech and Project AV8/ Navigation Warfare (NAVWAR) Advanced Technology to PE 0602146A / Network C3I Technology, Project AW5/Modular GPS Independent Sensors Technology.

In FY2025, Project AQ7/High Tempo Data Driven Decision Tools Technology is a skip year.

A. Mission Description and Budget Item Justification

This Program Element (PE) is aligned to the Network and Assured Positioning, Navigation, & Timing (APNT) Army Modernization Priorities. This PE investigates technologies, techniques, components and tools to provide an Army tactical network and enabling infrastructure that support Multi-Domain operations in contested, congested, degraded, and/or denied environments. This is accomplished through the design and development of technologies and components (e.g., electronic

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	

components, software and protocols) that provide unified transport and are supportable; mobile, and survivable, and robust mission command on the move; assured and secure positioning, navigation, and timing in all environments; converged and coordinated cyber and electronic warfare activities; resilient communication and intelligence, surveillance, and reconnaissance payloads for tactical space and high-altitude platforms, and the collection, processing, and dissemination of intel/ops information into a common operating environment. Commercial technologies are continuously investigated and leveraged where possible.

Work in this PE complements PE 0602143A (Soldier Lethality Technology), PE 0602145A (Next Generation Combat Vehicle 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), PE 0603466A (Air and Missile Defense Advanced Technology), PE 0603463A (Network C3I 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 performed by the United States Army Futures Command, the United States Army Space and Missile Defense Command and the Army Engineer Research and Development Center.

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	212.115	81.618	83.477	-	83.477
Current President's Budget	221.293	81.618	84.576	-	84.576
Total Adjustments	9.178	0.000	1.099	-	1.099
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	10.783	-			
• SBIR/STTR Transfer	-1.605	-			
• Adjustments to Budget Years	-	-	1.099	-	1.099

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BP2: *Sensor and Electronic Network Initiatives (CA)*		
Congressional Add: *Program Increase - Energy Efficient Devices*	10.000	-
Congressional Add: *Program Increase - Anti-Tamper Technology*	25.000	-
Congressional Add: *Program Increase - EW and Advanced Sensing*	6.500	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
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Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Program Increase - Integrated Photonics for Contested RF Environments*	14.000	-
Congressional Add: *Program Increase - Social Network Analysis*	5.000	-
Congressional Add: *Program Increase - BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT*	5.000	-
Congressional Add: *Program Increase - INERTIAL NAVIGATION SYSTEMS*	11.500	-
Congressional Add: *Program Increase - KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY*	1.000	-
Congressional Add: *Program Increase - MAN PORTABLE DOPPLER RADAR*	10.000	-
Congressional Add: *Program Increase - SECURE ELECTRONIC PACKAGING*	10.000	-
Congressional Add: *Program Increase - SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY*	5.000	-
Congressional Add: *Program Increase - WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS*	5.000	-
Congressional Add: *Program Increase - BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS*	9.000	-
Congressional Add: *Program Increase - ALTERNATIVE POSITION, NAVIGATION, AND TIMING*	19.000	-
Congressional Add: *Program Increase - MASS-DISTRIBUTED ACOUSTIC SURVEILLANCE NETWORK*	8.000	-
Congressional Add: *Program Increase - URBAN SUBTERRANEAN MAPPING TECHNOLOGIES*	4.000	-
Congressional Add: *Program Increase - AI/ML Materials for Sensors and Electronics*	7.000	-
Congressional Add Subtotals for Project: BP2	155.000	-
Congressional Add Totals for all Projects	155.000	-

Change Summary Explanation

Increase funding reflects planned research to examine newly emerging quantum sensor architecture; investigate Free Space Optics (FSO) capabilities; design and develop classified RF training data sets; investigate non-GNSS RF sources, analog neural blocks and novel time transfer techniques/concepts.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AM6 *I Modular RF Communications Technology*	
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AM6: *Modular RF Communications Technology*	-	-	5.986	8.335	-	8.335	-	-	3.507	12.835	0.000	30.663

A. Mission Description and Budget Item Justification

This Project investigates and develops techniques, methods, and standards for automation and intelligence to optimally broadcast data among available radio frequency (RF) and networking technologies. This Project adds resiliency to the network through diversity and automation techniques to make automated network decisions (e.g., automated Primary, Alternate, Contingency, and Emergency (PACE)) for the tactical Army to maintain operation in continually changing environments.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AM7 (Modular RF 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Predictive Intelligent Network (PIN)	-	5.986	8.335
Description: The effort investigates the Automated PACE plan capability by developing predictive algorithms and using various sources of information to create a resilient and adaptive network configuration that allows continued and secure communications in Anti-Access/Area Denial (A2AD) environments. The PIN predictive algorithms plans the optimal network topology and configuration by leveraging information on network loads, cyber activities, terrain, weather, movement, and RF situational awareness. In addition, this effort leverages and disseminates RF sensing electronic support information for use by operational forces, to coordinate and enable continued communications through electronic and navigation warfare effects. *FY 2024 Plans:* Will investigate the use of Artificial Intelligence/ Machine Learning (AI/ML) techniques to proactively respond to negative network anomalies before they occur by monitoring and processing information such as traffic patterns, congestion conditions, routing patterns and routing stability, movement patterns, and RF information from various sensors and detected cyber events; perform a simulation study to inform decisions on applying detected cyber activities to influence the selection of transports or selection of radio modalities to further protect communications in challenging environments; investigate the use of the prediction and automated PACE decision engines to provide resilient communications for aspects of electronic and navigation warfare missions, to include electronic protection, electronic support and electronic attack; investigate the use of the automated PACE capability to facilitate the transmission of electronic support data to planning and management tools; investigate use cases in which			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
the predictive and automated PACE decision engines can enable continued communications through electronic attack and disseminate electronic support information for use by operational forces. *FY 2025 Plans:* Will investigate fielded sensors, sensor data collection systems, and the platforms on which they reside to determine the types of RF situational awareness information available for use in predictive algorithms; determine the current state-of-the-art for network prediction from the Army, Joint Service, and industry partners; will further refine understanding of algorithm performance, limitations, and computational requirements. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned milestones for investigation of fielded sensors, sensor data collection systems, and the platforms they reside in, as well as a state-of-the-art Network Prediction study. In Fiscal Year (FY) 2025 this project is realigned from Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AM7 (Modular RF Communications Advanced Technology).			
Accomplishments/Planned Programs Subtotals	-	5.986	8.335

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AM8 *I Protected SATCOM Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AM8: *Protected SATCOM Technology*	-	-	6.599	6.510	-	6.510	3.659	2.238	6.513	12.023	0.000	37.542

A. Mission Description and Budget Item Justification

This Project investigates resiliency of Wideband Satellite Communications (SATCOM) in contested and congested electromagnetic environments. Wideband SATCOM is the primary high-bandwidth Beyond Line of Sight (BLOS) communications used by the tactical Army. This Project designs and develops technologies and components, such as interference cancellation, to increase availability and reliability of Wideband SATCOM in spectrum-challenged environments.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AM9 (Protected SATCOM 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 Command, Control, Computer, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Multi-Orbit Modem (MOM) *Description:* This effort designs and develops Satellite Communications (SATCOM) ground terminal modem and management technology components to enable operation over multiple satellite constellations to increase performance and resiliency of wideband SATCOM in contested and congested electromagnetic environments. Modem components will include a software based terminal controller for modem management, repository of modem waveforms, and supporting network management. This effort develops resiliency through a flexible modem technology investigation and is complementary with Protected SATCOM efforts focused on antenna development. *FY 2024 Plans:* Will investigate a SATCOM Multi-Orbit-Modem system of systems architecture through modeling and simulations that improves size, weight, and power requirements to access current SATCOM orbit constellations and integrate with SATCOM aperture technologies; validate modem architecture in relevant test events coordinated with stakeholders for initial single beam operations capabilities; investigate Multi-Orbit-Modem system, to determine initial requirements for simultaneous multi-beam capabilities both current and emerging SATCOM constellation; validate an integrated modem system to include an integrated virtual software environment with hardware based integrated circuit. *FY 2025 Plans:* Will investigate virtualization/containerization of waveforms and use of a 3U Virtual Path Cross-Connect (VPX) carrier card for Application Specific Integrated circuit (ASIC)-based waveforms;	-	6.599	6.510

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AM8 *I Protected SATCOM Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
investigate path to Digital-IF (DIFI) for analog-based waveforms; mature management and control system technology as applicable to satellite communications waveforms. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Minor funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	-	6.599	6.510

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*				**Project (Number/Name)** AN3 / *Non Traditional Waveforms Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AN3: *Non Traditional Waveforms Technology*	-	3.290	14.000	10.069	-	10.069	7.545	2.614	-	-	0.000	37.518

A. Mission Description and Budget Item Justification

This Project investigates non-traditional protocols and technologies to provide spectrum efficiency, high bandwidth, low latency, lower spectrum footprint, and/or anti-jam capabilities to tactical networks. This Project develops network resiliency for the dismounted and vehicular units through science & technology investigation.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AN4 (Non-Traditional Waveforms 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: 5G Technologies *Description:* This effort investigates the use of 5G communication services and associated technologies to support high bandwidth, low latency communications for tactical environments with mobile infrastructures.	3.290	-	-
Title: Tactical Application of Advanced Comms *Description:* This effort investigates the use of commercial communication services and associated technologies to support high bandwidth, low latency communications for tactical environments with mobile infrastructures. This effort will leverage the latest semi-conductor material research to enable compact antenna aperture designs that provide output power and/or broader frequency coverage required to support aerial platforms performing relay mission in support of non-line-of sight applications without increasing the overall SWAP. *FY 2024 Plans:* Will investigate tactically relevant advanced communications capabilities for air-to-ground and mature communications components such as antennas and waveforms. Will continue incorporation of anti-jam and LPI / LPD and increase network robustness through spectrum diversity and efficiency across dispersed nodes and different terrain types. *FY 2024 to FY 2025 Increase/Decrease Statement:*	-	2.946	-

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AN3 *I Non Traditional Waveforms Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned conclusion of this effort.			
Title: Spectrum Superstorm	-	1.857	2.033
Description: This effort investigates the use of obfuscation and technical effects in the radio frequency spectrum using distributed and dispersed techniques to coordinate signal effects against adversaries from distant transmitters. This effort enables Army emitters to operate free from adversary geolocation attempts through technical effect applications. ***FY 2024 Plans:*** Will investigate the use of distributed techniques, such as coherent and adaptive beamforming for technical effects. Will develop methods of obfuscating the spectrum while providing awareness and coordination with spectrum activities of blue forces. Will research multiple-input multiple-output (MIMO) algorithms aiming to have single obfuscation nodes appears as many systems on the battlefield. ***FY 2025 Plans:*** Will develop orchestration software to dynamically manage RF emissions with emphasis on proof of concept of command and control and incorporating feedback from vendor commercial off the shelf hardware; demonstrate minimum viable product over the air. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Relay for Aerial to Non-line-of-sight Ground Environments (RANGE)	-	6.580	-
Description: This effort investigates the use of aerial platforms as communications relays ensuring communications coverage is maintained in non-line-of-sight (NLOS) environments, while considering communications resiliency such as anti-jam and low probability of detection. This effort will mature covert, multiband, and embedded antenna elements using new antenna materials for compact antenna aperture designs. ***FY 2024 Plans:*** Will investigate small form factor aerial relay communications payloads capable of enabling both low-band (e.g. L-band (1-2 GHz)/ S-band (2-4 GHz)/C-band (4-8 GHz)) and high-band (e.g. millimeter-wave (30-300 GHz)) operations. Will mature directional communications components and determine applicability of novel waveforms and antennas for aerial relay. Will develop novel software and hardware for tracking and steering directional links. Will design and develop new antenna apertures. Will validate spatial low probability of detection is effective versus the threat using modeling and simulation. Will investigate impact of directional communications on spectrum re-use in congested and contested frequency bands. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned conclusion of this effort.			
Title: Quantum Sensing	-	2.617	4.930
Description: This effort investigates the use of novel quantum-enhanced spectral receivers capable of wideband sensing of extremely low power signals at very large standoff distances. This effort matures quantum component technologies for use in very high receiver sensitivity. This effort designs and develops tactically relevant quantum sensors, considering form-factor, size, weight, power, and receiver performance. ***FY 2024 Plans:*** Will investigate Josephson Junction (JJ) and Rydberg receiver quantum sensor technologies via modeling and simulation. Will begin development of classical auxiliary components to support and enable quantum sensors for tactical Army applications. Will validate range of frequencies in which Rydberg sensors can reliably detect signals. Will investigate optimal frequency bands for both Rydberg and JJ quantum receivers. Will investigate methods to continue to improve the sensitivity to detect even weaker signals and expand detection protocols for more complicated waveforms. ***FY 2025 Plans:*** Will develop improved modeling and simulation of Josephson Junction and Rydberg receiver quantum sensor technologies with increased fidelity, additional capabilities, and/or increased model scope. Will investigate non-traditional system configurations such as hybrid sensors and external accessories to enhance capability for targeted applications. Will conduct experiments to characterize performance limitations of quantum sensors and their auxiliary components including response to environmental conditions. Will mature classical auxiliary components as necessary to achieve the receiver sensitivity and spectrum agility of quantum sensors. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned milestone investigations to examine newly emerging quantum sensor architecture concepts, which will enable performance optimization and risk mitigation for the future architecture design of the hardware.			
Title: Extremely High Bandwidth Communications (ExHiBComm)	-	-	3.106
Description: This effort develops communication systems capable of 100X today's data rates while providing spatial low probability of intercept and low probability of detection to the links due to extremely high frequencies of operation. This effort will generate two products: Free Space Optics (FSO) and access points supporting multiple users with extremely high bandwidth. ExHibComm will target on-the-move ground links, but it can support ground to air, ground to space, air to air and air to space applications, enabling multi domain operations. ExHiBComm solves the challenge of spectrum scarcity and enables links anywhere in the world without the need of frequency clearances. ***FY 2025 Plans:***			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*	**Project (Number/Name)** AN3 / *Non Traditional Waveforms Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will conduct an analysis of alternatives to investigate Free Space Optics (FSO) capabilities when mounted on a mobile platform. Will determine the capabilities and limitations for FSO systems to perform 360-degree sector scanning to track well and maintain connectivity while a vehicular platform is on-the-move. Will conduct experiments to assess the capabilities of the FSO system on frequency transport legacy communication radios, enable multipoint operations and fail over with a primary, alternate, contingency and emergency (PACE) communication plan. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In FY2025, expansion of communication efforts throughout the program element and funding will be utilized to conduct an analysis of alternatives to investigate FSO capabilities and experimentation to assess the capabilities of the FSO system.			
Accomplishments/Planned Programs Subtotals	3.290	14.000	10.069

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 I 2					R-1 Program Element (Number/Name) PE 0602146A I *Network C3I Technology*				Project (Number/Name) AN7 I *COE - Every Receiver is a Sensor Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AN7: *COE - Every Receiver is a Sensor Technology*	-	2.450	1.044	-	-	-	-	2.124	2.147	2.168	0.000	9.933

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 Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AN8 (COE - Every Receiver is a Sensor Advanced Tech) and PE 0602146A (Network C3I Technology) / Project AN9 (UNT - Every Receiver is a 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Intelligence Surveillance and Recognizance (ISR) Optimization for MDO Support Technology	2.450	1.044	-
Description: This effort investigates and designs Intelligence Surveillance and Reconnaissance (ISR) collection management technologies and analytics to enhance performance and optimize use of Army ISR resources during multi-domain operations (MDO). Efforts focus on developing the analytics necessary to increase situational awareness of non-organic collections across all domains (Air, Land, Maritime, Space, Cyber and Electromagnetic spectrum), determine highest payoff use of tactical ISR assets, and optimize sensor selection and placement to answer unit intelligence requirements. *FY 2024 Plans:* Will develop threat forecasting technologies to validate derivation of prioritized collection requirements to optimize application of Army ISR resources during MDO in contested environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding change reflects planned lifecycle conclusion of this Science and Technology effort.			
Accomplishments/Planned Programs Subtotals	2.450	1.044	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AN7 *I COE - Every Receiver is a Sensor Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*					**Project (Number/Name)** AN9 *I UNT - Every Receiver is a Sensor Technology*	

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AN9: *UNT - Every Receiver is a Sensor Technology*	-	1.998	2.115	4.624	-	4.624	11.045	8.129	6.713	6.141	0.000	40.765

A. Mission Description and Budget Item Justification

This Project develops algorithms that enable every communication receiver in the tactical environment to operate as a sensor while maintaining the systems' original networking capability. This Project matures standards and protocols to expand the Cyber-Electromagnetic Activity (CEMA) situational understanding. This Project extends Army's deep sensing capability by improving simultaneous functionality, leveraging all potential sensing assets within the area of operations and supporting real time feedback of mission effectiveness.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO1 (UNT - Every Receiver is a Sensor Advanced Tech) and PE 0602146A (Network C3I Technology) / Project AN7 (COE - Every Receiver is a 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Multi-Int Modernization Combined Architecture (MIMCA) *Description:* This effort investigates optimization of radio frequency transmit and receive resources to conduct simultaneous electronic warfare (EW), signals intelligence (SIGINT) and offensive cyber missions. Efforts will leverage low power interference techniques adapted to high power applications to reduce interference from co-located capabilities on multifunction systems and novel resource scheduling characteristics to execute Cyber and ElectroMagnetic Activities (CEMA) and support real-time feedback such as Battle Damage Assessment (BDA) and adaptive Electronic Attack (EA). *FY 2024 Plans:* Will leverage interference mitigation techniques primarily designed for low power systems and investigate their feasibility to support multifunction operations; investigate applications for sensor assets that operate in the same portion of the spectrum. *FY 2025 Plans:* Will mature commercial interference mitigation concepts that operate with high power multifunction systems to increase the efficiency of Radio Frequency (RF) spectrum resources; design of multifunction scheduling interfaces to ensure compatibility with the commercial interference mitigation technology. *FY 2024 to FY 2025 Increase/Decrease Statement:*	1.998	2.115	2.119

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AN9 *I UNT - Every Receiver is a Sensor Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase is an economic adjustment.			
Title: Army SIGINT Modernization	-	-	2.505
Description: This effort will investigate and develop Radio Frequency (RF) signal analysis and processing techniques to improve detection, identification, and exploitation of high priority peer/near-peer adversary military signals. Effort will significantly increase detection and parameterization of unknown signals, improving battlespace operations in contested Radio Frequency (RF) environments. *FY 2025 Plans:* Will design detection, classification, direction finding, and multi-channel adaptive beamforming techniques for peer/near-peer adversary military RF signals; conduct experiments to validate technique performance metrics to quantify algorithm robustness against various RF environments and scenarios. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort. Funds realigned from PE 0603457 (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology) and PE 0603463 (Network C3I Advanced Technology) / Project AO1 (UNT - Every Receiver is a Sensor Advanced Tech).			
Accomplishments/Planned Programs Subtotals	1.998	2.115	4.624

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602146A I Network C3I Technology					Project (Number/Name) AO4 I Energy Efficient Devices Technology			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AO4: Energy Efficient Devices Technology	-	5.280	5.589	7.159	-	7.159	9.377	11.385	11.948	11.013	0.000	61.751

A. Mission Description and Budget Item Justification

This Project addresses sustainment operations by unburdening the Soldier and reducing logistics requirements (e.g., fewer batteries) for communications, computing, and sensing. The objective is to investigate the underlying energy efficiency of supply and demand for Soldier-portable and distributed sensor electronics to enable the dismounted Soldier to maintain communications, freedom of movement, and increase mission duration. The majority of the electronics power used by the dismounted Soldier and by distributed electronics is attributable to radio frequency (RF) communications. In addition, freedom of movement and action during sustained and high tempo operations requires seamless battery recharging. To address these challenges, energy efficient electronics research includes RF and optoelectronic circuits, devices, materials and wireless power (and data) transfer.

Work in this Project complements Program Element (PE) 0602146A (Network C3I Technology) / Project AN3 (Non-Traditional Waveforms Technology), PE 0602143A (Soldier Lethality Technology) / Project BD8 (Soldier & Sm Unit Tactical Energy Tech), and PE 0601102A (Defense Research Sciences) / Project AA9 (Information and Networking).

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Energy Efficient Electronic and Photonic Components	5.280	5.589	5.656
Description: This effort investigates energy efficiency improvements in support of four key areas: RF component devices, optoelectronic devices for alternative communications modes, long-lived and high efficiency power sources, and efficient wireless power and data transfer technologies. These components enable energy-efficient communications and networked energy, specifically leading to increased Soldier mission duration and long-lived networked electronics. FY 2024 Plans: Will investigate approaches to increase efficiency in Ultraviolet (UV) sources for communications; conduct research of 'time folding' radio frequency (RF) circuits for efficient operation of small size, weight and power (SWaP) systems, encompassing techniques for increasing the RF power in short pulses, while utilizing charging from a small battery; investigate power density limitations of textured silicon carbide betavoltaic devices coupled with nickel-63 radioisotope beta emission; design piezoelectric transformer for temperature robustness as well as model and experimentally assess wake-up receiver sensitivity as a function of			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*	**Project (Number/Name)** AO4 / *Energy Efficient Devices Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
operation frequency and power draw; continue to investigate novel silicon based field programmable neural array circuit with in-memory computing for efficient computation close to the network edge. *FY 2025 Plans:* Will mature novel silicon-based reprogrammable neural array circuitry components to include refinement of arithmetic logic units, memory, routing, and timing for efficient inferencing close to the network edge; investigate and develop novel materials and heterostructures to natively embed mathematical integration of spiking signals for efficient neural networks; investigate semiconductor and scintillator materials that can efficiently convert ions into electrical output in compact power sources; assess self-detachable receiver with improved power transfer and magnetic attachment for acoustic through metal power transfer; investigate novel architectures such as super-luminescent designs to increase Ultraviolet (UV) source output power and efficiency for communications; investigate novel high efficiency high performance transceivers using high-voltage wide bandgap and ultra-wide bandgap semiconductor materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Tactical Edge Cognitive Computing (TECC) *Description:* This effort investigates innovative microelectronic designs that incorporate spiking neural network devices with state-of-the-art digital electronics. Novel physical material processing methods will enable the incorporation of emerging materials for spiking neural networks into complementary metal-oxide semiconductor (CMOS) foundries and circuit structures to enable hardware configuration to different neural networks. Models of spiking devices and circuits guide the translation of mathematical spiking neural networks into state-of-the-art neuron hardware. These designs are combined with state-of-the-art digital electronics to enable highly efficient artificial intelligence on sensors, radios and/or other Army systems. *FY 2025 Plans:* Will investigate incorporating analog neural blocks alongside digital neural blocks using state-of-the-art microelectronics approaches; incorporate specific inferencing neural networks into the microchips for assessment and proof of concept; mature processes for ferroelectric oxides to enable non-volatile spike integration in legacy CMOS; develop automated design techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding realigned from Program Element (PE) 0602145A (Next Generation Combat Vehicle Technology) / Project BF8 (Artificial Intelligence & Machine Learning Tech) and PE 0602181A (All Domain Convergence Applied Research) / Project CM7 (Collaborative Convergence Applied Research) to this effort.	-	-	1.503
Accomplishments/Planned Programs Subtotals	5.280	5.589	7.159

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) AO4 / Energy Efficient Devices Technology

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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| Appropriation/Budget Activity
2040 / 2 | | | | R-1 Program Element (Number/Name)
PE 0602146A / *Network C3I Technology* | | | | | Project (Number/Name)
AP5 / *Electronic Warfare Technology* | | | |

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AP5: *Electronic Warfare Technology*	-	5.230	5.355	5.400	-	5.400	2.879	2.880	2.912	2.941	0.000	27.597

A. Mission Description and Budget Item Justification

This Project investigates emerging technologies   related to Electronic Warfare (EW) applications, non-kinetic survivability/lethality, and emerging concepts of employment in the increasingly contested and congested electromagnetic environment, with the goal of enhancing the survivability/lethality of Army platforms through Electronic Attack (EA), electronic warfare support (ES), and Electronic Protection (EP) with high operational realism for current and future threats being implemented at multiple scales.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO7 (EW for Maneuver Operations (EMO) Adv Tech).

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 Army Research Laboratory (ARL) and Data and Analysis Center (DAC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Electronic Warfare Technology Research ***Description:*** This research investigates emerging Electromagnetic Warfare technologies and novel approaches to apply distributed and combined effects to a broader class of threats, with a goal of adequately degrading threat performance. This effort examines approaches for interdisciplinary laboratory and field experiments with analysis and assessment tools to address survivability and effective countermeasures in a realistic Electromagnetic environment. ***FY 2024 Plans:*** Will investigate cognitive countermeasures to emerging complex and cognitive radar threats whereby reducing reliance on human operators and a priori information; validate effects in multi-channel Hardware-in-the-Loop (HIL) environment thus increasing scenario complexity to enable distributed electronic warfare applications while incorporating a high-level of operational realism; validate indoor HIL simulated results in a relevant outdoor test environment. ***FY 2025 Plans:*** Will validate cognitive countermeasures by improving network-enabled Hardware-in-the-loop (HIL) assessment environment; adapt cognitive algorithms to emerging high performance processing innovations; leverage advancements in generative artificial	2.416	2.499	2.524

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 **/** 2	**R-1 Program Element (Number/Name)** PE 0602146A **/** *Network C3I Technology*	**Project (Number/Name)** AP5 **/** *Electronic Warfare Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
intelligence and reinforcement learning to improve effectiveness of countermeasures against emerging complex emitters and cognitive radar threats. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Electronic Warfare Assessment Technologies ***Description:*** This effort investigates emerging technologies related to EW applications (e.g., digital RF memory, software defined radios, cognitive radars) and electromagnetic-enabled cyberspace operations in the increasingly contested and congested environment. Research is focused on near-peer and future threats to enhance survivability/lethality, and discover critical vulnerabilities, of Army technologies and systems through cyber and electromagnetic activities (CEMA). ***FY 2024 Plans:*** Will develop EW techniques and processes for use as cognitive countermeasures for emerging complex and cognitive radar threats; conduct laboratory, HIL, and field experimentation for assessment of developing technology; mature techniques for low-cost emitting targets and countermeasure assets. ***FY 2025 Plans:*** Will investigate emerging complex threats related to cognitive radars and near peer adversary use of artificial intelligence/machine learning (AI/ML) techniques in radars for identification and classification of targets; develop EW threat emulation capabilities to investigate the effects of emerging radar threats (e.g., cognitive, AI-enabled functions) by conducting laboratory, hardware-in-the-loop, and field experiments of technology; develop metrics to quantify and understand EW effects. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	0.675	0.686	0.690
Title: Combined and Distributed Electromagnetic Warfare (CDEW) ***Description:*** This research investigates emerging Electromagnetic Warfare technologies and novel approaches to apply distributed nodal and combined/coordinated electromagnetic spectrum warfare effects to counter a broader class of threats, with a goal of adequately degrading threat performance, increasing standoff distance to target, and increasing the survivability of US systems contested and complex environments. ***FY 2024 Plans:*** Will investigate, develop, and assess EW techniques requiring the use of distributed apertures; investigate combined and distributed techniques against emerging multi-static emitters; refine and assess a 2-node synchronization technique that includes	2.139	2.170	2.186

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AP5 *I Electronic Warfare Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
feedback electronics to correct node phase in real-time; assess multi-aperture beam-forming performance for improved pointing-angle for electronic support and electronic attack. *FY 2025 Plans:* Will design and build a 5-node, distributed transceiver aperture for electronic attack and benchmark its performance; implement an algorithm to measure the relative position of the distributed nodes without Global Positioning System (GPS); mature the synchronization algorithm for the 5-node architecture; and assess increased power density on a target. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	5.230	5.355	5.400

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AQ2 *I EW Techniques Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AQ2: *EW Techniques Technology*	-	0.513	0.541	3.701	-	3.701	3.706	-	-	-	0.000	8.461

A. Mission Description and Budget Item Justification

This Project develops countermeasures against adversarial counter-fire systems that obscure and create distractive blue force locations. This Project will develop and mature distributed, coordinated electronic warfare (EW) capabilities designed to extend effective range, reduce blue transmitter susceptibility to localization, and introduce errors in adversary intelligence, surveillance and reconnaissance (ISR) systems to facilitate maneuver within multi-domain operations (MDO).

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO7 (EW for Maneuver Operations (EMO) Adv Tech).

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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Simultaneous Counter Measures (CM) for Active Reconnaissance and Surveillance (SCARS) *Description:* This effort will provide investments in Electronic Warfare (EW), against advancing counter-fire sensors. This effort will investigate highly synchronized techniques to achieve advanced effects. *FY 2024 Plans:* Will validate reduced efficacy of adversary counterfire systems to target friendly forces via modeling and simulation; overlay counter ISR and counterfire applications to assess the impact decoy techniques have on adversarial targeting capabilities. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned life cycle conclusion of this Science and Technology effort.	0.513	0.541	-
Title: Sparrow Technology *Description:* This effort will fund research in Electronic Warfare (EW) to impair and/or degrade adversary counter-fire sensor networks. This effort will investigate and mature highly synchronized techniques to simultaneously produce advanced effects against RF systems capable of degrading Army countermeasures (camouflage, concealment, tactics, and other EW capabilities) leaving friendly forces susceptible to detection, location, and kinetic engagement. The hardware and software capabilities developed will provide opportunistic, multiplatform delivery of electromagnetic warfare capabilities that are more challenging for adversaries to mitigate.	-	-	3.701

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AQ2 *I EW Techniques Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2025 Plans: Will perform hardware and software validation supporting the design and development of distributed EW payloads; mature and develop software capabilities on distributed EW payload for specific threat(s). *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of project. In Fiscal Year (FY) 2025, funding is realigned from Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AO7 (EW for Maneuver Operations (EMO) Adv Tech) to this effort.			
Accomplishments/Planned Programs Subtotals	0.513	0.541	3.701

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AQ7 *I High Tempo Data Driven Decision Tools Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AQ7: *High Tempo Data Driven Decision Tools Technology*	-	1.242	1.306	-	-	-	2.359	4.165	3.839	3.879	0.000	16.790

Note

In Fiscal Year (FY) 2025, this Project has a skip year.

A. Mission Description and Budget Item Justification

This Project investigates and develops data driven decision tools that increase operational tempo and allow commanders to dominate decision spaces over adversaries. The tools will provide the commander with contextually relevant data and adaptive decision models. Information and recommendations will be made and disseminated to commander and staff in a cognitively appropriate manner.

Work in this Project complements Program Element (PE) 0603463A Network C3I Advanced Technology / Project AQ8 (High Tempo Data Driven Decision Tools Adv Tech).

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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: RoadRunner	1.242	1.306	-
Description: This effort investigates and develops stakeholder prioritized capabilities that fuse intel and ops perspectives that drive decisions to enable dominance in complex Multi-Domain Operations. Effort will design applications which provide enhanced operations, and intelligence functions through efficient analysis and utilization of battlespace data, and increased speed of action. *FY 2024 Plans:* Will develop fused intel and ops software assisting Commanders and staff by managing time constraints and cognitive limitations to synchronize warfighter functions; validate battle damage assessments and after action reports automatically with proposed force structures and operations; conduct experiments with live and simulated battlespace data and intelligence information, adjusting running estimates by analyzing the changing battlespace OODA loops. *FY 2024 to FY 2025 Increase/Decrease Statement:* This effort completes in FY 2024, in FY 2025 this project is a skip year.			
Accomplishments/Planned Programs Subtotals	1.242	1.306	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AQ7 *I High Tempo Data Driven Decision Tools Technology*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602146A / Network C3I Technology				**Project (Number/Name)** AR5 / Understanding the Environment as a Threat Technolo		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AR5: *Understanding the Environment as a Threat Technolo*	-	1.297	-	-	-	-	-	-	-	-	0.000	1.297

A. Mission Description and Budget Item Justification

This Project designs and advances mission planning software enabling the Soldier to identify, track, and plan for industrial or commercial chemical/environmental threats. Software modules will increase capability of mission based planning technologies providing new operational routing options for mission execution with environmental threat overlays.

Work in this Project complements Program element (PE) 0603463A (Network C3I Advanced Technology) / Project AR6 (Understanding the Environment as a Threat Adv Tech).

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 Engineer Research and Development Center Environmental Laboratory, Geospatial Research Laboratory, and Information Technology Laboratory..

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Subsurface Forensics	1.297	-	-
Description: This effort will prepare Soldiers for the risks of deliberate or accidental release of toxic industrial chemicals and materials by investigating and developing methods to collect data to characterize and predict the fate and transport of hazards of concern.			
Accomplishments/Planned Programs Subtotals	1.297	-	-

C. Other Program Funding Summary ($ in Millions)
N/A
Remarks
N/A

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 *I* 2						R-1 Program Element (Number/Name) PE 0602146A *I Network C3I Technology*			Project (Number/Name) AT7 *I Network-Enabled GeoSpatial-GEOINT Services Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AT7: *Network-Enabled GeoSpatial-GEOINT Services Tech*	-	3.137	2.555	4.045	-	4.045	3.103	3.014	8.924	8.480	0.000	33.258

A. Mission Description and Budget Item Justification

This Project investigates and develops an integrated capability to rapidly share mission critical 3-dimensional (3D) information that supports planning and execution at the Soldier level. This will be achieved through the maturation of next-generation geospatial analytical models for 3D complex urban environment data, delivering enriched understanding of dynamic Operational Environments and distributed to a tactical Common Operating Environment. This Project will result in improved situational awareness and autonomy at low echelons, contributing to increased maneuver and mobility during manned and unmanned teaming operations.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AT8 (Network-Enabled GeoSpatial and GEOINT Services AdvTech).

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 Engineer Research and Development Center Geospatial Research Laboratory, Cold Regions Research and Engineering Laboratory, and Information Technology Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Geospatial Data for Tactical Visualization	1.057	-	-
Description: This effort develops new open source software, data models and processes to generate a vision-based geospatial foundation layer to enable end-users systems to visualize real-time mission critical geospatial content at the required level-of-detail (LOD) and enable position-navigation self-localization capability applicable to end-user devices at required accuracies optimized for the device, application, and mission.			
Title: Geospatial - Intelligence Community Merge Research	1.062	1.675	1.139
Description: This effort researches different approaches to automatically search Intelligence Community (IC) databases to discover and then extract relevant attributes to be added as new metadata to adaptively scaled 3D terrain features and/or geographic areas. Geospatial and relevant intelligence data will be merged together, discoverable, and capable of user-selected query from a single computing environment. An enhanced 3D common operating picture will be demonstrated providing a more comprehensive understanding of the Operational Environment for greater situational awareness and decision making. *FY 2024 Plans:*			

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AT7 *I Network-Enabled GeoSpatial-GEOINT Services Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will develop an automated approach for connectivity and integration of enriched specific geospatial products and selected Intelligence community (IC) databases/schemas for the purpose of developing and refining situational understanding of a triggered or selected situation.?Will investigate automated approaches for designation of intelligence search terms that will spawn discovery, or automated processing, of geospatial/GeoINT products that improve situational understanding. *FY 2025 Plans:* Will investigate GIS mapping software deployment for mesh and intelligence attributes and explore other types of information with geographics (or derivable location) that can be fused on mesh data. Will develop software for automated crawling, discovery, and extraction of IC database attributes and appending of these attributes as new 3D model metadata. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned completion of workflows required to complete software development in Fiscal Year 2025.			
Title: Geospatially Relevant Intuitive Propagation Services Technology *Description:* This effort researches a novel expert propagation model to integrate battlefield sensor data with environmental predictive modeling (weather and terrain influences). The resulting technology will optimize collection asset employment against adversaries as well as providing situational awareness of friendly units' multi-modal signature footprint (e.g. radio frequency, thermal, acoustic). This effort will significantly reduce the analyst cognitive load, and fill an important need for fused, validated, environment and terrain-aware analyses for multi-modal sensors in support of C2, Intelligence and Protection Warfighting Functions. *FY 2024 Plans:* Will design realistic use cases within the Common Operating Environment to evaluate and gather relevant data and submit sensor performance analysis requests to optimize collection assets. *FY 2025 Plans:* Will develop multi-modality software to take real-time cues from the sensor network and publish sensor performance results back to the Sensor Compute Environment producing geospatial data discoverable within Army devices. Will integrate fractional line of sight algorithms into the Geospatial Relevant Intuitive Propagation Services (GRIPS) sensor performance modeling environment. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned milestones for the development of capabilities integrated with sensor networks to enable full automation from discovery to output.	1.018	0.880	2.404
Title: Terrain & Battlefield Computing, Optimized Network Computing Resources *Description:* This effort investigates the Army's network ability to provide appropriate resources for geospatial data to include tools that require a wide range of data volumes (from low to very heavy), and as a consequence, may incur significant	-	-	0.502

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AT7 *I Network-Enabled GeoSpatial-GEOINT Services Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
computational costs. The goal is to develop a simulation testbed for geospatial tools under different network configurations and application scenarios. The simulation testbed will measure and inform network requirements that can accommodate geospatial products downstream and as far out as necessary. *FY 2025 Plans:* Will research and assess geospatial tools that perform machine learning, require medium-to-high data volumes, and enable visualization. Will investigate computing environments based on hardware capabilities (server, desktops, small devices). Will determine access and permissions to existing networks that will be targeted for deployment and design initial testbed specifications for simulation based on targeted tools. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.			
Accomplishments/Planned Programs Subtotals	3.137	2.555	4.045

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*				**Project (Number/Name)** AT9 / *Tactical GeoSpatial Information Capabilities Techn*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AT9: *Tactical GeoSpatial Information Capabilities Techn*	-	0.499	2.717	2.069	-	2.069	2.962	2.225	4.155	2.955	0.000	17.582

A. Mission Description and Budget Item Justification

This Project investigates and develops next generation geospatial analytical tools for 3-dimensional complex environments for low echelon and tactical edge exploitation. Research focuses on improving geospatial and Geospatial Intelligence (GEOINT) aspects of situational awareness in the complex environments by exploiting new data sources, automating analytical tasks, and testing new collection technologies, including interiors of infrastructure. Research develops capabilities to enhance/update provisioned (baseline) standard, sharable, geospatial foundation (SSGF) data through automated analytics on multi-sourced spatial data resulting in streamlined, enhanced 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.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AU1 (Tactical GeoSpatial Information Capabilities ATech).

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 Engineer Research and Development Center Geospatial Research Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Geospatial Analytics and Prediction Technology	0.499	2.717	2.069
Description: This effort designs and develops automated/semi-automated geospatial tools implementing spatial/temporal data analysis, creation of predictive scenarios, anomaly detection and cross-scale and local scale analysis of terrain.			
FY 2024 Plans: Will develop a high resolution 3-Dimensional workflow from building interiors and subterranean spaces. Will investigate temporal nature of landscape and anomaly detection and cross-scale analysis of terrain.			
FY 2025 Plans: Will conduct investigations of terrain and scenario forecasting for integrated effects of changing terrain, in support of anticipatory decision making. Will advance spatial-temporal and cross-scale analysis of terrain to identify regions requiring additional surveillance and generate seasonally adjusted layers.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*	**Project (Number/Name)** AT9 / *Tactical GeoSpatial Information Capabilities Techn*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding decrease reflects the planned reduction of workflows as technologies transition to Program Element 0603463A (Network C3I Advanced Tech) / Project AU1 (Tactical GeoSpatial Information Capabilities ATech).			
Accomplishments/Planned Programs Subtotals	0.499	2.717	2.069

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*						**Project (Number/Name)** AV3 *I Foundational S&T for Network C3I Technology*	

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AV3: *Foundational S&T for Network C3I Technology*	-	0.001	-	-	-	-	-	-	-	-	0.000	0.001

A. Mission Description and Budget Item Justification

This Project develops underlying technologies applicable to artificial intelligent agents and holistic network integration as applied to, but not limited to autonomous manned-unmanned teaming for ground and air platforms. This Project also matures emerging research leading to potential technology development in areas of strategic importance to the Army in network technologies, by bringing competitively selected Universities with research teams into Technical Alliances.

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

Research in this Project is performed by the United States Army Futures Command (AFC).

Research in this project is done in coordination with PE 0603463A (Network C3I Advanced Technology) / Project AV4 (Foundational S&T for Network C3I Advanced Tech).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Development of Disruptive, Innovative Research for Emerging (DIRE) Applied Network Capabilities *Description:* This effort develops innovative network capabilities using a rapid and agile methodology to examine feasibility of incorporation into Army network problem sets.	0.001	-	-
Accomplishments/Planned Programs Subtotals	0.001	-	-

C. Other Program Funding Summary ($ in Millions)
N/A
Remarks

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AV5 *I Protective Technologies*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AV5: *Protective Technologies*	-	6.236	6.553	5.307	-	5.307	5.312	5.315	5.373	5.428	0.000	39.524

Note

AV5/Protective Technologies restructured -In Fiscal Year (FY) 2025, funding is restructured to Program Element (PE) 0603462 (C3I Advanced Technology) / Project DI6 (Anti-Tamper Adv Tech Dev).

A. Mission Description and Budget Item Justification

This Project develops Anti-Tamper tools, devices, and techniques to protect acquisition program systems' Critical Program Information (CPI) from continually evolving adversarial reverse engineering/exploitation threats due to battlefield loss and foreign sale. Loss of CPI will impact the ability of these systems to maintain US overmatch capabilities.

Research in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project DI6 (Anti-Tamper Advanced Tech Development)

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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Protective Technologies	6.236	6.553	-
Description: This effort develops tools, devices, and techniques to protect acquisition program systems' Critical Program Information (CPI) from adversarial reverse engineering/exploitation threats due to battlefield loss and foreign sale. Loss of CPI will impact the ability of these systems to maintain US overmatch capabilities. ***FY 2024 Plans:*** Will continue to explore the latest exploitation threats faced by DoD and Army weapons systems and focus design and development efforts toward new protective technologies to be made available to Army and DoD weapons system programs and their developers in meeting their Ant-Tamper requirements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025, funding is restructured to Program Element (PE) 0603462 (C3I Advanced Technology) / Project DI6 (Anti-Tamper Adv Tech Dev).			
Title: Anti-Tamper Technology Development	-	-	5.307
Description: This task continues the development of anti-tamper tools, devices, and techniques to protect acquisition program systems' (CPI) from adversarial reverse engineering/exploitation threats due to battlefield loss and foreign sale. Loss of CPI will			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AV5 *I Protective Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
impact the ability of these systems to maintain US overmatch capabilities. Such tools, devices and techniques are not readily available for use by US Army and DoD programs to use in their systems. *FY 2025 Plans:* Will develop advanced microelectronics-based security solutions for anti-tamper application to address emerging adversarial threats. Will evaluate new anti-tamper technologies for integration in Army and DoD systems to protect critical technology with improved resilience to exploitation. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects restructure from task Protective Technologies within this project.			
Accomplishments/Planned Programs Subtotals	6.236	6.553	5.307

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AV9 *I Advanced PNT for GPS Independent Environments Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AV9: *Advanced PNT for GPS Independent Environments Tech*	-	8.829	9.022	8.062	-	8.062	8.020	8.776	8.871	8.960	0.000	60.540

A. Mission Description and Budget Item Justification

This Project develops technologies that will enable precise and assured Positioning, Navigation, and Timing (PNT) in Global Positioning System (GPS)-denied environments by addressing the PNT's toughest Scenario - Scenario 4 (no available GPS signal during the mission duration) with a goal of enabling Soldier missions of up to seven days in a GPS denied environment. This is achieved by researching advanced quantum timing circuits, advanced inertial measurement unit (IMU) components, multi-sensor modalities, perception techniques, geo-location data, vision aided navigation sensors, and available radio frequency (RF) signals.

This work also addresses the PNT Scenario 1 (GPS operations that start well and have degraded GPS signals throughout the mission duration) through Scenario 3 (GPS operations that have bad or limited availability of GPS signals throughout the entire mission). This is achieved by investigating the ability to transmit jam- resistant, precision timing synchronized signals using optical fibers, free-space using lasers, and in the RF domain using innovative RF antenna concepts to extend the reach of Soldier compatible capabilities in heavily contested GPS environments.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Modular GPS Independent Sensors Advanced Tech) and Program Element (PE) 0602146A (Network C3I Technology) / Project AW5 (Modular GPS Independent Sensors 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Precision Measurement Technology for Contested Environments	3.260	3.309	2.464
Description: This effort will develop technologies that will enable precise and assured PNT in GPS-denied environments for extended durations. This research will improve the accuracy while also focusing on size, weight, power, cost (SWAP-C) of current IMUs to advance capability at the tactical edge to include sUAS and dismounts. This effort will address the design, fabrication, and assessment of novel micro-electromechanical system (MEMS) sensor designs and materials and the integration of multiple sensor modalities with the IMUs using sensor fusion and perception techniques to reduce drift and increase positional accuracy. Research will also include the ability to transmit jam-resistant precision position, navigation, and timing signals via electro-optical and/or RF transmission methods. *FY 2024 Plans:*			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AV9 *I Advanced PNT for GPS Independent Environments Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will fabricate, characterize, and optimize micro-electromechanical systems (MEMS) gyroscopes and accelerometers with novel self-calibration techniques; apply inertial measurement unit (IMU) system-level modeling techniques to determine expected performance improvements due to novel materials and calibration techniques; validate inertial sensor performance improvements with integrated control electronics; design, fabricate, and characterize performance of resonators and inertial sensors leveraging novel piezoelectric materials. *FY 2025 Plans:* Will assess performance limits of micro-electromechanical systems (MEMS) inertial sensors with novel self-calibration and tuning methods based on integrated novel piezoelectric materials; investigate new high-quality-factor structural materials for next-generation inertial sensors; validate inertial measurement unit (IMU) system-level modeling techniques for multiple degrees of freedom. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects reduction of research in the area of inertial sensors and optical designs for MEMs.			
Title: Quantum Effects for Assured PNT in Zero-GPS Environments *Description:* This effort will research SWAP-C quantum based timing sub-systems, incorporate advanced sensors, RF signals (beyond GPS), navigation databases, and advanced algorithms. This effort incorporates advanced quantum timing circuits, advanced IMU components, multi-sensor modalities, perception techniques, geolocation data, vision aided navigation sensors, and available RF signals in order to increase precise and assured PNT operations in a GPS denied environments for up to seven days. *FY 2024 Plans:* Will validate and integrate novel PNT sensors with hybrid, modular multi-sensor fusion engine; develop and optimize novel algorithms and architecture for sensor fusion state estimation; continue to develop self-stabilization circuitry for frequency stabilization of micro-resonator optical frequency combs; design and develop integration techniques for micro-resonator optical frequency combs, injection-locked laser, and self-stabilization circuit that enable low-SWAP chip-scale optical clocks/oscillators; develop low SWAP-C optical transmit/receive unit for free-space optical positioning and time transfer. *FY 2025 Plans:* Will investigate optimized algorithms and architecture for modular positioning, navigation, and timing (PNT) sensor fusion state estimation; down-select self-stabilization circuitry architecture for frequency stabilization of micro-resonator optical frequency combs; assess integration techniques for micro-resonator optical frequency combs, injection-locked laser, and self-stabilization	5.569	5.713	5.598

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AV9 *I Advanced PNT for GPS Independent Environments Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
circuit that enable low-SWAP chip-scale optical clocks/oscillators; investigate performance of low SWAP-C optical transmit/receive unit for free-space optical positioning and time transfer. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	8.829	9.022	8.062

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AW1 *I Autonomous Navigation Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AW1: *Autonomous Navigation Technology*	-	1.977	-	1.002	-	1.002	2.848	5.921	3.006	1.904	0.000	16.658

A. Mission Description and Budget Item Justification

This Project investigates use of sensors on the platform and available navigation signals to the localization and decision making of Robotic/Autonomous Systems. Additionally, it examines the use of machine learning algorithms for cooperative navigation to aid in a Positioning, Navigation and Timing (PNT) solution. This will enable the user to achieve operational overmatch in a Global Positioning System (GPS) impeded environment as well as enhanced navigation (reducing dependence on GPS) through challenging terrains. This project investigates and develops techniques and algorithms to provide assured access to PNT in degraded electromagnetic (jamming), space, or cyber environments and notify Soldiers, Systems, and Platforms when PNT cannot be trusted for mission duration. This project seeks to study and develop an innovative, adaptive Navigation Warfare (NAVWAR) electronic attack (EA) capability, both jamming and spoofing, utilizing cooperative platforms to deny adversaries the ability to utilize GNSS receivers, reducing their overall mission effectiveness. The cooperative platforms can defeat advanced Global Navigation Satellite System (GNSS) capabilities, including controlled reception pattern antennas (CRPAs), by creating a diverse and adaptive jamming geometry. Cooperative platforms can leverage their distributed environmental situational awareness to establish and transmit spoofing solutions.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AV8 (Navigation Warfare (NAVWAR) 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 United States Army Space and Missile Defense Technical Center and Command, Control, Computer, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Intelligent Electronic Protect (IEP) *Description:* This effort provides assured access to PNT in degraded electromagnetic (jamming), space, or cyber environments; notifies Soldiers, Systems, and Platforms when PNT cannot be trusted for mission duration; provides Soldiers, Systems, and Platforms a reduction in the likelihood of being spoofed for mission duration; provides unhindered access to military GPS level of accuracy when access to military GPS is unavailable; and facilitates graceful degradation of PNT systems when military GPS is denied or degraded.	1.977	-	-
Title: Positioning, Navigation and Timing (PNT) Defeat Techniques	-	-	0.501

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602146A / *Network C3I Technology*	**Project (Number/Name)** AW1 / *Autonomous Navigation Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort enables simultaneous execution of Electronic Warfare (EW) and PNT defeat missions with more efficient use of available EW/Cyber and Electromagnetic Activities/PNT (EW/CEMA/PNT) resources. It will provide a unique approach to defeat adversary systems utilizing NAVWAR Attack as an embedded mode in EW systems. *FY 2025 Plans:* Will investigate current-state and novel NAVWAR Attack techniques. Will determine the capabilities and limitations of utilizing existing EW systems for NAVWAR Attack. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding realigned from Program Element (PE) 0603041A (All Domain Convergence Advanced Technology) / Project DA4 (All Domain Convergence Engineering & Architectures).			
Title: Resilient NAVWAR Defeat *Description:* This effort provides dynamic and resilient Navigation Warfare (NAVWAR) electronic attack through employing cooperative platforms to deny the adversaries use of GNSS, decrease the adversary's operational effectiveness, and increase blue-force maneuver space. *FY 2025 Plans:* Will conduct a study to quantify this advanced resilient NAVWAR EA capability to include platform market research, optimized geometric diversity, platform formation control, EA techniques, targeting algorithms, and machine learning (ML) parameters. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding realigned from Program Element (PE) 0603041A (All Domain Convergence Advanced Technology) / Project DA4 (All Domain Convergence Engineering & Architectures).	-	-	0.501
Accomplishments/Planned Programs Subtotals	1.977	-	1.002

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** AW5 *I Modular GPS Independent Sensors Technology*	
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AW5: *Modular GPS Independent Sensors Technology*	-	-	-	4.546	-	4.546	6.896	7.297	3.782	6.532	0.000	29.053

Note

In Fiscal Year (FY) 2025, funding was realigned from Project Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Navigation Warfare (Modular GPS Independent Sensors Advanced Tech) and Project AV8 (Navigation Warfare (NAVWAR) Advanced Technology).

A. Mission Description and Budget Item Justification

This Project performs research and development of modular Global Positioning System (GPS)-independent sensors and an open architecture sensor fusion core enabling simple, plug-and-play sensor modules that can be tailored for any platform based on mission needs and requirements. This Project investigates the design of a single receiver that integrates multiple commercial and military signal sources to provide Position Navigation and Timing (PNT) solution effective in contested environments.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Modular GPS Independent Sensors Advanced Tech).

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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Frequency Independent Localization and Time for Enhanced Resiliency (FILTER) ***Description:*** This effort increases the resilience of Position, Navigation and Timing (PNT) systems by enabling them to take advantage of additional, non-Global Navigation Satellite Systems (GNSS) Radio Frequency (RF) sources. This effort investigates the design of a single PNT receiver that integrates multiple commercial and military signal sources to provide a PNT solution that enables operation in contested environments. ***FY 2025 Plans:*** Will begin investigation of non-GNSS RF sources, such as signals of opportunity (SOOPS) and Low Earth Orbit (LEO) satellite system technologies developed by industry and academia, to determine feasibility for use as alternate PNT sources; evaluate	-	-	2.040

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** AW5 *I Modular GPS Independent Sensors Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
selected RF sources performance to determine their position and timing accuracies; conduct experiments with sensor fusion algorithms to incorporate selected RF sources into a single solution. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025, funding was realigned from Project Element (PE) 0603463A (Network C3I Advanced Technology) / Project AV8 (Navigation Warfare (NAVWAR) Advanced Technology).			
Title: Techniques and Algorithms for Cooperative Assured Position, Navigation and Timing (PNT) *Description:* This effort develops techniques for precision time transfer across Army platforms (Soldier, Ground Vehicles, Aviation) to ensure accurate timing down to the most disadvantaged user It will enable provision of cooperative PNT between Army platforms as a core enabler of many warfighter capabilities (Electronic Warfare (EW, Radar, etc.)). Effort increases resilience of PNT systems through usage of additional RF sources reducing the effectiveness of outside interference of congested and contested environments. *FY 2025 Plans:* Will investigate novel time transfer techniques/concepts at nanosecond and picosecond precision levels to develop proof of concept; determine priority application areas for proof of concept cooperative PNT between Army platforms. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025, funding was realigned from Project Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Navigation Warfare (Modular GPS Independent Sensors Advanced Tech).	-	-	2.506
Accomplishments/Planned Programs Subtotals	-	-	4.546

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2				R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology					Project (Number/Name) BP2 / Sensor and Electronic Network Initiatives (CA)			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BP2: *Sensor and Electronic Network Initiatives (CA)*	-	155.000	-	-	-	-	-	-	-	-	0.000	155.000

Note
 Congressional Interest Item funding provided for Sensor and Electronic Network Initiatives.

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding provided for Sensor and Electronic Network Initiatives.

 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 2023	FY 2024
Congressional Add: Program Increase - Energy Efficient Devices	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Energy Efficient Devices		
Congressional Add: Program Increase - Anti-Tamper Technology	25.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Anti-Tamper Technology		
Congressional Add: Program Increase - EW and Advanced Sensing	6.500	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for EW and Advanced Sensing		
Congressional Add: Program Increase - Integrated Photonics for Contested RF Environments	14.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Integrated Photonics for Contested RF Environments		
Congressional Add: Program Increase - Social Network Analysis	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Social Network Analysis		
Congressional Add: Program Increase - BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for BEYOND-LINE-OF-SIGHT NETWORKING ENHANCEMENT		
Congressional Add: Program Increase - INERTIAL NAVIGATION SYSTEMS	11.500	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Inertial Navigation System		
Congressional Add: Program Increase - KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY	1.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for KU-BAND PHASED-ARRAY RADAR EMPLOYING 5G TECHNOLOGY		
Congressional Add: Program Increase - MAN PORTABLE DOPPLER RADAR	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for MAN PORTABLE DOPPLER RADAR		
Congressional Add: Program Increase - SECURE ELECTRONIC PACKAGING	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SECURE ELECTRONIC PACKAGING		
Congressional Add: Program Increase - SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SPECTRUM SHARING AND MANAGEMENT WITH ADAPTIVE AND RECONFIRURABLE TECHNOLOGY		
Congressional Add: Program Increase - WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for WAVEFORM DIVERSITY EXPERIMENTAL RESEARCH FOR SENSORS		
Congressional Add: Program Increase - BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS	9.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for BIOLOGICAL SENSORS FOR REMOTE ENVIRONMENTS		
Congressional Add: Program Increase - ALTERNATIVE POSITION, NAVIGATION, AND TIMING	19.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Alternative Position, Navigation, and Timing		
Congressional Add: Program Increase - MASS-DISTRIBUTED ACOUSTIC SURVEILLANCE NETWORK	8.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) BP2 / Sensor and Electronic Network Initiatives (CA)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for Mass-Distributed Acoustic Surveillance Network		
Congressional Add: Program Increase - URBAN SUBTERRANEAN MAPPING TECHNOLOGIES	4.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Urban Subterranean Mapping Technologies		
Congressional Add: Program Increase - AI/ML Materials for Sensors and Electronics	7.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for AI/ML Materials for Sensors and Electronics		
Congressional Adds Subtotals	155.000	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*					**Project (Number/Name)** CG3 *I Assured PNT Communications Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CG3: *Assured PNT Communications Applied Research*	-	9.833	5.652	4.158	-	4.158	2.867	4.231	4.283	4.332	0.000	35.356

A. Mission Description and Budget Item Justification

This Project designs and develops technologies for Space-enabled, High Altitude (HA) and Counter-Surveillance and Reconnaissance (C-SR) applications to support Army tactical ground forces. The Project focuses on advancing technology discovery and development in key research areas that support Army's access to space-based capabilities, C-SR, quantum science communications and sensing, multi-function and multi-mission applications. This Project supports Tactical Land Component Forces access to Space-enabled and C-SR capabilities for force projection and maneuver through persistent and deep sensing.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CJ8 (Assured PNT Communications Advanced Tech).

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 Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Assured PNT Communications Applied Research	9.833	5.652	-
Description: This effort will design, develop, and validate Space and High Altitude technologies, components, and tools that lead to smaller, lighter, more responsive payloads and applications. These technologies will allow for the rapid integration and development of tactical payloads in support of responsive Space or High Altitude environments. Will develop High Altitude (HA) testbed environment. Will continue classified capability development. Will validate Quantum Entanglement (QE) in the lab.			
FY 2024 Plans: Will develop High Altitude (HA) testbed environment. Will continue classified capability development. Will validate Quantum Entanglement (QE) in the lab.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects administrative realignment to HAYFINS, Quantum Sensing, and Multi-Function RF Applications Research tasks within this project.			
Title: HAYFINS	-	-	1.838

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602146A / Network C3I Technology	Project (Number/Name) CG3 / Assured PNT Communications Applied Research

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort researches and develops a ground-based system supporting Space and Autonomy Modernization priorities by fusing protection technologies with legacy systems that provide multi-modal capabilities to the Army to enhance freedom of maneuver supporting Multi-Domain Operations (MDO). This provides a tailored selection and application of multi-layered active and passive measures. *FY 2025 Plans:* Will validate component levels in the lab through integration and simulated testing of components. Investigate concept of component analysis. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects administrative realignment from the Assured PNT Communications Applied Research task within this project			
Title: Quantum Sensing *Description:* This effort investigates quantum sensing technologies for application to Army missions and matures capabilities to experimentally validate applications to the Army sensing missions. This effort will validate Quantum based Radio Frequency (RF) and Electro Optical (EO) architectures for enhancing Army sensor performance standards with particular interests in radar, deep sensing missions, Low Probability of Intercept/Low probability of Detection (LPI/LPD) signals acquisition and transmission, environmental characterizations, and traditional sensor sensitivity enhancements. *FY 2025 Plans:* Will design and develop a quantum sensing technology applicable to Army sensing missions. Will mature sensing components to enhance traditional sensing capabilities. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects administrative realignment from the Assured PNT Communications Applied Research task within this project.	-	-	0.600
Title: Multi-Function RF Applications Research *Description:* This effort investigates multi-function Radio Frequency (RF) systems for Army missions. Design and develop a flexible configuration enabling multi-mission applications utilizing single or multi-antenna configurations. This effort will validate the complex combinations of multi-antenna configurations, and multi-mission waveforms for enhancements to traditional sensor modalities such as radar, communications and other missions. Components will be matured enabling optimal combinations of RF architectures to enhance traditional sensor and RF system performances (e.g., enhanced receiver sensitivities, enhanced sensing distances, enhanced simultaneous multi-mission performance metrics, and more).	-	-	1.720

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** CG3 *I Assured PNT Communications Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2025 Plans: Will design and develop an architecture capable of supporting multiple Army missions, investigate waveforms and system configurations to optimize the independent missions from the multi-function system. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects administrative realignment from the Assured PNT Communications Applied Research task within this project.			
Accomplishments/Planned Programs Subtotals	9.833	5.652	4.158

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** CI3 *I Mobile and Survivable Command Post (MASCP) Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CI3: *Mobile and Survivable Command Post (MASCP) Tech*	-	5.540	3.268	2.375	-	2.375	2.378	2.380	-	-	0.000	15.941

A. Mission Description and Budget Item Justification

This Project develops and investigates emerging communications, tactical cloud, distributed computing, power management and storage, and shielding materials necessary to improve Command Post (CP) survivability and effectiveness for near-peer Multi-Domain Operations (MDO) engagements.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).

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.

Work in this Project is performed by the Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center and Soldier Center (SC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: CP Modularity and Dispersion Technology	2.554	2.657	-
Description: Funds research to enable CP's to reconfigure and reconstitute at speeds consistent with a near-peer MDO engagement. Investigates emerging low probability of interception (LPI)/low probability of detection (LPD) radio technologies, distributed computing, tactical data and security architectures, and distributed collaboration methods. Develops mobile, and integrated power systems that enable CP's to disperse geographically and create extended at-the-halt and on-the-move command and control. *FY 2024 Plans:* Will mature technology solutions applicable to CP survivability (e.g., resilient communications, adaptable computing infrastructure, advanced energy sources and smart distribution); design and develop dispersed Command Post node communications with resilient (e.g. anti-jam, low probability of detection (LPD)) and redundant (e.g. spectrum agile, multiple transport path) capabilities; investigate directional antennas and components for each command post node for spatial LPD and improved frequency reuse. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned life cycle conclusion of this Science and Technology effort.			
Title: Signature Management and Reduction Technology	2.409	-	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** CI3 *I Mobile and Survivable Command Post (MASCP) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: Investigates and develops electromagnetic spectrum (EMS) management tools to model CP signatures and optimize the employment of CP nodes and communication assets.			
Title: Technology Supporting Camouflage, Concealment, and Deception	0.577	0.611	2.375
Description: This effort matures innovative camouflage, concealment and deception technologies for expeditionary high-value assets to defeat advanced current and emerging adversary Intelligence, Surveillance and Reconnaissance (ISR) threats, and to reduce the probability of detection in multi-domain operations. Matures physics-based models for material and system performance that support probability of 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 2024 Plans:* Will validate the performance of biomimetic camouflage materials or other solutions (Fibers, Coatings, and Pigments) based on analysis of alternatives; perform trade space analysis for concealment properties from ISR threats; conduct investigations to validate concealment properties for command post survivability. *FY 2025 Plans:* Will investigate and develop novel solutions to improve the electromagnetic signatures of Mobile Command Posts to avoid detection and improve Command Post survivability. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025, funding was realigned from Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CI7 (Mobile & Survivable Command Post (MASCP) Adv Tech) to accomplish work related to improvements in signature management of Command Posts and Command Post survivability.			
Accomplishments/Planned Programs Subtotals	5.540	3.268	2.375

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** CU6 *I Adaptive Information Mediation and Analytics*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CU6: *Adaptive Information Mediation and Analytics*	-	6.830	7.226	5.957	-	5.957	5.964	7.301	7.380	7.454	0.000	48.112

A. Mission Description and Budget Item Justification

This Project develops techniques to accelerate decision-making at lower echelons where data, information systems (IS), and Soldiers are distributed across complex and hostile environments. With robust multi-modal distributed information analytics and adaptive information mediation, decision makers can share understanding across echelons through a cross-reality information interaction. Research focuses on operational issues and gaps concerning decision uncertainty, at-the-edge situational awareness/understanding, and secure low-Size, Weight, and Power (SWAP) IS that support converged capabilities. These capabilities are critical in overcoming limitations in traditional uni-modal machine learning architectures that depend on extensive training data and stove-piped Command and Control systems that cannot provide a shared, adaptive common operating picture across echelons.

Work in this Project complements Program Element (PE) 0603462 (Next Generation Combat Vehicle Advanced Technology) / Project BF4 (Combat Vehicle Robotics Adv Tech) and Program Element (PE) 0603463 (Network C3I Advanced Technology) / Project AQ8 (High Tempo Data Driven Decision Tools Adv Tech).

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.

Work in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Adaptive Cross Reality Information Mediation *Description:* This effort investigates and develops techniques that intelligently integrate local and external data sources across different interaction modalities to enable enhanced situational awareness, shared understanding between echelons, augmented information representations, and accelerated decision-making. It provides techniques that support at-the-edge situational awareness and accelerate decision-making among distributed humans and agents. Specifically, the research focuses on improving decentralized, yet collaborative decision-making agents through intelligent mediation and delivery of tactical information to dynamic immersive, augmented, and conventional displays that are adaptive to the user and context. *FY 2024 Plans:* Will explore a framework for prioritized data management, filtering, processing, and dissemination; investigate knowledge-based strategies and methods for quantifying the value of information to provide the right information to the right people at the right time; develop a framework for seamless integration with program of records and heterogeneous Internet of Things (IoT) smart sensors to enable a Common Operating Picture (COP) and Situational Awareness (SA) via information representation and visualization	2.038	2.146	2.160

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602146A I *Network C3I Technology*		**Project (Number/Name)** CU6 I *Adaptive Information Mediation and Analytics*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
in an immersive environment; explore cross-echelon and cross-reality information exchange in secure and controlled Joint Action Partner and Multi Domain Operation (MDO) environments. *FY 2025 Plans:* Will investigate how a cross-reality (XR) common operating picture (COP) can be used to enhance shared situational understanding within and across echelons and devices through adaptive visualization and interaction techniques; develop information mediation methods that enable intelligent interoperability with other immersive and non-immersive program of record information systems as part of a common 3-dimensional (3D) world model; study paradigms and develop tools that enable Soldiers equipped with XR devices to execute command and control of robotic autonomous systems and other intelligent sensors to improve battlefield awareness and enhance lethality across multiple domains. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Multi-Domain Information Analytics (MDIA) *Description:* This effort develops Artificial Intelligence/Machine Learning (AI/ML) approaches for providing Situational Awareness (SA) across echelons that are robust to compromised, corrupted, or limited data and networks in contested and unpredictable battlespace environments. These approaches will provide increased probability of discernment of true vs. false targets, and incorporate uncertainty-aware neuro-symbolic AI/ML to calibrate confidence in algorithm predictions. Research will incorporate multimodal analysis with multi-view scene understanding from heterogeneous sensor systems for context-aware inference, utilize transfer learning techniques to bridge domain gap between real and synthetic data for improved machine learning, and employ Size, Weight and Power-Time (SWaP-T) constrained processing at the edge on emerging low power secure compute architectures through neural network pruning and compression. Simulations of Command and Control (C2) strategies will incorporate the MDIA approaches. *FY 2024 Plans:* Will develop enhanced aided target recognition (AiTR) and scene understanding algorithms for both ground based (manned and unmanned ground vehicles) and unmanned aerial vehicles (UAVs) applications; mature synthetic data generation techniques for simulation of militarily-relevant targets and environments, and optimize algorithm training through hybrid datasets of real and synthetic target data for both electro-optical/visible and infrared spectral bands; explore artificial intelligence (AI) for command and control approaches, integrating real-time in situ cursor on target information for course of action generation by an artificial commander; conduct holistic experiments of developed AiTR models and decision aid/command and control software at large scale Army field experimentation events to validate the efficacy of approaches and inform further technology development and maturation; develop uncertainty-aware evidential reasoning methods for processing over light weight SWaP computing devices	4.792	5.080	3.797

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602146A I *Network C3I Technology*	**Project (Number/Name)** CU6 I *Adaptive Information Mediation and Analytics*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
and assess their robustness due to limited training data and adversarial manipulations; develop neuro-symbolic complex event processing algorithms for recognition of complex events. *FY 2025 Plans:* Will develop an NTC data pipeline that includes dataset preparation and data extraction software encoding; use Geospatial Data Integration Server (GDIS) to store geographically-synchronized data for planning and visualization tools; investigate optimization techniques, such as hyperparameter and neural-architecture search to determine uncertainty- aware evidential reasoning configuration to obtain optimal tradeoff across accuracy, uncertainty calibration, robustness to adversarial manipulation, and computational efficiency in light weight SWaP compute devices; investigate multiple user feedback approaches; develop approaches to fuse Aided Target Recognition (AiTR) and synthetically trained models with mission data. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects a reduction in research that supports battlefield modeling and learning models.			
Accomplishments/Planned Programs Subtotals	6.830	7.226	5.957

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*				**Project (Number/Name)** CV4 *I Pathfinder 3D Applied Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CV4: *Pathfinder 3D Applied Technology*	-	2.111	2.090	1.257	-	1.257	1.677	1.889	1.809	1.533	0.000	12.366

A. Mission Description and Budget Item Justification

This Project investigates and develops a geospatial rapid position and navigation solution in Global Positioning System (GPS) degraded and denied environments. Research focuses on using onboard sensors and high-resolution digital terrain geospatial alternative solution based upon Visual Three-Dimensional (3-D) Terrain Referencing and Navigation (VTRAN). This Project will result in the linkage of air and ground assets integrating sensory and (One World Terrain and Reference) geospatial data within the modular GPS Independent Sensors architecture. This Project provides critical alternatives to maneuver forces for position and navigation in a multi-domain operational environment.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project DB6 (Pathfinder 3D Adv Technology).

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 United States Army Engineer Research and Development Center Geospatial Research Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: PATHFINDER 3-D Navigation Technology *Description:* This effort will design and develop enhanced feature classification for improved position navigation performance and will improve 3-D data extraction techniques to reduce computation. *FY 2024 Plans:* Will develop algorithms and methods to generate position/orientation from geospatially-based Visual Terrain Reference and Navigation and onboard sensors in the absence of GPS as an assured position navigation technology. *FY 2025 Plans:* Will expand visual terrain referencing solutions to include inputs from thermal IR, intensified EO, and incorporate metrics for ancillary passive sensor devices to generate a two-dimensional feature set matched to a three-dimensional foundation terrain data set. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects the planned reduction of workflows as technologies transition to Program Element 0603463A (Network C3I Advanced Tech) / Project DB6 (Pathfinder 3D Advanced Technology).	2.111	2.090	1.257
Accomplishments/Planned Programs Subtotals	2.111	2.090	1.257

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602146A *I Network C3I Technology*	**Project (Number/Name)** CV4 *I Pathfinder 3D Applied Technology*

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*							
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	113.099	34.683	32.089	-	32.089	37.664	48.793	49.399	67.734	0.000	383.461
AF1: *Long Range Maneuverable Fires (LRMF) Technology*	-	2.595	-	-	-	-	-	-	-	-	0.000	2.595
AF3: *Extended Range Propulsion Technology*	-	8.667	11.201	-	-	-	4.170	17.437	17.594	30.541	0.000	89.610
AF8: *Affordable Extended Range Precision Technology*	-	9.385	9.929	9.151	-	9.151	9.169	9.187	9.292	9.385	0.000	65.498
AG4: *Extended Range Artillery Munition Suite Technology*	-	6.434	1.310	10.161	-	10.161	12.392	10.440	10.655	15.832	0.000	67.224
AG6: *Energetic Materials and Advanced Processing Techno*	-	3.664	-	-	-	-	-	-	-	-	0.000	3.664
AH4: *Precision and Coop Weapons in a Denied Env Tech*	-	9.124	8.950	9.260	-	9.260	9.114	8.909	9.006	9.096	0.000	63.459
BN5: *Fuze and Power for Munitions*	-	2.730	3.293	3.517	-	3.517	2.819	2.820	2.852	2.880	0.000	20.911
BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*	-	70.500	-	-	-	-	-	-	-	-	0.000	70.500

A. Mission Description and Budget Item Justification

This Program Element (PE) is directly aligned to the Army Long Range Precision Fires (LRPF) Modernization Priority. Work in this PE investigates and develops 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 covering Strategic, Operational and Tactical Fires Lines of Effort. LRPF Missiles Applied Research investigates and develops a broad range of Missile technologies to enhance Army integrated LRPF capabilities at extended range. Cannon Artillery Applied Research investigates and develops critical technologies to increase range, precision, and both point and area effects for cannon artillery. Supporting LRPF Technologies Applied Research investigates and develops a broad range of component technologies to address weapon cost drivers and enhance performance of future LRPF munitions and systems.

Research in this PE complements PE 0603464A (Long Range Precision Fires Advanced Technology).

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

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602147A I *Long Range Precision Fires Technology*	

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	128.529	34.683	30.525	-	30.525
Current President's Budget	113.099	34.683	32.089	-	32.089
Total Adjustments	-15.430	0.000	1.564	-	1.564
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-14.999	-			
• SBIR/STTR Transfer	-0.431	-			
• Adjustments to Budget Years	-	-	1.564	-	1.564

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*		
Congressional Add: *Program Increase - ADVANCED GRAPHITIC FOAM FOR LONG-RANGE PRECISION FIRES*	15.000	-
Congressional Add: *Program Increase - ALUMINUM LITHIUM ALLOY SOLID ROCKET ADVANCEMENT*	15.000	-
Congressional Add: *Program Increase - HIGH SPEED MISSILE MATERIALS*	10.000	-
Congressional Add: *Program Increase - HIGH TEMPERATURE SUPER ALLOYS*	5.000	-
Congressional Add: *Program Increase - LOW-COST MISSILE TECHNOLOGY DEVELOPMENT*	10.000	-
Congressional Add: *Program Increase - REACTIVE MATERIALS*	10.500	-
Congressional Add: *Program Increase - THERMODYNAMIC LATENT PROPULSION*	5.000	-
Congressional Add Subtotals for Project: BO9	70.500	-
Congressional Add Totals for all Projects	70.500	-

Change Summary Explanation

Funding increase is due to a realignment of funds for multidomain artillery munition and fuze and power tech munitions from platform agnostic armaments and optionally manned artillery.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** AF1 *I Long Range Maneuverable Fires (LRMF) Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AF1: *Long Range Maneuverable Fires (LRMF) Technology*	-	2.595	-	-	-	-	-	-	-	-	0.000	2.595

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by developing next generation Multi-Domain Operations extended range weapon system technology for Precision Strike Missile to increase survivability, penetration, and range in anti-access/area-denial (A2/AD) and denied environments.

Research in this Project complements Program Element (PE) 0603464A (Long Range Precision Fires Advanced Technology) / AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech).

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

Research in this Project is performed by the Aviation and Missile Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Long Range Maneuverable Fires (LRMF) Technology *Description:* Investigates and develops critical technologies for next generation Multi-Domain Operations extended range weapon system technology for Precision Strike Missile to increase survivability, penetration, and range in complex A2/AD and denied environments.	2.595	-	-
Accomplishments/Planned Programs Subtotals	2.595	-	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** AF3 *I Extended Range Propulsion Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AF3: *Extended Range Propulsion Technology*	-	8.667	11.201	-	-	-	4.170	17.437	17.594	30.541	0.000	89.610

Note
 In Fiscal Year (FY) 2025 funding in this Project has a Skip Year

A. Mission Description and Budget Item Justification
 This Project directly supports Long Range Precision Fires Modernization Priority capabilities by designing, fabricating, and investigating missile enabling propulsion technologies to enable range extension and/or block speed improvement for long range applications; and enables improvement in High Performance Propellants (HPP) via gains in energy density and burn rate control.

 Work in this Project complements Program Element (PE) 0602147A (Long Range Precision Fires Technology) / Project AF8 (Affordable Extended Range Precision Tech) and Program Element (PE) 0603464A (Long Range Precision Fires Advanced Technology) / Project AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech).

 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Extended Range Propulsion Technology	8.667	11.201	-
Description: Designs, fabricates, and investigates missile enabling propulsion technologies to enable significant range extension and/or block speed improvement for long range applications and enables improvement in HPP via gains in energy density and burn rate control. *FY 2024 Plans:* Will conduct a flight weight air-breathing propulsion system experiment to validate and advance the component design; conduct a static test to determine capability of new mixing techniques to produce higher performance and minimized smoke propellants; determine feasibility and applicability of air-breathing pressure-gain combustion technology; continue to conduct experiments to establish understanding of solid thermodynamic latent propulsion technology for potential to enable throttling of solid rocket propellants, enhancing system capabilities and survivability. *FY 2024 to FY 2025 Increase/Decrease Statement:*			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*	**Project (Number/Name)** AF3 *I Extended Range Propulsion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
In Fiscal Year (FY) 2024 this effort is completed. Propulsion technologies will be further developed in PE 0602147A (Long Range Precision Fires Tech)/ Project AF8 (Affordable Extended Range Precision Tech) and matured and demonstrated in PE 0603464A (Long Range Precision Fires Adv Tech) / Project AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech)			
Accomplishments/Planned Programs Subtotals	8.667	11.201	-

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

PE 0602147A: *Long Range Precision Fires Technology*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** AF8 *I Affordable Extended Range Precision Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AF8: *Affordable Extended Range Precision Technology*	-	9.385	9.929	9.151	-	9.151	9.169	9.187	9.292	9.385	0.000	65.498

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires (LRPF) Modernization Priority capabilities by investigating the design and fabrication of components and subsystems critical to produce affordable extended range precision missiles as well as critical component technologies including: advanced propulsion, seekers/sensors, fire control, datalink, guidance, navigation and controls, airframes, and additional high payoff areas.

Work in this Project complements Program Element (PE) 0602147A (Long Range Precision Fires Technology) / AF1 (Long Range Maneuverable Fires (LRMF) Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology) / AF2 (Long Range Maneuverable Fires (LRMF) Advanced Tech)

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

Research in this Project is performed by the Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: LRPF High Payoff Missile Technology *Description:* Identify and explore potential breakthrough technologies to mitigate or eliminate warfighter gaps in Long Range Precision Fires to gain overmatch against potential peer and near-peer adversaries. *FY 2024 Plans:* Will complete assessments and validation of improved target state estimation techniques for strategic hypersonic missiles to enhance endgame performance; conduct experiments to validate analysis tools for high temperature structural composites; investigate reachback datalinks to support employment of on-board missile sensors for deep fires targeting; research missile battery size, weight, power, and cost upgrades over existing off the shelf components; develop alternative navigation technology and guidance algorithms to allow operation in GPS denied environments. *FY 2025 Plans:* Will continue to research missile battery size, weight, power, and cost upgrades over existing off the shelf components; conduct experiment of a fully integrated software defined receiver for alternative navigation to allow operation in GPS degraded and denied environments; conduct experiments to mature and validate solid thermodynamic latent propulsion technology for potential to enable throttling of solid rocket propellants, enhancing system capabilities and survivability; continue investigations into high energy propellants utilizing novel ingredients and formulations; conduct proof of principle experiment for a reachback datalink	9.385	9.929	9.151

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / *Long Range Precision Fires Technology*	**Project (Number/Name)** AF8 / *Affordable Extended Range Precision Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
to support employment of on-board missile sensors for deep fires targeting; continue investigating survivability and effector technologies for long range fires. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	9.385	9.929	9.151

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army							Date: March 2024				
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602147A I Long Range Precision Fires Technology			Project (Number/Name) AG4 I Extended Range Artillery Munition Suite Technology				

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AG4: Extended Range Artillery Munition Suite Technology	-	6.434	1.310	10.161	-	10.161	12.392	10.440	10.655	15.832	0.000	67.224

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical enabling component technologies and designing high precision terminal guidance in denied environments, capable of surviving high gun shock loads, at extended ranges, and automated cannon artillery technologies to increase operational tempo and unburden the soldier.

Work in this Project complements Program Element (PE) 0603464A (Long Range Precision Fires Advanced Technology) / AG5 (Extended Range Artillery Munition Suite Adv Tech).

The cited research 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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Extended Range Artillery Munition Suite Enabling Technologies Description: This effort develops, matures and integrates a gun hardened suite of components (software, sensors, navigation and communications) to enable the application of distributed, cooperative and collaborative tactics for munitions and Radio Frequency (RF) seeking components.	2.133	-	-
Title: Large Caliber Cannon Technologies Description: This effort will advance the current state of the art in cannon and barrel technology for compatibility with higher velocity and precision munitions, harder rotating bands, high temperature operation, robustness against non-firing loads, and minimized weight and imbalance. This effort will investigate cannon concepts focused on residual stress & dynamic strain reduction, coating metallurgy, and barrel cooling to increase tube life and performance in high demand environments. *FY 2025 Plans:* Will assess novel materials to improve the expected life and performance of large caliber cannons to include: cannon cooling methods, high temperature composites, refractory coatings, and advanced methods of heat rejections/ transmission for new cannon designs. *FY 2024 to FY 2025 Increase/Decrease Statement:*	3.198	-	3.258

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*	**Project (Number/Name)** AG4 *I Extended Range Artillery Munition Suite Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase in FY25 reflects the planned work to improve the expected life and performance of large caliber cannon systems.			
Title: Precision Munitions Technology	1.103	1.310	3.056
Description: This effort develops technology enablers which are critical to increasing precision and effectiveness for large caliber armaments at extended ranges in extreme launch and flight environments. These technology enhancements are required for sustaining and increasing mission capabilities in degraded and contested environments. ***FY 2024 Plans:*** Will develop munition technology enablers which will increase precision and effectiveness for large caliber armaments at extended ranges. These technologies will include: RF converged and multimodal seeker technologies, gun hardened inertial navigation systems, on-board targeting algorithms, and munition self-protection capabilities. Will design small form factor gun hardened components to investigate the performance against aerial and ground targets. Will validate prior modeling and simulation results of Integrated Aerial Defense Systems penetration of precision artillery munitions. ***FY 2025 Plans:*** Will mature munition components to include: radio frequency convergence and multimodal seeker technologies, gun-hardened inertial navigation systems, on-board targeting algorithms, and munition self-protection capabilities to increase precision and effectiveness for large caliber armaments at extended ranges; investigate small form factor gun hardened components against aerial and ground targets; design and develop hardware and software in the loop for a full array of precision subsystems. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects the planned maturation of munition components.			
Title: Multidomain Artillery Munition	-	-	3.847
Description: Multi-Domain Artillery Munition will develop components required to integrate novel payload components within conventional and developmental airframe carriers. Develops precision capabilities, collaborative engagement, automated on-board trajectory/engagement processing, and counter-counter measures for current and future munition platforms. ***FY 2025 Plans:*** Will investigate the operational effectiveness of component payloads at current and extended ranges; investigate data requirements across the setter, projectile, and payload subsystems for operation at extended ranges in austere environments; design and develop key interfacing munition component features to enable integration within munition airframe volume constraints; mature munition and sub-munition payload component designs for gun-launch survivability. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*	**Project (Number/Name)** AG4 *I Extended Range Artillery Munition Suite Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase reflects planned initiation of this effort. Funding realigned from Program Element (PE) 0603116A (Lethality Advanced Technology) / Project DB2 (Future Armaments Scalable Technologies)			
Accomplishments/Planned Programs Subtotals	6.434	1.310	10.161

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army								**Date:** March 2024			
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** AG6 *I Energetic Materials and Advanced Processing Techno*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AG6: *Energetic Materials and Advanced Processing Techno*	-	3.664	-	-	-	-	-	-	-	-	0.000	3.664

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technology of propellants and energetic materials to increase the range of artillery and mortar rocket assisted projectiles.

Research in this Project complements (Program Element) PE 0602141A (Lethality Technology) / AH9 (Advanced Warheads Technology) and PE 0603464A (Long Range Precision Fires Advanced Technology) / AG5 (Extended Range Artillery Munition Suite Adv Tech).

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

Research in this Project is performed by the United States Army.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Scale-up of Insensitive Energetic Materials	3.664	-	-
Description: Conduct research to advance the maturity of disruptive energetic materials.			
Accomplishments/Planned Programs Subtotals	3.664	-	-

C. Other Program Funding Summary ($ in Millions)
N/A
Remarks

D. Acquisition Strategy
N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** AH4 *I Precision and Coop Weapons in a Denied Env Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AH4: *Precision and Coop Weapons in a Denied Env Tech*	-	9.124	8.950	9.260	-	9.260	9.114	8.909	9.006	9.096	0.000	63.459

A. Mission Description and Budget Item Justification

This Project investigates technologies to deliver accurate fires from extended ranges in denied environments and informs future close- and deep-range Long Range Precision Fires (LRPF) capabilities (e.g., Extended Range Cannon Artillery, Precision Strike Missile).

Work in this Project research technologies for navigation of munitions without Global Positioning System (GPS) and flying munitions to much greater distances against advanced threat Area Denial Assets by delivering navigation technology for multiple munitions with complementary sensors and maneuverability technology for munitions with enhanced lift and control characteristics.

Work in this Project transitions foundational research obtained in PE 0601102A (Defense Research Sciences) / AA7 (Mechanics and Ballistics) and complements PE 0602141A (Lethality Technology) / Project AH6 (Disruptive Energetics and Propulsion Technologies), Project AH7 (Lethal and Scalable Effects Technologies), and Project AH8 (Lethality Materials and Processes 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Foundational Weapons Flight and Guidance Technology in Extreme Environments	9.124	8.950	9.260
Description: This effort investigates, designs, and develops technologies to improve guidance (e.g., better accuracy, more information/aim-point refinement, reduce GPS dependency) and flight (extended range glide, intercept moving target, course correct to imperfectly located target, perform evasive terminal maneuver to increase survivability) of munitions subject to extreme environments (e.g., set-back, set-forward and balloting load, electro-magnetic spectrum contested, counter-measures). Key navigation technologies include algorithms for image processing, state estimation, communications, embedded processing and electronics, and sensors (e.g., inertial, imagers with optics, software-defined radios and antennae). Key maneuvering technologies include the airframe, control actuation, and flight control algorithms. *FY 2024 Plans:* Will investigate novel flight control algorithms and vehicle control mechanisms to improve stability and maneuverability while surviving high-G cannon launch, high thermal load in flight, and defenses from integrated air defense systems; recommend design paths for high-lift, low-drag munition configurations for future Army cannon and missile fires; define limitations of algorithms for			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*	**Project (Number/Name)** AH4 *I Precision and Coop Weapons in a Denied Env Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
image-based mid-course navigation of Army munitions in Global Positioning System (GPS)-denied environments; formulate algorithms for delivering collaborative weapons in contested environments using multi-agent simulation and surrogate unmanned aerial system experiments; develop Army launch and flight platform and improved instrumentation for laboratory firing range facilities; confirm maturity of select weapon flight and guidance technologies in extreme Army environments of high mechanical and thermal loading, terminal survivability, and contested electro-magnetic spectrum; improve understanding of complex weapon flight and guidance problems through advancing combined experimental-modeling capabilities. *FY 2025 Plans:* Will explore high-level control algorithms for high-speed weapons that employ data-driven or model-based approaches to include formation flight, trajectory shaping, and optimal real-time information gathering and evasion; improve aerodynamic modeling and understanding of complex, high-speed maneuvering weapon vehicle dynamics via free-flight experimentation (spark range, onboard sensor) and computational studies; formulate parameter estimation algorithms and use for onboard sensor gun firing data analysis to confirm aerodynamic performance of high-speed weapon; incorporate onboard electronics, sensors, and actuators into lab-scale experimental platform for research range gun firings; conduct all-digital and hardware-in-the-loop simulation to assess full spectrum and edge case delivery accuracy performance; perform assessments focused on confirming technology readiness level of maneuvering flight and mid-course navigation technologies; complete analysis of artificial intelligence and image-based geo-registration algorithms for Army indirect fires applications; formulate algorithms and conduct studies for accurately delivering multiple payloads to targets when subject to threat detection, engagement, and contested electromagnetic spectrum. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	9.124	8.950	9.260

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602147A I *Long Range Precision Fires Technology*					Project (Number/Name) BN5 I *Fuze and Power for Munitions*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BN5: *Fuze and Power for Munitions*	-	2.730	3.293	3.517	-	3.517	2.819	2.820	2.852	2.880	0.000	20.911

A. Mission Description and Budget Item Justification

This Project directly supports Long Range Precision Fires Modernization Priority capabilities by investigating critical component technologies and designs capable to enable advanced lethality and scalable warheads for future munitions as well as exploring new power technologies for extended run time and extended range munitions.

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

Research in this Project is performed by the Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Energetics *Description:* This effort develops advanced fuze and power technologies for future munition applications that enable an increase in range and lethality, of ammunitions. *FY 2024 Plans:* Will design fuze and power component technology supporting electronic countermeasure evaluations for proximity. Will develop wireless synchronization between GPS components. Will conduct experiments on advanced initiation scheme for lethality concepts. Will develop advanced thermal batteries for future munitions. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease restructured to Fuze and Power Technologies for Munitions within this project.	2.730	3.293	-
Title: Fuze and Power Technologies for Munitions *Description:* This effort develops advanced fuze and power technologies for future munition applications that enable an increase in range and lethality, of ammunitions. *FY 2025 Plans:* Will investigate novel fuze and power technologies including tracking proximity sensor single chip technology, aimpoint refinement sensing, energy transfer mechanisms for advanced initiation schemes and high-power density technology for munitions and	-	-	3.517

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*	**Project (Number/Name)** BN5 *I Fuze and Power for Munitions*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
extreme environments; validate wireless fuze setting for increased fuze setting speed and future automation; develop algorithms and architectures for dynamic triggering. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding restructured from Advanced Energetics within this project.			
Accomplishments/Planned Programs Subtotals	2.730	3.293	3.517

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602147A *I Long Range Precision Fires Technology*				**Project (Number/Name)** BO9 *I WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BO9: *WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)*	-	70.500	-	-	-	-	-	-	-	-	0.000	70.500

Note

Congressional Interest Item funding provided for Weapons and Munitions Tech Program Initiative.

A. Mission Description and Budget Item Justification

Congressional Interest Item funding provided for Weapons and Munitions Tech Program Initiative.

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 2023**	**FY 2024**
Congressional Add: Program Increase - ADVANCED GRAPHITIC FOAM FOR LONG-RANGE PRECISION FIRES	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ADVANCED GRAPHITIC FOAM FOR LONG-RANGE PRECISION FIRES		
Congressional Add: Program Increase - ALUMINUM LITHIUM ALLOY SOLID ROCKET ADVANCEMENT	15.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ALUMINUM LITHIUM ALLOY SOLID ROCKET ADVANCEMENT		
Congressional Add: Program Increase - HIGH SPEED MISSILE MATERIALS	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for HIGH SPEED MISSILE MATERIALS		
Congressional Add: Program Increase - HIGH TEMPERATURE SUPER ALLOYS	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for HIGH TEMPERATURE SUPER ALLOYS		
Congressional Add: Program Increase - LOW-COST MISSILE TECHNOLOGY DEVELOPMENT	10.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602147A / Long Range Precision Fires Technology	**Project (Number/Name)** BO9 / WEAPONS & MUNITIONS TECH PROGRAM INITIATIVE (CA)

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for LOW COST MISSILE TECHNOLOGY DEVELOPMENT		
Congressional Add: Program Increase - REACTIVE MATERIALS	10.500	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Reactive Materials		
Congressional Add: Program Increase - THERMODYNAMIC LATENT PROPULSION	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for THERMODYNAMIC LATENT PROPULSION		
Congressional Adds Subtotals	70.500	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*						
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	103.022	73.844	52.685	-	52.685	53.269	67.099	58.618	48.639	0.000	457.176
AK2: *Aviation Survivability Technology*	-	1.191	-	-	-	-	-	-	-	-	0.000	1.191
AK9: *Adv Teaming for Tactical Aviation Operations Tech*	-	14.546	14.863	14.898	-	14.898	14.911	14.921	15.083	15.235	0.000	104.457
AL8: *Holistic Situational Awareness and Dec Making Tech*	-	-	1.004	3.023	-	3.023	3.026	-	-	-	0.000	7.053
BP7: *Future Vertical Lift Air Platform Tech (CA)*	-	35.000	-	-	-	-	-	-	-	-	0.000	35.000
BZ7: *Future Vertical Lift Medical Technologies*	-	7.496	7.644	7.460	-	7.460	7.452	7.573	7.671	7.750	0.000	53.046
CC3: *FVL Radar Technologies*	-	-	-	5.198	-	5.198	3.600	2.100	1.638	1.173	0.000	13.709
CH2: *Air Launched Effects Technology*	-	4.065	4.312	2.087	-	2.087	3.390	3.286	-	-	0.000	17.140
CH3: *Holistic Team Survivability Technology*	-	10.691	11.041	11.066	-	11.066	11.079	11.087	11.132	11.243	0.000	77.339
CH4: *Power & Thermal Management for FVL Tech*	-	7.426	9.766	5.335	-	5.335	5.350	5.316	5.398	5.453	0.000	44.044
CI4: *Adaptive Avionics Technologies*	-	-	1.005	3.618	-	3.618	3.622	3.625	3.664	3.701	0.000	19.235
CI5: *High Speed Maneuverable Missile (HSMM) Tech*	-	22.607	24.209	-	-	-	0.839	19.191	14.032	4.084	0.000	84.962

Note

In Fiscal Year (FY) 2025, project CC3 / FVL Radar Technologies is a new start.

A. Mission Description and Budget Item Justification

This Program Element (PE) is directly aligned to the Future Vertical Lift (FVL) Army Modernization Priority. This PE conducts air vehicle and mission system component design, fabrication, and evaluation to enable Army Future Vertical Lift. Emphasis is on developing aviation platform and mission system technologies to enhance

Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army			**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army* / BA 2: *Applied Research*		**R-1 Program Element (Number/Name)** PE 0602148A / *Future Verticle Lift Technology*		

manned and unmanned air vehicle combat and combat support operations for attack, reconnaissance, air assault, survivability, logistics, and command and control missions.

Research in this PE contributes to the Army Science and Technology (S&T) air systems portfolio and is fully coordinated with efforts in PE 0603465A (Future Vertical Lift Advanced Technology), PE 0602183A (Air Platform Applied Research) and PE 0603043A (Air Platform Advanced Technology).

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

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	104.348	73.844	70.486	-	70.486
Current President's Budget	103.022	73.844	52.685	-	52.685
Total Adjustments	-1.326	0.000	-17.801	-	-17.801
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.002	-			
• SBIR/STTR Transfer	-1.328	-			
• Adjustments to Budget Years	-	-	-17.801	-	-17.801

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BP7: *Future Vertical Lift Air Platform Tech (CA)*		
Congressional Add: *Program Increase - High Strength Functional Composites*	5.000	-
Congressional Add: *Program Increase: Adaptive Flight Control Technology*	3.000	-
Congressional Add: *Program Increase - DIGITAL TWIN PATHFINDER*	17.000	-
Congressional Add: *Program Increase - SEAT TRACK INTEGRATED REPLACEABLE/UPGRADABLE PROTECTION SYSTEM*	10.000	-
Congressional Add Subtotals for Project: BP7	35.000	-
Congressional Add Totals for all Projects	35.000	-

Change Summary Explanation

In Fiscal Year (FY) 2025 a portion of this Program Element (PE) is restructured to Project 0602183A (Air Platform Applied Research) / Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe).

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*					**Project (Number/Name)** AK2 *I Aviation Survivability Technology*		

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AK2: *Aviation Survivability Technology*	-	1.191	-	-	-	-	-	-	-	-	0.000	1.191

A. Mission Description and Budget Item Justification

This Project investigates advanced technologies to reduce Future Vertical Lift (FVL) platform susceptibility and vulnerability to damage from guided and unguided threats, as well as technologies to defeat small arms, rocket and missile threats. It also investigates and develops an integrated team-based system of systems survivability approach for Integrated Air Defense Systems breaching through purpose driven mix of improved survivability situational awareness, signature management, vulnerability reduction, route and maneuver optimization, expendables, advanced sensors, and Electro-optical (EO) & Radio Frequency (RF) jamming across distributed platforms.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology).

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.

Work in this Project is performed by the Armaments Center (AC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Tunable Pyrotechnics Technologies	1.191	-	-
Description: Develop and investigate technologies for nano, reactive, and advanced/novel materials to enable, customize and "tune" a family of Countermeasure Decoys for FVL platforms.			
Accomplishments/Planned Programs Subtotals	1.191	-	-

C. Other Program Funding Summary ($ in Millions)
N/A
Remarks

D. Acquisition Strategy
N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army									**Date:** March 2024		
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*				**Project (Number/Name)** AK9 *I Adv Teaming for Tactical Aviation Operations Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AK9: *Adv Teaming for Tactical Aviation Operations Tech*	-	14.546	14.863	14.898	-	14.898	14.911	14.921	15.083	15.235	0.000	104.457

A. Mission Description and Budget Item Justification

This Project investigates and develops subsystem and component level technologies that enable advanced teaming behaviors for mixed platform formations in combined arms operations. Primary component technologies to develop are in the areas of resilient autonomy algorithms, team-based communications and situational awareness management, decision aiding for weapons systems engagement, autonomous terrain and collision avoidance, and human autonomy interface design.

Research in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project AL1 (Adv Teaming for Tactical Aviation Oper Adv Tech).

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

Research in this Project is performed by Aviation & Missile Center (AvMC), and Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Teaming Concepts	8.495	8.715	8.708
Description: Investigates and develops subsystem and component level technologies that enable advanced manned and unmanned teaming behaviors for mixed air and ground platform formations in combined arms operations. ***FY 2024 Plans:*** Will investigate and develop technologies that enhance autonomous team of teams operations in complex urban / fringe and littoral environments, including highly-autonomous coordinated team mission behaviors, navigation and mission execution at low altitude in featureless and cluttered terrain, and sophisticated behaviors for employment of targeted electronic attack using teams of UAS. Will further enhance technologies for collaborative team operations over extended ranges with degraded networks, and improve human to machine supervisory interfaces for complex dynamic UAS team operations. ***FY 2025 Plans:*** Will further develop a suite of technologies that enable UAS team-o- teams ecosystem operations in contested, complex urban / fringe and littoral environments with degraded networks. Will develop autonomy and teaming technologies that build in behavior resilience to dynamically adjust to component failures and enhance contingency management for extended durations without			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	R-1 Program Element (Number/Name) PE 0602148A *I Future Verticle Lift Technology*	Project (Number/Name) AK9 *I Adv Teaming for Tactical Aviation Operations Tech*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
human intervention required. Will begin designing domain-specific data generation and training methods to develop learning-based solutions for risk-informed course of action selection and decision aiding of human supervisor. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Title: Enhanced Optics for Long Range Targeting	6.051	6.148	6.190
Description: This effort will deliver advanced airborne optics and reconfigurable filtering devices to enable agile, multi-task sensors for compact, long-range targeting, enhanced survivability and lethality of the Future Vertical Lift (FVL) and Future Unmanned Aircraft System (FUAS). This effort will restore visual overmatch in any (day/night) environment through visual penetration of all obscurants (e.g. brownout, white out, engineered smokescreens) from a single sensor, as well as narrowband filtering for active imaging through obscurants while maintaining advanced target acquisition. Improved detection and identification and long range target acquisition capability will result from filtering out scattered light and enabling 3-dimensional ranging through environmental obscurants. *FY 2024 Plans:* Will validate the new dual band infrared (IR) optical material in a relevant lens design; enabling lower size, weight, and power - cost (SWaP-C), improved durability, and dual-band flexibility. Will develop a compact and lightweight optical design, and novel optical components to support scalable long-range electro-optic infrared (EOIR) sensor payloads on current and future low-SWAP unmanned air platforms. Will determine applicable payload pointing and stabilization approaches to pair with the optical payload design to meet platform constraints. Will investigate feasibility of multi-spectral payload designs for small unmanned platforms. *FY 2025 Plans:* Will mature the new dual band infrared (IR) optical material Calcium Lanthanum Sulfide (CLS) and conduct experiments with complex dual-band optics representative of fielded high performance targeting sensors. Will mature infrared sensor optics packages suitable for low SWaP-C gimbal integration for small-unmanned aerial vehicle (UAV) and launched effects platforms. Will conduct experiments with infrared optics packages against Commercial off the Shelf (COTS) EOIR payloads. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	14.546	14.863	14.898

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2	R-1 Program Element (Number/Name) PE 0602148A *I Future Verticle Lift Technology*	Project (Number/Name) AK9 *I Adv Teaming for Tactical Aviation Operations Tech*	

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*					**Project (Number/Name)** AL8 *I Holistic Situational Awareness and Dec Making Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
AL8: *Holistic Situational Awareness and Dec Making Tech*	-	-	1.004	3.023	-	3.023	3.026	-	-	-	0.000	7.053

A. Mission Description and Budget Item Justification

This Project focuses on modeling and simulation of pilotage and decision aiding system technology that allows for carefree operations in complex and hostile environments.

Work in this Project is fully coordinated with PE 0603465A (Future Vertical Lift Advanced Technology Development), Project AL9 (Holistic Sit Awareness and Dec Making Adv Tech).

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.

Work in this Project is performed by Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Holistic Mission Manager (HMM) Concepts	-	1.004	3.023
Description: Increase Future Vertical Lift (FVL) mission effectiveness by an order of magnitude by merging existing Mission Systems Division MOSA technologies (HSA-DM, SAINT, A-Team, IME) into a single, ownship-centric mission manager. Dynamically load-balance the ownship, optimizing actions within the mission-team space. Increase lethality through mission effectiveness achieved by better crew workload management and mission management that coordinates all aspects of ownship mission requirements. Interoperability with all MDO players. ***FY 2024 Plans:*** Will survey government, industry, and academia to identify gaps and report on the existing and emerging mission planning/management tools; conduct stakeholder engagements and program planning activities; develop and coordinate a request for information. ***FY 2025 Plans:*** Will engage with Academia, Industry, and other DOD agencies to initiate research for the integration of the relevant technology outputs from applicable S&T programs into a holistic mission manager for FVL platforms. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** AL8 *I Holistic Situational Awareness and Dec Making Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY25 funding increase reflects an increase in relevant research activities with Academia, Industry, and other DOD agencies in areas such as current mission planning tools (AMPS and JMPS), and novel methods of mission planning and team coordination (ATAK) and other emerging technologies.			
Accomplishments/Planned Programs Subtotals	-	1.004	3.023

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 I 2				**R-1 Program Element (Number/Name)** PE 0602148A I *Future Verticle Lift Technology*					**Project (Number/Name)** BP7 I *Future Vertical Lift Air Platform Tech (CA)*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BP7: *Future Vertical Lift Air Platform Tech (CA)*	-	35.000	-	-	-	-	-	-	-	-	0.000	35.000

Note
 Congressional Interest Item funding provided for Future Vertical Lift Air Platform Technology.

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding provided for Future Vertical Lift Platform 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 2023**	**FY 2024**
Congressional Add: Program Increase - High Strength Functional Composites	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for High Strength Functional Composites		
Congressional Add: Program Increase: Adaptive Flight Control Technology	3.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Adaptive Flight Control Technology		
Congressional Add: Program Increase - DIGITAL TWIN PATHFINDER	17.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Digital Twin Pathfinder		
Congressional Add: Program Increase - SEAT TRACK INTEGRATED REPLACEABLE/UPGRADABLE PROTECTION SYSTEM	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SEAT TRACK INTEGRATED REPLACEABLE/UPGRADABLE PROTECTION SYSTEM		
Congressional Adds Subtotals	35.000	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) BP7 / *Future Vertical Lift Air Platform Tech (CA)*

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*				**Project (Number/Name)** BZ7 *I Future Vertical Lift Medical Technologies*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BZ7: *Future Vertical Lift Medical Technologies*	-	7.496	7.644	7.460	-	7.460	7.452	7.573	7.671	7.750	0.000	53.046

A. Mission Description and Budget Item Justification

This Project involves research to prevent injury and performance degradation in Aviators, Unmanned Arial System (UAS) Operators and other Warfighters in training and operations; refines risk assessment and performance models based on operational stressors, e.g., sleep deprivation, work load, fatigue; and delivers biomedical-based spinal injury criteria and assessment methodologies. This research provides medical information important to the design and operational use of future vertical lift aircraft, and when appropriate, ground vehicles.

The cited research 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 2023**	**FY 2024**	**FY 2025**
Title: Medical Standards to Support Future Vertical Lift (FVL)	7.496	7.644	7.460

Description: This effort develops and delivers medical guidelines and strategies to assure optimal Soldier performance and protection on the future technologically-intensive battlefield. Key elements of the program include: 1) tailored medical selection and retention standards for FVL; 2) medical strategies to maintain and enhance human performance in Multi-domain operations (MDO); 3) human-centered technology design guidance to accommodate the range of aircrew; 4) improved protection standards to reduce FVL occupant injury; and 5) operator state monitoring tools to enable scalable autonomy in FVL aircraft.

FY 2024 Plans:
Will develop Health Hazard Assessment methods and criteria to protect FVL occupants from Head Supported Mass, impulsive noise/ shock, and repeated jolt. Will develop recommendations for maintaining orientation in Manned-Unmanned Teaming (MUM-T) and FVL operators. Will develop recommendations for multisensory cuing for Degraded Visual Environment (DVE) operations. Will develop recommendations for counter-measures for motion sickness in Soldiers transported by FVL. Will assess FVL flight envelope physiological effects and recommend countermeasures. Will assess FVL vibration effects on aircrew health and performance. Will recommend updated head supported mass (HSM) limits to prevent injury and maintain FVL aircrew performance. Will develop recommended human variables for operator state assessment and a holistic aircrew workload/ performance stress model.   Will develop input for human behavior and biomedical monitoring algorithms. Will develop medical aspects of FVL scalable autonomy system incorporating real-time biomedical monitoring inputs. Will develop recommendations for hearing protection of FVL aircrew, operators, and passengers. Will update recommended head supported mass (HSM) limits to prevent FVL aircrew injury. Will develop next-generation head protection strategies for FVL aircrew. Will develop

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602148A I *Future Verticle Lift Technology*	**Project (Number/Name)** BZ7 I *Future Vertical Lift Medical Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
recommendation package for enhanced FVL crashworthiness. Efforts in this task are further developed in Program Element 060465A, Project CJ5. ***FY 2025 Plans:*** Assess physiologic changes in aviators during cognitive workload. Define the temporal components of an aviator/operator state monitoring system. Determine the efficacy of multisensory cues to maintain optimal flight performance and increase situational awareness under operational stressors. Provide a correlation of HGU-56/P Aircrew Integrated Helmet System damage to head injury. Measure operator response to simulated adaptive automation. Study neurophysiological patterns of spatial disorientation in rotary-wing operations. Conduct a retrospective analysis of injures in accidents involving DoD tilt-rotor and standard rotary wing airframes. Study the effects of 3D auditory cues and automatic noise reduction on aircrew performance. Compare the visual outcomes of different vision improvement surgeries. Efforts in this task are further developed in Program Element 060465A, Project CJ5. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	7.496	7.644	7.460

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602148A I *Future Verticle Lift Technology*					Project (Number/Name) CC3 I *FVL Radar Technologies*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CC3: *FVL Radar Technologies*	-	-	-	5.198	-	5.198	3.600	2.100	1.638	1.173	0.000	13.709

Note
 FVL Radar Technologies is a new start within the Future Verticle Lift Technology program in FY 2025.

A. Mission Description and Budget Item Justification
 This Project develops underlying technologies applicable to next generation radar apertures used for detection, tracking and precision targeting, navigation and fire control for multiple modalities. Efforts will enable increased platform survivability and lethality in congested/contested MDO environments.

 Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project CC4 (FVL Radar Advanced Technologies).

 The cited research 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 Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Airborne Distributed Radar	-	-	5.198

Description: Research and develop distributed radar techniques, including algorithms for Artificial Intelligence (AI)-enabled Automated Target Recognition for distributed airborne radar applications. Conduct monostatic and distributed vulnerability analyses.

FY 2025 Plans:
Will perform a trade study to investigate and inform government and industry of potential problem space contributions through experimentation, studies, and modeling and simulation. Create appropriate documentation and trade studies report to capture findings. Investigate radar waveforms and AI/ML technologies supporting target identification, classification, tracking and prosecution of battlefield threats using radar observations made across distributed platforms. Conduct experiments and laboratory proof-of-concepts to validate initial component designs and concepts.

FY 2024 to FY 2025 Increase/Decrease Statement:

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CC3 *I FVL Radar Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
In FY23 and FY24 this project experiences skip years while CC4 matured and demonstrated earlier investments. In Fiscal Year (FY) 2025 funding is realigned from Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project CC4 (FVL Radar Advanced Technologies), however; this effort is a new start.			
Accomplishments/Planned Programs Subtotals	-	-	5.198

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*				**Project (Number/Name)** CH2 *I Air Launched Effects Technology*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CH2: *Air Launched Effects Technology*	-	4.065	4.312	2.087	-	2.087	3.390	3.286	-	-	0.000	17.140

Note

Fiscal Year (FY) 2025 a portion of this project is restructured to Program Element 0602183A / Air Platform Applied Research, Project CU9 (Systems Design Technology)

A. Mission Description and Budget Item Justification

This Project utilizes improved analytic modeling to investigate the effects that potential unmanned system capabilities could have on air vehicle design considerations and operational concepts. This Project improves government capability to design and assess novel Unmanned Aircraft System (UAS) concepts. This Project also develops and investigates the ability to launch a UAS from a manned or unmanned future vertical lift aircraft at tactical altitudes and to control the same after launch from nearby Future Vertical Lift (FVL) aircraft, as well as development of the associated payloads (recon, battle damage assessment, targeting, comms, decoy). 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 Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project AK8 (Air Launched Effects Advanced Technology).

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

Work in this Project is performed by Aviation and Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Systems Concepts Studies for Air Launched Effects	4.065	4.312	-

Description: Investigates and models air vehicle concepts to understand the effects that potential operational Air Launched Effects capabilities will have on air vehicle properties.

FY 2024 Plans:
Will explore tradespace for air vehicle concepts with application to FUAS and ALE. Will develop models to estimate performance, improve methods for cost analysis, and incorporate improved propulsion models.

FY 2024 to FY 2025 Increase/Decrease Statement:

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CH2 *I Air Launched Effects Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
This effort ends in FY24 and funding is realigned to Versatile Air Launched Effects (VALE) Concepts within this project. In Fiscal Year (FY) 2025 a portion of this effort is restructured to Program Element 0602183A / Air Platform Applied Research, Project CU9 (Systems Design Technology).			
Title: Versatile Air Launched Effects (VALE) Concepts	-	-	2.087
Description: Conducts configuration trades analysis studies and develops technologies that support air and ground launched effects operations in complex, contested environments including urban / fringe and littoral. Matures individual technologies and design concepts that shape investment for Versatile Air Launched Effects Demonstration and inform the System Specifications for the LE Program of Record. *FY 2025 Plans:* Will begin exploration of modular air vehicle concepts that incorporate payloads, propulsion, and energy storage for air and ground launched effects operations in long-range littoral and high-maneuverability urban missions. *FY 2024 to FY 2025 Increase/Decrease Statement:* This effort begins in FY25 with funding realigned from Systems Concepts Studies for Air Launched Effects within this Project.			
Accomplishments/Planned Programs Subtotals	4.065	4.312	2.087

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 **/** 2				**R-1 Program Element (Number/Name)** PE 0602148A **/** *Future Verticle Lift Technology*				**Project (Number/Name)** CH3 **/** *Holistic Team Survivability Technology*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CH3: *Holistic Team Survivability Technology*	-	10.691	11.041	11.066	-	11.066	11.079	11.087	11.132	11.243	0.000	77.339

A. Mission Description and Budget Item Justification

This Project will investigate and design advanced survivability technologies to develop a holistic team-based solution that delivers advanced sensing and electronic warfare (EW) effects across a family of aircraft to optimally penetrate and survive in the anti-access/area denial (A2AD) environment. This Project will take an integrated team-based system of systems survivability approach through a purpose-driven mix of improved survivability situational awareness, signature management, vulnerability reduction, enhanced platform survivability against directed energy munitions, route and maneuver optimization, expendables, advanced sensors, and electro-optics (EO) & radio frequency (RF) jamming for existing and future air platforms. This Project will also provide advanced teaming algorithms for survivability. This Project develops and evaluates multi layered survivability concepts and supporting technologies for increased survivability of Future Vertical Lift (FVL) Family of Systems (FVL FoS) in an advanced and evolving integrated air defense systems environment.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology) / Project CG1 (Holistic Team Survivability Adv Tech).

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

Work in this Project is performed by Aviation & Missile Center (AvMC) and Command, Control, Communication, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Survivability Concepts *Description:* This effort will provide analysis of the rapidly evolving and emerging threat environment and impacts to Future Vertical Lift Family of Systems FVL FoS platforms, developing and evaluating full spectrum survivability concept, collaborative team based survivability algorithms and behaviors *FY 2024 Plans:* Will initiate the development of damage prediction algorithms given a threat/ballistic impact. Will develop RF material coupons for durability improvement and weight reduction. Will continue development and maturation of algorithms, behaviors, and human machine interface for team-based survivability. Will continue the development and analysis of uniquely tailored Electro-Optical/ Infrared coatings for FVL and UAS applications, leveraging emergent coatings technologies. Will investigate microclimatology for	3.362	3.464	3.488

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CH3 *I Holistic Team Survivability Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
survivability algorithm development. Will investigate emergent fuel cell vulnerability reduction technologies for next generation FVL platforms. *FY 2025 Plans:* Will continue the maturation of RF material for improved durability improvement and weight reduction. Continue to mature and refine algorithms, behaviors, and human machine interface for team-based survivability and begin software in the loop integration. Will continued development and testing of uniquely tailored Electro-Optical/ Infrared coating formulations for FVL and UAS applications. Developed microclimatology algorithms improved survivability situational understanding. Development and maturation of survivability and mission effectiveness modeling and simulation toolsets. Will investigate aviation survivability science and technology concepts and component technologies. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Distributed Electronic Warfare Effects *Description:* This effort investigates and develops critical EW components and techniques to enable the FVL capability to operate and survive in A2/AD environments. It provides scalable low size, weight, power, and cost (SWaP-C) signal processing components and decision-making algorithms that adapt and counter the characteristics of advanced and emerging threats. *FY 2024 Plans:* Will mature algorithms and conduct multi-node experiment of hardware performance and software algorithm functionality. Will develop methods for distributed detection and geolocation of A2/AD threats with enhanced accuracy. Will investigate the impact of threat progression on measured performance of detection and countermeasure algorithms in both the single node and multi-node cases. *FY 2025 Plans:* Will develop decision-making algorithms capable of dynamically adapting to changes in threat state and position; assess methods for distributed detection and geolocation of A2/AD threats and quantify improvements in accuracy; model multi-mission EW payload hardware and simulate sensing and effects performance in multi-node configuration. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	7.329	7.577	7.578
Accomplishments/Planned Programs Subtotals	10.691	11.041	11.066

C. Other Program Funding Summary ($ in Millions)

N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CH3 *I Holistic Team Survivability Technology*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*			**Project (Number/Name)** CH4 *I Power & Thermal Management for FVL Tech*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CH4: *Power & Thermal Management for FVL Tech*	-	7.426	9.766	5.335	-	5.335	5.350	5.316	5.398	5.453	0.000	44.044

Note

In Fiscal Year (FY) 2025 a portion of this Project is restructured to Program Element (PE) 0602183A (Air Platform Applied Research) / Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe)).

A. Mission Description and Budget Item Justification

This Project directly supports Future Vertical Lift (FVL) Modernization Priority capabilities by investigating and developing power and thermal management technologies to provide significantly higher electrical power capability to FVL aircraft while addressing consequential size, weight, and thermal issues. This Project provides power capability for advanced electric aeromechanical effectors, advanced mission systems algorithms for route planning and teaming, and advanced electronic warfare devices. This also Project investigates emerging electrical power generation and distribution, energy storage, and thermal management technologies needed for future Command, Control, Communications, Computers, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) and survivability equipment for application to FVL and other Army platforms. Enables significantly increased aircraft electrical power capability for advanced electric aeromechanical effectors, advanced mission systems to include algorithms for route planning and teaming, and for advanced electronic warfare devices while minimizing size and weight.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project CH7 (Power & Thermal Management for FVL Adv Tech).

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

Work in this Project is performed by Aviation & Missile Center (AvMC) and Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Optimized Energy for C5ISR Platforms	5.058	5.270	5.335
Description: This effort investigates electrical power and thermal management associated with high power C5ISR capabilities on ground and air platforms enabling enhanced mobility and mission flexibility. This effort funds research to improve FVL aircraft and other Army platforms power efficiency through the use of on-demand hybrid electrical power architectures, while also researching ways to eliminate platform thermal constraints. This effort will also investigate safer battery chemistries which enable very high			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CH4 *I Power & Thermal Management for FVL Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
density electrical power sources and energy storage to be flight certified for high rate pulsed power, electrical power management, and thermal management for dynamic high rate pulsed power. ***FY 2024 Plans:*** Will mature safe silicon chemistry components to develop and enable light weight, high power aviation energy storage systems. Will validate thermal management components through real world assessment to drive rejection of waste heat generated by platform mission equipment. Will?mature?cold plate designs and conduct experiments on novel phase change materials capable of managing peak thermal loads. Will design and develop power management strategies and algorithms for vertical lift platforms to efficiently distribute electrical power. ***FY 2025 Plans:*** Will validate safety of silicon chemistry and enabling components for light weight, high power aviation energy storage systems. Will design and develop a family of thermal management approaches through real world assessment to drive rejection of waste heat generated by platform mission equipment. Will conduct experiment on cold plate designs, novel and engineered phase change materials capable of managing peak thermal loads. Will validate electrical power management strategies and algorithms for vertical lift platforms to efficiently distribute electrical power. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Power & Thermal Management Components ***Description:*** This effort develops electrical power and thermal management component technologies to meet the power and thermal demands of Future Vertical Lift aircraft while minimizing system size and weight. Technology will be validated through component level test.	2.368	-	-
Title: Adaptive Power Component Technologies ***Description:*** This effort develops adaptive propulsion and power system component technologies to provide highly efficient propulsion and power capability to FVL aircraft while addressing consequential SWAP & thermal issues. Technology will be validated through component level test. ***FY 2024 Plans:*** Will perform detailed design and system integration modeling and analysis of adaptive power technologies that can provide key capabilities for a future hybrid propulsion system. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	-	2.486	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CH4 *I Power & Thermal Management for FVL Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
In FY25 this effort is restructured to Program Element (PE) 0602183A (Air Platform Applied Research) / Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe)).			
Title: Hybrid Propulsion Conceptual Design Analysis	-	2.010	-
Description: Explore design and development of hybrid-electric propulsion concepts / applications (conventional & non-conventional) for multiple manned-VTOL classes to achieve greatest operational benefit for FVL future Platforms. Analysis will include trade studies to identify metrics, best architectures/technologies/configurations, and demonstration path for improved FVL aircraft capability. *FY 2024 Plans:* Will conduct component and system modeling. Will perform down-select of initial hybrid electric propulsion concepts as applied to FVL/enduring aircraft configurations to be investigated and initiate trade-studies/benefit analysis (key metrics include weight, system complexity, fuel burn, and electrical efficiency). *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY25 this effort is restructured to Program Element (PE) 0602183A (Air Platform Applied Research) / Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe)).			
Accomplishments/Planned Programs Subtotals	7.426	9.766	5.335

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*				**Project (Number/Name)** CI4 *I Adaptive Avionics Technologies*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CI4: *Adaptive Avionics Technologies*	-	-	1.005	3.618	-	3.618	3.622	3.625	3.664	3.701	0.000	19.235

A. Mission Description and Budget Item Justification

This Project will Build on Modular Open Systems Approach (MOSA) successes to enable future aviation mission systems to proactively exploit emerging innovation from multiple technological domains, employing continuous development and continuous deployment by researching and developing advanced avionics integration techniques and optimized processing management.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project CI8 (Adaptive Avionics Advanced Technologies).

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

Work in this Project is performed by Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Future Avionics Implementation Research (FAIR)	-	1.005	3.618
Description: This effort will investigate evolving advanced avionics technologies and integration techniques in disparate environments for FVL mission systems, and will research complex computing environments, contextual resource management and ownship network technologies to implement on FVL air platforms. **FY 2024 Plans:** Will conduct trade studies and internal research to understand the state of the art with respect to computing resource management techniques using contextual based situational awareness, innovative and flexible data architectures, distributed data processing and advanced ship network technologies. **FY 2025 Plans:** Will continue to conduct trade studies that further explore and narrow technology focuses in support of Adaptive Avionics advanced research activities. The types of research envisioned under these studies may include, but are not limited to, market research, analysis, and experimentation. Conduct engagements with stakeholders to ensure priority alignment and will begin to provide lessons learned from trade studies and market research to respective Adaptive Avionics 6.3 efforts. **FY 2024 to FY 2025 Increase/Decrease Statement:**			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2		R-1 Program Element (Number/Name) PE 0602148A / *Future Verticle Lift Technology*	Project (Number/Name) CI4 / *Adaptive Avionics Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Funding increase in FY25 reflects further investigations/studies into more specific, specialized, and complex topics that are identified in this effort's FY24 activities and studies.			
Accomplishments/Planned Programs Subtotals	-	1.005	3.618

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*				**Project (Number/Name)** CI5 *I High Speed Maneuverable Missile (HSMM) Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CI5: *High Speed Maneuverable Missile (HSMM) Tech*	-	22.607	24.209	-	-	-	0.839	19.191	14.032	4.084	0.000	84.962

A. Mission Description and Budget Item Justification

The Project investigates, designs, and evaluates missile component technologies compatible with Future Vertical Lift (FVL) and Future Unmanned Aircraft Systems (FUAS) aviation platforms and ground platforms in a Multi-Domain Battle/Cross-domain Maneuver operational environment. Efforts provide technologies to support a smaller, faster, maneuverable missile capable of long-range non-line-of-sight attack in contested/degraded environments. Technology development increases aviation and ground lethality and platform survivability by increasing missile standoff range, speed, and maneuverability, a faster rate of fire, shorter times of flight, and multi-threat lethal effects. Enables cross domain applications for aviation and ground vehicle platforms, including handoff capability, to engage threats in dead zones, and to operate in contested environments.

Work in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology), Project CK2 (High Speed Maneuverable Missile Adv Tech).

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

Work in this project is performed by Aviation and Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: High Speed Maneuverable Missile (HSMM) Technology	22.607	24.209	-
Description: Efforts provide technology development to support a maneuverable missile capable of both short range direct attack and long range non-line-of-sight attack with reduced time to target; reduced size and weight for increased load-out; capable of air launched missions in degraded/contested environments. ***FY 2024 Plans:*** Will conduct experiments to validate the critical component designs including navigation sensor, warheads, fire control, and digital missile datalinks. Will conduct experiments to validate the design and development of the missile test bed. Will use the missile test bed to investigate increases in maneuverability, aviation lethality, and platform survivability in degraded/contested environments. Will validate detailed design of the advanced propulsion system and technologies by optimizing increases in range and speed to support long range precision strike performance in degraded/contested environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:***			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602148A *I Future Verticle Lift Technology*	**Project (Number/Name)** CI5 *I High Speed Maneuverable Missile (HSMM) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
In Fiscal Year (FY) 2024 this task for HSMM technology development completes. Maturation and demonstration of component technologies continue in PE 0603465A (Future Vertical Lift Adv Tech), Project CK2 ((High Speed Maneuverable Missile Adv Tech).			
Accomplishments/Planned Programs Subtotals	22.607	24.209	-

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Appropriation/Budget Activity
2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*

R-1 Program Element (Number/Name)
PE 0602150A *I Air and Missile Defense Technology*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	94.972	33.301	39.188	-	39.188	42.813	51.931	52.026	55.179	0.000	369.410
AE2: *Unconventional Countermeasures-Survivability Tech*	-	3.896	3.384	2.772	-	2.772	2.719	3.779	3.370	3.093	0.000	23.013
BN6: *Advanced Weapons Components (CA)*	-	68.752	-	-	-	-	-	-	-	-	0.000	68.752
CV7: *High Energy Laser Direct Diode Apl Tech*	-	2.796	1.495	3.224	-	3.224	3.036	7.425	8.988	9.079	0.000	36.043
CV8: *Vulnerability Modules for Multi-Domain Operations*	-	7.788	8.987	7.750	-	7.750	7.467	6.704	2.791	4.483	0.000	45.970
DA9: *Radar Survivability through Dis Sensing Tech*	-	5.591	4.703	4.084	-	4.084	2.271	-	-	-	0.000	16.649
DC1: *Next Generation DE Concept Development & Analysis*	-	6.149	6.446	8.303	-	8.303	8.329	8.356	10.505	12.704	0.000	60.792
DE3: *Adv Beam Control Component Development for C-CM*	-	-	8.286	5.361	-	5.361	5.752	11.739	10.921	10.921	0.000	52.980
HP1: *High Power Microwave Technology**	-	-	-	-	-	-	0.501	2.004	4.008	2.004	0.000	8.517
SU1: *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*	-	-	-	7.694	-	7.694	12.738	11.924	11.443	12.895	0.000	56.694

*This project's R-2a exhibit has been suppressed due to funding not beginning until after FY 2025

Note

SU1 / Counter Small Unmanned Aircraft Sys(C-sUAS) Tech -(Extended Range C-sUAS (XRC) Tech) in Fiscal Year (FY) 2025 is a New Start.

This is an Army priority effort for Counter-small Unmanned Aircraft System (C-sUAS) capability.

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*		**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*

A. Mission Description and Budget Item Justification

This Program Element (PE) line is directly aligned with the Air & Missile Defense (AMD) Army Modernization Priority. Work in this PE investigates and develops AMD technologies to enable defense of ground forces and selected geopolitical assets from aerial attack, missile attack, and surveillance. Major focus areas for AMD Science and Technology include: Missiles, Directed Energy, Gun-Based Air Defense Technologies, and Battlefield Sensors and Supporting AMD Technologies. Missiles Applied Research investigates and develops a broad range of Missile technologies to enhance Army integrated AMD capabilities at extended range. Directed Energy Applied Research investigates and develops critical High Energy Laser (HEL) technologies to explore performance against Air Defense threats and for other Directed Energy applications across Army Modernization Priorities. Gun-Based Air Defense Technologies Applied Research investigates and develops Combined Arms for Air Defense (CAFAD) technologies and components in a laboratory environment. Sensors and Supporting AMD Technologies Applied Research investigates and develops Battlefield Sensor and radar technologies required for detection, acquisition and tracking of air defense targets as well as supporting technologies that enhance AMD.

Work in this PE complements PE 0603466A (Air and Missile Defense Advanced Technology).

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

Research is performed by U.S. Army Aviation and Missiles Center (AvMC).

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	88.768	33.301	31.432	-	31.432
Current President's Budget	94.972	33.301	39.188	-	39.188
Total Adjustments	6.204	0.000	7.756	-	7.756
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	7.000	-			
• SBIR/STTR Transfer	-0.796	-			
• Adjustments to Budget Years	-	-	7.756	-	7.756

Congressional Add Details ($ in Millions, and Includes General Reductions)	**FY 2023**	**FY 2024**
Project: BN6: *Advanced Weapons Components (CA)*		
Congressional Add: *Program Increase - BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER*	9.000	-
Congressional Add: *Program Increase - COUNTER UAS CENTER FOR EXCELLENCE*	5.000	-

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Congressional Add: *Program Increase: HIGH ENERGY LASER AND OPTICAL TECHNOLOGY*	10.000	-
Congressional Add: *Program Increase - ARMY MISSILE RISK-BASED MISSION ASSURANCE*	5.000	-
Congressional Add: *Program Increase - Precision Long Range Integrated Strike (PLRIS)*	6.752	-
Congressional Add: *Program Increase - SMALL UAS TRACKING AND TARGETING DEVICES*	14.000	-
Congressional Add: *Program Increase - CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER*	2.000	-
Congressional Add: *Program Increase - MISSILE RISK-BASED MISSION ASSURANCE*	10.000	-
Congressional Add: *Program Increase - Missile Soldier Touch Point Center*	7.000	-
Congressional Add Subtotals for Project: BN6	68.752	-
Congressional Add Totals for all Projects	68.752	-

Change Summary Explanation

Increase in FY25 funding, due to realignment from Program Element (PE) 0603025A (Army Agile Innovation and Demonstration) / Project CK8 (Advanced Technology Development and Convergence), PE 0603041A (All Domain convergence Advanced Technology) / Project CM8 (Convergence Battlefield Integration), PE 0602145 Next Generation Combat Vehicle, and PE 0603464A (Long Range Precision Fires Advanced Technology) / Project CE9 (Armaments Advanced Technology) to support investigation of critical component technology to address small form factor C-sUAS missile systems.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*					**Project (Number/Name)** AE2 *I Unconventional Countermeasures-Survivability Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
AE2: *Unconventional Countermeasures-Survivability Tech*	-	3.896	3.384	2.772	-	2.772	2.719	3.779	3.370	3.093	0.000	23.013

A. Mission Description and Budget Item Justification

This Project designs and develops technologies to deter tactical surveillance and targeting by adversarial area denial systems and munitions. The Project investigates methods to increase survivability of critical assets against precision-guided near-peer advanced weapons threats, investigates and develops tonedown methods for signature management, and computationally develops novel countermeasures. This Project also develops a suite of high-fidelity, physics-based modeling and simulation tools for the design and development of unconventional countermeasures and survivability enhancers applicable to a wide range of operating environments.

Work in this Project complements Program Element (PE) 0603466A (Air and Missile Defense Advanced Technology) / Project AE3 (Unconventional Countermeasures-Survivability ATech).

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 United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Model-Based Assessment of Sensors and Countermeasures	1.853	-	-
Description: This effort develops a suite of high-fidelity, physics-based modeling and simulation tools for the design and development of unconventional countermeasures for a wide range of operating environments; develops tools for the evaluation of threat detection and object identification.			
Title: Advanced Integrated Unconventional Countermeasures Applications	2.043	1.651	1.036
Description: This effort develops methods and materials to defeat peer advanced reconnaissance, surveillance, targeting methods through advancements in material science and computational prototyping to reduce targetable signatures and confuse targeting systems. *FY 2024 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** AE2 *I Unconventional Countermeasures-Survivability Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will develop computational tools and validate material science solutions to aid in the optimization of signature management by coupling material science and computational simulations within a closed-loop computational architecture for targeted countermeasure applications. *FY 2025 Plans:* Will develop and optimize physical prototype survivability enhancement kits for FIRES assets. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects the transition of technologies for maturation and demonstration.			
Title: Virtual Unconventional Countermeasure Environment *Description:* This effort develops physics-based modeling and simulation tools for rapid prototyping of novel unconventional countermeasures across multiple relevant operational environments and sensing modalities on an assortment of platforms. *FY 2024 Plans:* Will conduct studies to investigate effects on countermeasure development and effectiveness assessment under rapidly developed physics-based geo-typical scenes. *FY 2025 Plans:* Will validate and incorporate new physics algorithms for heavily vegetated regions into high fidelity modeling capabilities to increase precision in comparison to environmental data. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned milestones and accomplishments.	-	1.733	1.736
Accomplishments/Planned Programs Subtotals	3.896	3.384	2.772

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks
 N/A

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*					**Project (Number/Name)** BN6 *I Advanced Weapons Components (CA)*			

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
BN6: *Advanced Weapons Components (CA)*	-	68.752	-	-	-	-	-	-	-	-	0.000	68.752

Note
 Congressional Interest Item funding provided for Advanced Weapons Components.

A. Mission Description and Budget Item Justification
 Congressional Interest Item funding provided for Advanced Weapon Components.

 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 2023**	**FY 2024**
Congressional Add: Program Increase - BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER ***FY 2023 Accomplishments:*** Work in FY 2023 was a continuation of, and furthered, efforts executed under FY 2022. This effort continued to characterize and optimize a diverse set of fiber laser systems, optics, and photonics to support development, maturation, and suitability assessments for technology insertion for High Energy Laser (HEL) weapon systems. Additionally, this effort continued development and mature the next generation direct diode laser systems. Finally, this effort researched crystalline fiber lasers and techniques for high energy pulsed power applications for next generation High Energy Laser systems. Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for BEAM CONTROL SYSTEMS AND INDUSTRY GRADE OPTICAL FIBER FABRICATION FOR ENERGY LASER.	9.000	-
Congressional Add: Program Increase - COUNTER UAS CENTER FOR EXCELLENCE	5.000	-

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602150A / *Air and Missile Defense Technology*	**Project (Number/Name)** BN6 / *Advanced Weapons Components (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Program Increase for COUNTER UA CENTER FOR EXCELLENCE.		
Congressional Add: Program Increase: HIGH ENERGY LASER AND OPTICAL TECHNOLOGY *FY 2023 Accomplishments:* Work in FY 2023 was a continuation of, and furthered, efforts executed under FY 2022. This effort continued to develop and mature improvements in tracking, targeting, cueing, and battle damage assessment. Leveraged previous development efforts to integrate and demonstrate an integrated laser ranger/illuminator with time gated camera that provides improved targeting and engagement in complex and cluttered environments. Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for HIGH ENERGY LASER AND OPTICAL TECHNOLOGY.	10.000	-
Congressional Add: Program Increase - ARMY MISSILE RISK-BASED MISSION ASSURANCE *FY 2023 Accomplishments:* Congressional Program Increase for ARMY MISSILE RISK-BASED MISSION ASSURANCE	5.000	-
Congressional Add: Program Increase - Precision Long Range Integrated Strike (PLRIS) *FY 2023 Accomplishments:* Congressional Program Increase for PRECISION LONG RANGE INTEGRATED STRIKE (PLRIS)	6.752	-
Congressional Add: Program Increase - SMALL UAS TRACKING AND TARGETING DEVICES *FY 2023 Accomplishments:* This effort developed, built and demonstrated a small agile gimbal prototype incorporating enhanced lasers and servos for greater targeting range. The demonstration gimbal for High Energy Laser (HEL) beam direction was based on requirements and designs for next generation lightweight HEL systems. Project expands U.S. manufactured compact stabilized tracking and targeting devices for Class I, II and III small Unmanned Air Systems (sUAS).	14.000	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** BN6 *I Advanced Weapons Components (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**
Work was performed in Huntsville, Alabama by the United States Army Space and Missile Defense Command (USASMDC), with the Rapid Capabilities and Critical Technologies Office (RCCTO) oversight. Congressional Program Increase for SMALL UAS TRACKING AND TARGETING DEVICES.		
Congressional Add: Program Increase - CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER *FY 2023 Accomplishments:* Congressional Program Increase for CYBER ELECTROMAGNETIC ACTIVITIES MISSILE DEFENDER.	2.000	-
Congressional Add: Program Increase - MISSILE RISK-BASED MISSION ASSURANCE *FY 2023 Accomplishments:* Congressional Program Increase for MISSILE RISK-BASED MISSION ASSURANCE.	10.000	-
Congressional Add: Program Increase - Missile Soldier Touch Point Center *FY 2023 Accomplishments:* Congressional Program Increase for Missile Soldier Touch Point Center	7.000	-
Congressional Adds Subtotals	68.752	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	

Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602150A I *Air and Missile Defense Technology*	Project (Number/Name) CV7 I *High Energy Laser Direct Diode Apl Tech*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CV7: *High Energy Laser Direct Diode Apl Tech*	-	2.796	1.495	3.224	-	3.224	3.036	7.425	8.988	9.079	0.000	36.043

A. Mission Description and Budget Item Justification

This Project designs and develops single mode diode emitters to increase output power to 100 Watts with >60% electrical-to-optical efficiency and packaging for an array of emitters. This Project will also develop and validate a 100 kW-class laser subsystem with 58% electrical-to-optical efficiency and 80% fractional power in bucket (PIB) in a lab setting. This Project will leverage industry and National Labs research to overcome gain limitations in the semi-conductor gain region. This Project also funds research necessary to make significant improvements to the size, weight, and power (SWaP) of laser subsystems.

Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis) and PE 0603466A (Air and Missile Defense Advanced Technology)/Project CV6 (Optimized High Energy Laser Source Advanced Technology).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Energy Laser Direct Diode Applied Technology	2.796	1.495	3.224
Description: This effort designs and develops single mode diode emitters to increase output power to 100 Watts with >60% electrical-to-optical efficiency and develop packaging for an array of emitters. This effort will also design and develop a 100 kW-class laser subsystem with 58% Electric to Optical efficiency and 80% fractional Power in the Bucket; validated in a lab setting. This effort will leverage industry and National Labs research to overcome gain limitations in the semi-conductor gain region. *FY 2024 Plans:* Complete development of single mode diode array and packaging. Evaluate spectral locking of array beam quality. Complete development of higher power and efficiency single mode diodes. Evaluate performance and optimize single mode diode designs based on findings. *FY 2025 Plans:* Design and develop technology to passively phase lock many single mode emitters. Research will focus on design concepts that include emitter architectures, packaging, and combining techniques that will get to kilowatt class modules with good beam quality. Initiate proof of concept combining experiments. *FY 2024 to FY 2025 Increase/Decrease Statement:*			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** CV7 *I High Energy Laser Direct Diode Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase reflects a planned increase of design, development and experimentation activities.			
Accomplishments/Planned Programs Subtotals	2.796	1.495	3.224

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity 2040 I 2					R-1 Program Element (Number/Name) PE 0602150A I *Air and Missile Defense Technology*			Project (Number/Name) CV8 I *Vulnerability Modules for Multi-Domain Operations*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CV8: *Vulnerability Modules for Multi-Domain Operations*	-	7.788	8.987	7.750	-	7.750	7.467	6.704	2.791	4.483	0.000	45.970

A. Mission Description and Budget Item Justification

This Project will design and develop High Energy Laser (HEL) Vulnerability Modules (VM), engagement tactics data and kill signatures for targeting Unmanned Aerial Systems, Cruise Missiles, and Rotary Wing threats for future HEL weapon systems. Developed smart VMs will enable real time threat feature detection and targeting, increasing the lethality of the HEL weapon systems through optimizing aimpoint selection. The Development of smart VMs will enable optimized targeting across a large range of current and future threat targets due to detection capabilities applied against threat features and not specific threats.

Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis.

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO and PEO Missiles and Space/PM Shield.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Vulnerability Modules for Multi Domain Operations	7.788	8.987	7.750
Description: This effort will design and develop Vulnerability Modules for Multi Domain Operations against current and emerging high priority threats. Investigates and conducts experiments on High Energy Laser Lethality against Unmanned Aerial Systems, Cruise Missiles and Rotary Wing aircraft. The effort will fund research and conduct experiments to optimize aimpoints for rapid and effective High Energy Laser weapon systems fire control solutions. This effort's subtasks are: o Smart Vulnerability Modules o Aimpoint-specific Fire Control Algorithms o Target System Response o HEL engagement Performance Scoring (Army Mobile Performance Scoring Sensor)			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** CV8 *I Vulnerability Modules for Multi-Domain Operations*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Each task is in support of the design and development of Multi-Domain Operations Vulnerability Modules against current and emerging priority threats - primarily Unmanned Aerial Systems, Cruise Missiles and Rotary Wing aircraft. The effort will fund research and conduct experiments to understand target High Energy Laser vulnerabilities and create smart methods to optimize aimpoints for effective High Energy Laser weapon systems fire control solutions. The evaluation of Target System Response's will further improve fire control systems by providing potential kill signatures to the operator. A key component to the generated Vulnerability Modules products is validation of prototypes using the Vulnerability Modules. The Army's Mobile Performance Scoring System is specifically designed to collect data to validate Vulnerability Modules. The Army Mobile Performance Scoring Sensor is two pieces - a hardware piece that tracks and collects data; and a software piece that estimates the total energy applied to the aimpoint to compare against the Vulnerability Modules values. The software will be designed to work with multiple collection telescopes such that Army Mobile Performance Scoring Sensor is a family of products. *FY 2024 Plans:* This effort will advance Vulnerability Modules (VMs) on Group 2&3 Unmanned Aerial Systems (UASs), Rotary Wing (R-W), and Subsonic and Supersonic Cruise Missiles (CMs) through vulnerability analysis and experiments. Conduct Part Two of UAS and R-W initial coupon/material and specific aimpoint experiments utilizing data gained in Smart VM development to further increase VM Readiness Levels (RLs). Conduct Subsonic CM complete set of components and full-scale experiments. Conduct studies of Supersonic CM analytical/existing data, intel, and SME operations combined with DoD simulations. *FY 2025 Plans:* This effort will mature Vulnerability Modules for Group 2-3 Unmanned Aerial Systems, Rotary Wing, and subsonic cruise missiles to a Vulnerability Modules Readiness Level 5; Supersonic Cruise Missiles to Vulnerability Module Readiness Level 4; and Hypersonic CM VM Readiness Level 3. The Smart Vulnerability Module methodology will be expanded to targets beyond the initial use in Group 1-2 Unmanned Aerial Vehicles. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned completion of Vulnerability Modules workflows of Class 2 and 3 Unmanned Aerial Systems.			
Accomplishments/Planned Programs Subtotals	7.788	8.987	7.750

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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| Exhibit R-2A, RDT&E Project Justification: PB 2025 Army | | | | | | | | | | **Date:** March 2024 | |

Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602150A I *Air and Missile Defense Technology*	Project (Number/Name) DA9 I *Radar Survivability through Dis Sensing Tech*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DA9: *Radar Survivability through Dis Sensing Tech*	-	5.591	4.703	4.084	-	4.084	2.271	-	-	-	0.000	16.649

A. Mission Description and Budget Item Justification

This project investigates and develops critical radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets. Radar enhancements are required for advanced Electronic Protection (EP) techniques against advanced jammers, electronic Combat Identification (CID), and resource optimization across the threat spectrum while retaining 360?coverage capability. Technology development includes providing capabilities for: dispersed multi-static operation, classifying/tracking emerging threats and high-volume threats; adaptive digital beam forming to enable resource efficiency, performance in a dynamic clutter environment and enhanced survivability in a contested battlespace; and multi-modal tracking and additional discrimination models to support diverse and emerging threats, such as swarms and guided munitions. Enhanced development for the state-of-the-art scalable, digital array radar testbed to include advanced algorithms, transmitted power, antenna gain, detection range and angle accuracy/resolution upgrades to the existing/new radar front/back ends will allow greater performance characterization for Multi-mission Army Radar systems supporting the Multi-domain Operations (MDO).

This research is coordinated with Army Program Element (PE) 0602141A (Lethality Technology) / Project CG4 (Advanced Radar Concepts); PE 0602148A (Future Vertical Lift Technology) / Project CC3 (FVL Radar Technology); and PE 0601102A (Defense Research Sciences) / Project AA8 (Foundational Distributed Radar); Additionally, this project leverages and works closely with Navy, Air Force, DARPA, and MDA radar research and development efforts.

This research complements Program Element (PE) 0602141A (Lethality Technology) / Project CJ7 (Future Air Defense Missile Enabling Technology) and PE 0603466A (Air and Missile Defense Advanced Technology) / Project DB3 (Radar Survivability through Dis Sensing Adv Tech).

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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Radar Survivability through Dis Sensing (RSDS) Tech	5.591	4.703	4.084
Description: Investigates and develops critical radar capability enhancements to defeat advanced Air and Missile threats and protect Army maneuver forces and critical assets			
FY 2024 Plans: Will develop RSDS software technology and radar representative hardware to minimize risks associated with integration into Army Radar systems; continue modeling and simulation efforts to develop concepts in the areas of operations analysis, radar resource optimization, and radar communications; inform performance metrics of distributed sensing in a multi-static radar			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** DA9 *I Radar Survivability through Dis Sensing Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
configuration; utilize the low-cost multi-static radar testbed and execute data collections in distributed sensing configurations in contested environments; perform data analysis to aid with modeling and simulation and the development of a software based RSDS capability for future and current air defense radar systems. *FY 2025 Plans:* Will develop a multi-static sensing concept of operations (CONOPS) to inform future requirements for Lower Tier Air and Missile Defense Sensor (LTAMDS); develop a strategy and framework to integrate multi-static awareness in the Integrated Air and Missile Defense Battle Command System (IBCS). Enhance the modeling and simulation efforts and concepts in the areas of operations analysis, radar resource optimization, and radar communications; inform performance metrics of distributed sensing in a multi-static radar configuration. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	5.591	4.703	4.084

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*				**Project (Number/Name)** DC1 *I Next Generation DE Concept Development & Analysis*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DC1: *Next Generation DE Concept Development & Analysis*	-	6.149	6.446	8.303	-	8.303	8.329	8.356	10.505	12.704	0.000	60.792

A. Mission Description and Budget Item Justification

This Project researches and investigates lethality effectiveness, adaptive optics, beam control, laser sources, target and beacon illuminator lasers, new tracking algorithms, laser and beam control equipping for High Energy Laser experimentation to improve future High Energy Laser weapon system effectiveness. This Project determines critical activities to enable next generation directed energy technical innovations and funds core competencies in Lethality and Directed Energy.

Research in this Project complements other Army Directed Energy efforts conducted under (PE) 0602150A (Air and Missile Defense Technology)/Project CV7 (High Energy Laser Direct Diode Apl Tech), Project DE3 (Advanced Beam Control Component Development for Counter-Cruise Missile), Project CV8 (Vulnerability Modules (VM) for Multi-Domain Operations), and PE 0603466A (Air and Missile Defense Advanced Technology)/Project CV6 (Optimized High Energy Laser Source Advanced Technology), Project IB1 (Integrated Beam Control Systems Demonstration for Counter-Cruise Missile).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Next Generation Direct Energy Concept Development and Analysis	6.149	6.446	8.303
Description: This effort funds foundational core competencies to develop and maintain a competent and skilled Directed Energy workforce as well as develop Science and Technology Labs to support future Directed Energy components, subsystems and system upgrades. This effort funds foundational research for future High Energy Laser weapons to effectively engage an array of threats. Research includes: - Basic physics modeling and investigating of target vulnerability from material analysis through data collection of High Energy Laser engagements using dynamic targets. - Identifying and prioritizing threat aim points by analyzing the time to kill for each aimpoint. - Validating Core Modeling and Simulations tools used in lethality and beam propagation. - Evaluating and prototyping High Energy Laser subsystems for adaptive optics, beam control, laser diodes and laser illuminators. ***FY 2024 Plans:***			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** DC1 *I Next Generation DE Concept Development & Analysis*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will research and investigate laser sources, beam control and advanced adaptive optics for increased high energy laser (HEL) system effectiveness against a range of threats. Conducts experiments to characterize high energy laser components and subsystem effectiveness. Continues to research and investigate laser source concepts to improve, size, weight, and power (SWaP) of HEL weapon systems. Determines critical activities to enable next generation DE technical innovations and core competencies. *FY 2025 Plans:* Will research and investigate laser sources, beam control and lethal effectiveness for emerging threats and increased high energy laser (HEL) system effectiveness against a range of existing threats. Will perform analysis on HEL weapon systems in varying architectures against emerging threats and develop concept architectures that will provide advanced warfighting capabilities. Develop technical research strategies and funding requirements for future advanced HEL capabilities. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects a planned increase of the Directed Energy modernization priorities and an increase of foundational core competencies in Directed Energy technologies to support future Directed Energy weapon systems.			
Accomplishments/Planned Programs Subtotals	6.149	6.446	8.303

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*				**Project (Number/Name)** DE3 *I Adv Beam Control Component Development for C-CM*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DE3: *Adv Beam Control Component Development for C-CM*	-	-	8.286	5.361	-	5.361	5.752	11.739	10.921	10.921	0.000	52.980

A. Mission Description and Budget Item Justification

This project researches and develops advanced Beam Control technology to create new sensors, illuminators, deformable mirrors, wave front sensors (WFS), other optical components, and acquisition and tracking concepts. Design and develop a 50-cm class off-axis beam expander with innovative cost savings research on components. Develop algorithms for WFS and laser quality tracking. Design a 1-meter class segmented Beam Director for Phased Array High Energy Laser beam inputs. This effort will increase the effective range of the Indirect Fire Protection Capability High Energy Laser weapon system.

Work is this Project complements (PE) 0602150A (Air and Missile Defense Technology)/Project DC1 (Next Generation Directed Energy Concept Development and Analysis) and PE 0603466A (Air and Missile Defense Advanced Technology)/Project IB1 (Integrated Beam Control Systems Demonstration for Counter-Cruise Missile).

The cited research is consistent with the Army's modernization programs, the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Modernization Strategy, and supports the Army's future capability opportunities for leap-ahead technology for Directed Energy.

Research is performed by the United States Army Space and Missile Defense Command - Technical Center (USASMDC-TC) in coordination with RCCTO.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advanced Beam Control Component Developments for C-CM	-	8.286	5.361
Description: Support Advanced Beam Control Phase I (extend effective range of the Indirect Fire Protection Capability High Energy Laser weapon system). Support Advanced Beam Control Phase II (extend effective range of the Indirect Fire Protection Capability High Energy Laser weapon system). Develop New Technologies for Beam Director Assemblies. Support the Space and Missile Defense Commands efforts in developing Counter Cruise Missile Components/Subsystems. ***FY 2024 Plans:*** Research and develop advanced beam control technology to improve weapon system effectiveness and extend the effective range.			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army			Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602150A / *Air and Missile Defense Technology*	Project (Number/Name) DE3 / *Adv Beam Control Component Development for C-CM*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Investigate optimal algorithms and hardware configuration for multiple wavefront sensor architectures. ***FY 2025 Plans:*** Continue research and development of beam control technologies that will enable a high energy laser weapon system to extend the effective range. Continue development of 50-cm class high energy laser beam expander with Technology Readiness Level (TRL) 4 laboratory validation. Continue development of advanced adaptive optics systems in a laboratory environment with a TRL 4 demonstration. Continue development of laser quality tracking improvements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects a planned completion of workflows of applied research and the transition of technology to integration and demonstration.			
Accomplishments/Planned Programs Subtotals	-	8.286	5.361

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army						**Date:** March 2024					
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*			**Project (Number/Name)** SU1 *I Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
SU1: *Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*	-	-	-	7.694	-	7.694	12.738	11.924	11.443	12.895	0.000	56.694

Note

Counter Small Unmanned Aircraft Sys (C-sUAS) Tech is a new start within the Air and Missile Defense Technology program in FY 2025.

This is an Army priority effort for Counter-small Unmanned Aircraft System (C-sUAS) capability.

A. Mission Description and Budget Item Justification

This Project investigates, designs and develops novel Counter-small Unmanned Aircraft System (C-sUAS) kinetic missile interceptor capabilities. Project will transition technologies for increased range, reduce reaction time, increase lethality, improve reliability, reduce reload time for fixed site and mobile C-sUAS configurations. Provides maneuver forces a quick-response, high speed, long-range kinetic interceptor capabilities against Group 3 small Unmanned Aircraft Systems (sUAS) that operate at higher altitudes with greater standoff ranges for Multi-Domain Operations (MDO). Designs and develops small, lightweight, and low-cost missile interceptor technologies for increased magazine depth (stowed kills) to enable brigade/maneuver force kinetic defeat numerous sUAS at short range. Provides deeper magazine against sUAS threats with versatile employment options at a low cost provides maneuver forces increased freedom of movement and protection during large scale combat operations. This project supports Air and Missile Defense Modernization priority efforts.

This research is coordinated with PE 0602141A (Lethality Technology) / Project CJ7 (Future Air and Missile Defense Enabling Technology); PE 0602147A (Long Range Precision Fires Technology / Project AF8 (Affordable Extended Range Precision Technology) and will transition for further maturation to PE 0603464A (Air and Missile Defense Advanced Technology) / Project SU2 (Counter s-UAS Advanced Tech)

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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Extended Range C-sUAS (XRC) Tech	-	-	7.694
Description: This effort investigates concepts, performs trade studies, and provides component technology development to increase range, reduce reaction time, increase lethality, improve reliability, and reduce reload time for C-sUAS kinetic interceptor capabilities for the maneuver forces fixed site and mobile C-sUAS configurations. *FY 2025 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602150A *I Air and Missile Defense Technology*	**Project (Number/Name)** SU1 *I Counter Small Unmanned Aircraft Sys (C-sUAS) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will investigate critical component technology to address small form factor C-sUAS missile systems; design and develop novel propulsion concepts through component evaluation and analysis; investigate small form factor seeker technology to meet long range missile intercept requirements; design and develop small form factor critical missile components for extended range UAS targets.			
FY 2024 to FY 2025 Increase/Decrease Statement: In Fiscal Year (FY) 2025 this Project is a New Start.			
Accomplishments/Planned Programs Subtotals	-	-	7.694

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*						
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	15.481	24.142	20.319	-	20.319	19.721	20.077	19.811	18.983	0.000	138.534
CL2: *AI Enhanced Intel Operations Technologies*	-	2.000	2.546	2.969	-	2.969	3.075	3.380	3.334	3.368	0.000	20.672
CL7: *ATR Using Multiple Cooperative Sensors App Tech*	-	6.155	10.895	5.696	-	5.696	4.805	4.804	4.851	4.908	0.000	42.114
CN7: *Predictive Maintenance Applied Research*	-	4.523	6.030	6.071	-	6.071	6.173	6.191	6.357	6.357	0.000	41.702
DA5: *AI Enabled Talent Management Applied Research*	-	0.307	-	0.307	-	0.307	0.313	0.319	0.326	-	0.000	1.572
DA6: *AI-Enabled Command and Coordination Apl Research*	-	2.496	3.265	3.525	-	3.525	3.539	3.561	3.065	3.096	0.000	22.547
DE8: *AI Development Environment Applied Research*	-	-	1.406	1.751	-	1.751	1.816	1.822	1.878	1.254	0.000	9.927

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates artificial intelligence (AI) and machine learning (ML) to support an AI-enabled Multi-Domain Operations (MDO) Force to mature target recognition/detection using multiple cooperative autonomous sensors (MCAS), leader decision-making, replication of tactical behaviors to enable autonomous capabilities for maneuver, predictive maintenance, and intelligence support for operations in support of long-range precision fires. The Army's Artificial Integration Center (AI2C) will provide strategic guidance and coordination of these applied research efforts in AI/ML across the Army Modernization enterprise.

Work in this PE contributes to the Army Science and Technology (S&T) portfolio and is fully coordinated with efforts in PE 0601601A (Artificial Intelligence Basic Research) and PE 0603040A (Artificial Intelligence Advanced Technologies).

The cited research is consistent with the Under Secretary of Defense for Research and Engineering S&T focus areas, the Army Modernization Strategy and the Chief Digital and Artificial Intelligence Office (CDAO).

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*		
B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	16.068	24.142	23.975	-	23.975
Current President's Budget	15.481	24.142	20.319	-	20.319
Total Adjustments	-0.587	0.000	-3.656	-	-3.656
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.002	-			
• SBIR/STTR Transfer	-0.585	-			
• Adjustments to Budget Years	-	-	-3.656	-	-3.656

Change Summary Explanation

Decrease in FY 2025 from the previous PB to the current PB reflects a realignment to PE 0603040A / Artificial Intelligence and Machine Learning Advanced Technologies

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Appropriation/Budget Activity 2040 / 2				R-1 Program Element (Number/Name) PE 0602180A / *Artificial Intelligence and Machine Learning Technologies*				Project (Number/Name) CL2 / *AI Enhanced Intel Operations Technologies*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CL2: *AI Enhanced Intel Operations Technologies*	-	2.000	2.546	2.969	-	2.969	3.075	3.380	3.334	3.368	0.000	20.672

A. Mission Description and Budget Item Justification

This Project will design and develop various technologies to augment human intelligence analysts with artificial intelligence (AI) and machine learning (ML)-enabled decision support, workflow automation, and recommendation tools to modernize how the Intelligence Warfighting Function supports Multi-Domain Operations and Joint All Domain Command and Control (JADC2). This Project will mature technologies that will enable interoperable intelligence organizations capable of conducting synchronized, proactive intelligence operations to optimize individual efficiencies and team performance.

The Capstone Concept for Joint Operations: Joint Force 2020 and the Force 2025 and Beyond (F2025B) strategy calls for the integration of terrestrial sensing and exploitation capabilities to accelerate the data to decision cycle across the Range of Military Operations (ROMO). The Army Operating Concept and the Army Functional Concepts identifies the need for interoperable intelligence organizations capable of conducting synchronized proactive intelligence operations that optimize individual efficiencies and team performance. These concepts are driven by a threat that has studied United States (US) advancements during the Global War on Terror and taken notes.

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

This research is supported and coordinated with the Army Intel Community, Army Futures Command, and the Army Intelligence, Surveillance, Reconnaissance (ISR) Task Force.

Work in this Project supports the Army Science and Technology Ground Portfolio and the Chief Digital and Artificial Intelligence Office (CDAO).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: AI Enhancements for Prometheus	0.557	-	-
Description: AI Enabled Intelligence Fusion for Targeting will address a "multi-INT" fusion problem and demonstrate how AI algorithms can fuse data from various military intelligence systems to support sensor to shooter automation for the strategic, operational, and tactical levels. This effort will design and develop AI capabilities for support of Long Range Precision Fires, Mission Command, and Maneuver Commanders by leveraging Intelligence Community enterprise investments in sensing, data transport, and Machine Learning / AI frameworks.			
Title: AI-Enabled Intelligence Decision Support	0.961	1.000	0.914

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL2 *I AI Enhanced Intel Operations Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: This effort will investigate the augmentation of Military Intelligence and Operations (Intel/Ops) with artificial intelligence capabilities to leverage Mission, Enemy, Terrain and Weather, Troops, Time Available, and Civilian Considerations (METT-TC) information available to Commanders in support of Intelligence Preparation of the Battlefield (IPB) and the Military Decision Making Process (MDMP). The effort will mature techniques to visualize and animate threat models to support automated AI-enabled enemy courses of action analysis. *FY 2024 Plans:* Design and develop AI agents to employ METT-TC information available to Commanders to generate courses of action for threat formations as well as conduct AI-war gaming in support of Intelligence Preparation of the Battlefield and the Military Decision Making Process. This effort will conduct experiments of automated real-time strategy war gaming between synthetic agents representing friendly and adversary forces at the Division echelon. *FY 2025 Plans:* Design and develop AI agents to employ METT-TC information available to Commanders to generate courses of action for threat formations as well as conduct AI-war gaming in support of Intelligence Preparation of the Operational Environment and the Military Decision Making Process. This effort will conduct experiments of automated real-time strategy war gaming between synthetic agents representing friendly and adversary forces at Corps and above echelons. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease is consistent with the lifecycle of this effort.			
Title: Foundation for AI Intelligence Support to Operations (ARCANE SERIES) *Description:* Design and develop an AI infrastructure/pipeline for training, integrating, and sustaining AI across multiple AI domains to inform requirements for enterprise production systems and edge systems for the Army Military Intelligence and Operations (Intel/Ops) community. *FY 2024 Plans:* Will mature data frameworks and data pipelines for fusion of intelligence data from multiple military intelligence systems. Will develop and conduct experiments with infrastructure components that can implement machine learning algorithms across multiple AI domains. *FY 2025 Plans:*	0.482	0.500	0.802

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL2 *I AI Enhanced Intel Operations Technologies*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will continue to mature data frameworks and data pipelines for fusion of intelligence data from multiple military intelligence systems. Will continue to develop and conduct experiments with infrastructure components that can implement machine learning algorithms across multiple AI domains. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase due to lifecycle of the task.			
Title: Rare Object Generation and Detection ***Description:*** This effort will design and develop AI and machine learning (ML) technology to generate and detect objects that are rarely detected and have limited training data sets (rare object generation and detection). Rare object generation and detection is a key ML challenge due to limited amounts of available training data that make it difficult to build high performing AI models to address these challenges. ***FY 2024 Plans:*** This effort will design and develop AI and machine learning (ML) algorithms for rare object generation, detection and recognition. Research will investigate technical approaches to address object image variations and limited amounts of available training data such as the use of synthetic data. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease due to lifecycle of the task.	-	0.511	-
Title: AI-Enabled Intelligence Fusion for Targeting ***Description:*** AI Enabled Intelligence Fusion for Targeting will investigate the fusion of different type of intelligence data (multi-INT fusion) and validate AI algorithms that can fuse data from various military intelligence systems to support sensor to shooter automation for the strategic, operational, and tactical levels. This effort will design and develop AI capabilities for support of Long Range Precision Fires, Mission Command, and Maneuver Commanders by leveraging Intelligence Community enterprise investments in sensing, data transport, and Machine Learning / AI frameworks. ***FY 2024 Plans:*** Will develop a system of applications that utilize AI technologies to identify targets of interest and develop algorithms that use multiple data sources to predict representation for novel object classes from a small number of novel class samples. Will investigate the fusion of visual, language, signal, and event-based information and semantic relationships to learn new objects and relationships and validate knowledge transfer from base classes to novel classes in order to reduce the time it takes to train AI algorithms. ***FY 2025 Plans:***	-	0.535	0.802

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602180A I *Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL2 I *AI Enhanced Intel Operations Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will develop and mature a system of applications that utilize AI technologies to identify targets of interest and develop algorithms that use multiple data sources to predict representation for novel object classes from a small number of novel class samples. Will investigate the fusion of visual, language, signal, and event-based information and semantic relationships to learn new objects and relationships and validate knowledge transfer from base classes to novel classes to reduce the time it takes to train AI algorithms. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase supports lifecycle of the task.			
Title: AI-Enabled Social Media Exploitation ***Description:*** Artificial Intelligence (AI) Enabled Social Media Exploitation will enhance the social cybersecurity posture for the U.S. Army by developing, maturing, and experimenting with AI-enabled tools for exploiting social media information and other pertinent publicly available information (PAI). This effort investigates how the combination of network science with AI/ML techniques such as natural language processing and low shot learning and enables identification and characterization of adversaries and collection opportunities via cyber-mediated vectors. These capabilities support improved battlefield awareness by allowing operational units to discover and track online, adversarial influence campaigns, in multiple languages across multiple platforms. ***FY 2025 Plans:*** Will design, develop, and mature an application for the purpose of investigating network science algorithms that apply natural language and low shot learning technologies for the purposes exploiting social media platforms and publicly available information for increased battlefield awareness. Will experiment internally to determine which technical approaches are most effective at achieving the desired effect. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Increase in FY2025 reflects initiation of Artificial Intelligence (AI) Enabled Social Media Exploitation to continue the AI designated efforts within the PE.	-	-	0.451
Accomplishments/Planned Programs Subtotals	2.000	2.546	2.969

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*				**Project (Number/Name)** CL7 *I ATR Using Multiple Cooperative Sensors App Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CL7: *ATR Using Multiple Cooperative Sensors App Tech*	-	6.155	10.895	5.696	-	5.696	4.805	4.804	4.851	4.908	0.000	42.114

A. Mission Description and Budget Item Justification

This Project will design and develop Artificial Intelligence (AI) and Machine Learning (ML) algorithms that leverage a team of air and ground sensors to autonomously navigate and collaborate through shared perception of the optical, thermal, and electromagnetic spectrums to find, identify, geo-locate, and track targets during reconnaissance missions.

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

Research in this Project supports the Army Science and Technology Lethality Portfolio and the Chief Digital and Artificial Intelligence Office (CDAO).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Collaborative Target Detection and Tracking *Description:* This effort will design and develop the AI / ML technologies to automatically detect and track targets using electro-optical, thermal, and electromagnetic sensors and constrained computing hardware onboard the air and ground vehicles and share threat perception across the unmanned team. *FY 2024 Plans:* Will develop algorithms that enable autonomous air and ground vehicles to track and maintain custody of targets after detection to aid in the subsequent stages of the targeting cycle including engagement and assessment. Develop algorithms that share the attributes of targets detected by a single platform to the entire team of autonomous sensors. *FY 2025 Plans:* Develop and experiment with the means to perform multi-scale detections on static and mobile targets, where initial detections from a wide-angle sensor are further discriminated using a detector that processes images with more pixels of the target provided by a separate pan, tilt, zoom (PTZ) sensor. Develop a cross-platform fusion model that uses the appearance of targets - to include 3D information to determine whether newly detected targets are the same as those previously reported to the common operating picture (COP). Develop and experiment with the means to pre-process imagery from sensors - using machine learning or computer vision - to optimize camera parameters so that high-quality images with more constant exposure, contrast, and color balance are fed into the Aided Target Recognition (AiTR) model. Develop methods for integrating a laser rangefinder with the PTZ unit to reduce target location error. Experiment with improved ATR performance based on the capabilities of faster maneuver,	4.204	4.695	2.505

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL7 *I ATR Using Multiple Cooperative Sensors App Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
multi-spectral detection for both static and mobile targets, maintain target custody of mobile targets and collaborate ground and air platforms to support these improvements.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease is due to realignment to PE 0603040A/ Artificial Intelligence and Machine Learning Advanced Technologies.			
Title: Autonomous and Collaborative Mobility *Description:* This effort will design and develop mobility algorithms using AI and ML techniques that allow autonomous ground and air vehicles to passively perceive the terrain and self-navigate without active and detectable sensing. Design and develop collaborative teaming techniques for autonomous air and ground vehicles to work together on reconnaissance missions. *FY 2024 Plans:* Design and develop AI algorithms that enable autonomous air and ground platforms to maneuver more tactically and collaboratively during reconnaissance missions. Develop a simulation environment that will allow for reinforcement learning to be leveraged in the development of tactical and collaborative behaviors for the air and ground platforms based on terrain, anticipated enemy locations, view shed, and other factors. Develop autonomy algorithms for more complex terrain and conditions, including nighttime and Global Positioning System (GPS)-denied environments. *FY 2025 Plans:* Develop and mature 3D stereo data self-registration techniques to improve robustness of perception in rough terrain by correcting for pose estimation error. Integrate multi-scale processing techniques (e.g., variable resolution and frame rates) to improve robustness of perception at higher traversal speeds. Develop a module that optionally activates and leverages data from a LiDAR sensor when the threat of detection is minimal. Develop and demonstrate autonomous operation without using or dependency on a global prior cost map. Develop terrain awareness for autonomous UAS's - using pre-loaded or referenced elevation data - so that UAS's avoid hazardous terrain features and can self-identify exclusion areas. Develop payloads on ground robotic vehicles that capable of storing, transporting, and autonomously launching small UASs. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease supports planned lifecycle of this effort.	0.962	4.700	2.189
Title: Intuitive Mission Command Interfaces *Description:* Design and develop the capability for warfighters to quickly and intuitively convey reconnaissance guidance, confirm or deny detected targets, and take recommended action through common mission command tools, including Tactical Assault Kit (TAK) and Integrated Visual Augmentation System (IVAS). *FY 2024 Plans:*	0.452	1.500	1.002

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL7 *I ATR Using Multiple Cooperative Sensors App Tech*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Develop software for the Integrated Visual Augmentation System (IVAS) that enables soldiers to intuitively relay reconnaissance intent to a team of autonomous sensors and quickly interpret feedback from the systems and make targeting decisions. Explore various algorithms that use voice commands, eye movements, and hand gestures to interact with the system for relaying intent and closing the targeting cycle more effectively. Develop feedback mechanisms in Android Tactical Assault Kit (ATAK) and IVAS to improve the AI algorithms once soldiers recognize mistakes by the autonomous sensors. *FY 2025 Plans:* Mature the User Interface/User Experience (UI/UX) to develop an updated messaging solution that supports interoperability to the dismounted, mounted and fires community as an improved Android Tactical Assault Kit (ATAK) plug-in across multiple WfF. The UI/UX would define critical command and control messages for the air and ground robots to ensure the protocol specification includes the automatic acknowledgement and retransmission of these messages that communicate to the Tactical Operations Center. Develop algorithms to reside on the robots and verify whether missions received from ATAK are valid (e.g., whether on area designated for reconnaissance is feasible based on platform range or battery life). Integrate joystick commands received from ATAK so that designated robots can be tele-operated on-demand until autonomy operations are employed. Develop UAS controls inside ATAK to operate UAS as a ground control station via a plug-in supported in multiple formations. Develop relevant real-time sensor data from robots to ATAK, to include state information and status health status robots, progress on mission execution, snapshots, or video from sensors, etc. Develop the ability for robots to send high-quality picture images, to include the option of panoramic images, on-demand from ATAK. Experiment with the features and enhancements to ATAK and verify full functionality in degraded wireless networks. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects the planned lifecycle of this effort.			
Title: Coeus *Description:* This effort investigates cloud and cloud-native architectures, orchestration technologies, and collaboration techniques to support current and future AI model development and machine learning operations (MLOps) tasks across a globally distributed workforce. Research will increase efficiency of development platforms, decrease model development costs, and reduce the time required to integrate new AI capabilities into software products.	0.537	-	-
Accomplishments/Planned Programs Subtotals	6.155	10.895	5.696

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CL7 *I ATR Using Multiple Cooperative Sensors App Tech*

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*					**Project (Number/Name)** CN7 *I Predictive Maintenance Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CN7: *Predictive Maintenance Applied Research*	-	4.523	6.030	6.071	-	6.071	6.173	6.191	6.357	6.357	0.000	41.702

A. Mission Description and Budget Item Justification

This Project designs and develops artificial intelligence (AI) and machine learning (ML) tools and capabilities to predict and analyze maintenance status for emerging and legacy aviation and ground platforms. Investigates techniques to extract data from maintenance databases and platform sensors and make inferences of missing data via virtual simulations. Will investigate maintenance concepts that employ AI data capture and integrate AI tools into enterprise resource planning for military aviation and ground vehicles. Will determine platforms of focus and prioritize by cost and value to Army missions. Each platform will be sequentially investigated at the appropriate component (i.e. engine health) and fleet level. Will determine appropriate technologies and capabilities needed to construct a robust Army-wide predicative maintenance platform that will accelerate the pace of innovation for this problem set. Will validate and inform requirements and technical architectures for modernization efforts of next generation aviation and ground systems both manned and unmanned.

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

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Predictive Maintenance	4.523	6.030	6.071
Description: This Project designs and develops artificial intelligence (AI) and machine learning (ML) tools and capabilities to predict and analyze maintenance status for emerging and legacy aviation and ground platforms. Investigates techniques to extract data from maintenance databases and platform sensors and make inferences of missing data via virtual simulations. Will investigate maintenance concepts that employ AI data capture and integrate AI tools into enterprise resource planning for military aviation and ground vehicles. Will determine platforms of focus and prioritize by cost and value to Army missions. Each platform will be sequentially investigated at the appropriate component (i.e. engine health) and fleet level. Will determine appropriate technologies and capabilities needed to construct a robust Army-wide predicative maintenance platform that will accelerate the pace of innovation for this problem set. Will validate and inform requirements and technical architectures for modernization efforts of next generation aviation and ground systems both manned and unmanned.			
The cited research is consistent with Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.			
Research in this Project supports the Army Science and Technology Ground Portfolio.			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** CN7 *I Predictive Maintenance Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2024 Plans: Will validate AI models addressing high-priority maintenance and supply concerns relevant to tactically-orientated formations. Will explore the pairing these AI models with the foundational components of a scalable hybrid edge/cloud data management environment able to maneuver with Army units in Multi-Domain Operations. Investigations will validate the appropriate balance of edge/cloud data storage, curation, movement, and automation. These features will be determined in reference to operations when the connection to the Department of Defense Information Network (DODIN) is disrupted and when it is connected.			
FY 2025 Plans: Designs and develops models for serialized component level analysis that are enhanced with non-serialized component information based off fault write-ups associated with a particular sub-component. Matures the model development and deployment pipeline to provide the ability to train, retrain, or update the component model and redeploy to the flight line in mission relevant time for predictive analytics. Predictive maintenance modeling will be expanded to proper maintenance management to allow for battalion maintenance officers to properly manage their unit's maintenance program and forecast upcoming scheduled and unscheduled maintenance.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding increase reflects an economic adjustment.			
Accomplishments/Planned Programs Subtotals	4.523	6.030	6.071

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*			**Project (Number/Name)** DA5 *I AI Enabled Talent Management Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DA5: *AI Enabled Talent Management Applied Research*	-	0.307	-	0.307	-	0.307	0.313	0.319	0.326	-	0.000	1.572

A. Mission Description and Budget Item Justification

This Project designs, develops, and validates applied behavioral and social science research to enhance the Soldier Lifecycle (e.g., selection, assignment, training, and leader development) and human relations (e.g., unit cohesion). This Project will design and develop new personnel measures and methods that more fully assess potential and predict performance, behavior, attitudes, and resilience. These technologies also provide innovative and effective Force Integration methods to optimize individual and team performance to ensure the Army can meet mission requirements in uncertain and complex environments. This Project designs and develops new performance measures and metrics for individuals and units, designs innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. This Project will also investigate 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 research is consistent with Under Secretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

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

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Artificial Intelligence (AI)-Enabled Skill Identification for Job Matching and Team Building ***Description:*** This effort will develop AI techniques to create an analytical suite that can measure skills required by job postings and skills possessed by soldiers and officers. This will permit the Army to "put the right person in the right job" and determine how to combine individuals to optimize team performance. ***FY 2025 Plans:*** Will investigate the scalability of the application to enterprise-level requirements. This will include, but not limited to, identifying various datasets of interest that are relevant to various skill sets, education, training, and expertise of candidates, investigating and analyses of these datasets by using natural language processing, large language models and other means. This project will design and develop algorithms to identify complementary team members and recommend individual substitutions, along with the retention of individuals to improve and maintain team performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase for higher priority AI project.	0.307	-	0.307
Accomplishments/Planned Programs Subtotals	0.307	-	0.307

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** DA5 *I AI Enabled Talent Management Applied Research*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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| **Appropriation/Budget Activity**
2040 *I* 2 | | | | | **R-1 Program Element (Number/Name)**
PE 0602180A *I Artificial Intelligence and Machine Learning Technologies* | | | **Project (Number/Name)**
DA6 *I AI-Enabled Command and Coordination Apl Research* | | | |

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DA6: *AI-Enabled Command and Coordination Apl Research*	-	2.496	3.265	3.525	-	3.525	3.539	3.561	3.065	3.096	0.000	22.547

A. Mission Description and Budget Item Justification

This Project designs and develops solutions that enable Artificial Intelligence (AI)-Enabled Command and Coordination. Additionally, project investigates and matures technologies required to enable commanders and their staff to synchronize and converge all elements of available combat power to achieve multi-domain effects. Technology maturation includes the development and testing of algorithms, models, software, hardware, and interfaces required to support the command of Army forces, coordination of Army operations, execution of the operations process, and establishing necessary C2 systems.

Work in this Project complements PE 0603040 (Artificial Intelligence and Machine Learning Advanced Technologies) / Project DA7 (AI-Enabled Command and Coordination Adv Tech).

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

Research in this Project is performed by the U.S. Army Artificial Intelligence Integration Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Course of Action (COA) Analysis for Optimal Operations ***Description:*** Design and develop a game theory based algorithm to create optimal or near-optimal COA for red and blue forces based on available data or user inputs.	1.538	-	-
Title: AI-Enhanced Battle Damage Assessment ***Description:*** Design and develop algorithms to optimize the relationships between known friendly force sensors and shooters and assign them to available targets.	0.958	-	-
Title: AI-Enhanced Planning for Optimal Operations ***Description:*** This effort designs and develops AI-enabled systems that link people, processes, networks, and command posts in support of command and control. Develops and trains models that analyze, understand, and optimize AI-operations across Army Battle Command Systems and data fabrics. Establishes access to fused multitudinous data sources in support of AI-based analytics capabilities. This effort will provide tool for Commanders and staffs at Echelons Above Brigade to explore hypothetical situations ISO the operations process and Army planning to achieve decision dominance.	-	2.000	1.002

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602180A / *Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** DA6 / *AI-Enabled Command and Coordination Apl Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
FY 2024 Plans: Will design and develop game theory and multi-agent reinforcement learning algorithms and integrate with an available simulation framework to create COAs at various echelons. Will investigate and determine scenario criteria need for the algorithm to function, design and develop learning strategies and utility functions, and integrate the AI system into an available simulation suite to enable model training.			
FY 2025 Plans: Will design and develop game theory and multi-agent reinforcement learning and other foundational AI models and algorithms to integrate with an available simulation framework to create courses of action (COAs) at the theater echelons. Investigate and determine scenario criteria need for the algorithm to function, design and develop learning strategies and utility functions, and integrate the AI system into an available simulation suite to enable model training.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects planned lifecycle of this effort.			
Title: AI Command and Coordination Environment	-	1.265	-
Description: This effort designs and develops AI-enabled systems that link people, processes, networks, and command posts in support of command and coordination. Develops and trains models that analyze, understand, and optimize AI-operations across Army Battle Command Systems and data fabrics. Establishes access to fused multitudinous data sources in support of AI-based analytics capabilities. *FY 2024 Plans:* Design and demonstrate a cloud native C2 environment for access to AI-tools at the edge in degraded communications environments. Incorporate tactical data fabric concepts with AI enabled decision dominance hardware and software requirements. *FY 2024 to FY 2025 Increase/Decrease Statement:* In Fiscal Year (FY) 2025 work in this task is realigned to the AI-Enabled Common Operating Picture and Battle Tracking task.			
Title: AI-Enabled Common Operating Picture and Battle Tracking	-	-	1.020
Description: Will develop and mature AI-enabled tools that allow commanders and staff to prepare for, execute, and assess Army operations to enable decision dominance. Will mature and demonstrate human-machine interfaces that take input of commanders' intent and plans and provides computer-based battle tracking to identify risk to mission and force and AI-optimized direction to Army forces and unified action partners. *FY 2025 Plans:*			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** DA6 *I AI-Enabled Command and Coordination Apl Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Develop AI-enabled common operating picture that surfaces ML/AI insights from the Sustainment, Intelligence, Fires, Protection, Movement and Maneuver, and Information Advantage warfighting functions. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025 work in this task is realigned from the AI Command and Coordination Environment task.			
Title: Distributed Artificial Intelligence ***Description:*** Designs and develops a distributed AI architecture that will be able to autonomously search for and discover heterogeneous data sources; optimizes AI processing across dynamic and opportunistic resources; and fuses AI capabilities between the enterprise, the edge, and AI-infused sensors and systems embedded on-platform. ***FY 2025 Plans:*** Will design and develop a distributed AI framework, algorithm(s), abstraction layer, and human-distributed AI interface developed around All-Domain CONOPs. Will investigate the advances in algorithms, autonomy, and artificial intelligence and several key research areas to accelerate the capabilities and impact of Distributed AI capabilities for the US Army. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** New effort in FY25.	-	-	0.501
Title: AI Foundations for Command and Coordination ***Description:*** Develops, trains, and fine tunes novel foundational models in computer vision, natural language processing/ understanding, and temporal/event series analysis that analyze, understand, and optimize AI-operations across Army Battle Command Systems and data fabrics. Establishes access to fused multitudinous data sources in support of AI-based analytics capabilities. ***FY 2025 Plans:*** Design and develop advanced algorithms for use by wider force and Operational Data Science Teams (ODSTs) to build and support emerging artificial intelligence enabled mission command information applications for the command post. Validates emerging lower echelon analytic platform tactical data fabric. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** New effort in FY25.	-	-	1.002
Accomplishments/Planned Programs Subtotals	2.496	3.265	3.525

C. Other Program Funding Summary ($ in Millions)
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** DA6 *I AI-Enabled Command and Coordination Apl Research*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy

  N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*					**Project (Number/Name)** DE8 *I AI Development Environment Applied Research*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DE8: *AI Development Environment Applied Research*	-	-	1.406	1.751	-	1.751	1.816	1.822	1.878	1.254	0.000	9.927

A. Mission Description and Budget Item Justification

This effort investigates cloud-native architectures, orchestration technologies, and collaboration techniques to support current and future Artificial Intelligence (AI) model development and machine learning operations (MLOps) tasks across a globally distributed workforce. Research will increase the effectiveness and efficiency of development platforms, decrease model development costs, optimize shared resources, and reduce the time required to integrate new AI capabilities into software products. This effort will provide the AI enabled Army of the future with low cost, rapid analytic and AI/ML solutions at the edge and enable accelerated algorithm development for faster delivery to the field. Less expensive AI/ML development by leveraging shared resources.

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

Research in this Project supports the Army Science and Technology Network Portfolio and the Chief Digital and Artificial Intelligence Office (CDAO).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Artificial Intelligence Environment Applied Research *Description:* This effort investigates cloud and cloud-native architectures, orchestration technologies, and collaboration techniques to support current and future AI model development and machine learning operations (MLOps) tasks across a globally distributed workforce. Research will increase efficiency of development platforms, decrease model development costs, and reduce the time required to integrate new AI capabilities into software products. *FY 2024 Plans:* Will investigate hybrid cloud architectures to support MLOps from the cloud to the tactical edge. Design and develop techniques to optimize cloud operations in a hybrid or multi-cloud environments. Will investigate the integration of additional software tools with the development environment to increase options of Artificial intelligence (AI) algorithm development and testing. *FY 2025 Plans:* Will investigate cloud-native architectures to support MLOps from the cloud to tactical edge. Investigate technologies to assess and instrument optimal compute, storage, and network design decisions. Integrate advanced tools for increased efficiency of AI test, evaluation, validation and verification, and the security of AI models and data intensive products. *FY 2024 to FY 2025 Increase/Decrease Statement:*	-	1.406	1.751

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602180A *I Artificial Intelligence and Machine Learning Technologies*	**Project (Number/Name)** DE8 *I AI Development Environment Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase reflects planned work in this effort.			
Accomplishments/Planned Programs Subtotals	-	1.406	1.751

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity	R-1 Program Element (Number/Name)
2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	PE 0602181A *I All Domain Convergence Applied Research*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	26.362	14.297	12.269	-	12.269	10.155	9.893	10.007	10.108	0.000	93.091
CM7: *Collaborative Convergence Applied Research*	-	26.362	14.297	12.269	-	12.269	10.155	9.893	10.007	10.108	0.000	93.091

A. Mission Description and Budget Item Justification

The Program Element (PE) executes research as part of a campaign of learning to assess feasibility of technologies in an operational environment, learning from early failure and re-scope research to improve speed of response, scalability, interoperability, and range of engagement. This PE will investigate technologies that will enable sensor to shooter applications, from tactical to strategic level, taking a system design approach in support of Army experimentation events and Department of Defense (DoD) Combined Joint All-Domain Command and Control (CJADC2). The research will enable optimal lethal and non-lethal effects across all domains using artificial intelligence and machine learning to improve how we recognize threats, augment and enhance leader decision-making, and replicate tactical behaviors to enable autonomous capabilities.

Work in this PE complements PE 0602145A (Next Generation Combat Vehicle Technology), PE 0602146A (Network C3I Technology) and PE 0603463 (Network C3I 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 program is performed by the Army Research Laboratory (ARL).

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	27.360	14.297	22.613	-	22.613
Current President's Budget	26.362	14.297	12.269	-	12.269
Total Adjustments	-0.998	0.000	-10.344	-	-10.344
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.001	-			
• SBIR/STTR Transfer	-0.999	-			
• Adjustments to Budget Years	-	-	-10.344	-	-10.344

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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602181A *I All Domain Convergence Applied Research*	

Change Summary Explanation

Decrease in funding due to the of realignment of funding supporting all domain situational awareness into a broader integrated sensor to shooter project with integration from network, fires, and ground.   Realignment of funding went to Lethality Technology PEs 0602141A CIB and 0603116 CID.

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army									**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602181A *I All Domain Convergence Applied Research*				**Project (Number/Name)** CM7 *I Collaborative Convergence Applied Research*		

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CM7: *Collaborative Convergence Applied Research*	-	26.362	14.297	12.269	-	12.269	10.155	9.893	10.007	10.108	0.000	93.091

A. Mission Description and Budget Item Justification

This Project supports research required to oppose adversary technologies in the threat based early operational environment. Focus is on those technologies that will aid in reducing the sensors to shooters timelines. This is accomplished using Artificial Intelligence (AI) algorithm decision agent design architectures, advanced methods for processing data, and improved AI performance. Additionally, this Project will research technologies and solutions necessary to enable mission command in multi-domain operations. The project will accelerate emerging research to achieve sensor to shooter dominance.

Work in this Project complements Program Element (PE) 0603041A (All Domain Convergence Advanced Technology), PE 0602146A (Network C3I Technology) and PE 0603463 (Network C3I 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: AI-Enabled Decision Support in Distributed Networks	3.488	3.641	3.665
Description: This effort research techniques to understand and model complex multi-platform tactical networks in Multi-Domain Operational environments to develop training data sets for AI-enabled tactical decision support capabilities. This effort leverages Army research informed by Army Doctrine on data value, consensus, uncertainty, human-agent teaming and network science to optimize decision support training data production. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long-Range Precision Fires Army Modernization Priorities.			
FY 2024 Plans: Will research real-time human-in-the-loop (HITL) feedback process to improve target detection and decision support for multi-platform networks; explore techniques to modify in real-time HITL for improved accuracy and efficiency; conduct experiments to assess performance improvements from hardware-software co-design; investigate multi-agent reinforcement learning (MARL) on Capability Graph Networks (CGN) for basic fire and maneuver missions.			
FY 2025 Plans: Will research methods to identify tactical Windows of Opportunity across distributed network domains using models such as Spatio-Temporal Graph Neural Networks for novel adaptive sampling in the time domain with accelerated model-hardware			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602181A I *All Domain Convergence Applied Research*	**Project (Number/Name)** CM7 I *Collaborative Convergence Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
codesign; investigate techniques for information synthesis with multi-modal analytics (imagery, video, Synthetic Aperture Radar (SAR), acoustic); research algorithms for human-robot distributed decision making with multi-agent reinforcement learning; investigate explainability features and methods to insert knowledge mechanisms (update rules-base) into "Neuro-Symbolic AI" agents (the combination of artificial neural networks and data-driven deep learning with knowledge representation and reasoning approaches). ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Synthetic Data for AI-Enabled Decision Support ***Description:*** This effort research approaches to incorporate synthetic data to augment Army training data sets and optimize AI performance for uncommon Multi-Domain Operations (MDO) targets and environments. This effort investigates efficacy and optimal application of synthetic training data developed using multiple technical methods, including physics-based models and generative adversarial techniques. This effort will experiment with artificially augmented data sets to enable classification of rare targets and cost-effective enterprise-level training data generation. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long-Range Precision Fires Army Modernization Priorities. ***FY 2024 Plans:*** Will mature synthetic data generation pipelines in both the electro-optical/visible and infrared spectral bands, consisting of physics based and generative adversarial based data-driven approaches, for both target signatures and background scenes to optimize machine learning detection/classification accuracy on targets while reducing false alarms in the background; develop synthetic environments/simulation testbeds for assessment of deep reinforcement learning based course of action generation as a command and control decision aid; conduct experiments in Army-relevant environments and field assessments to validate synthetic data methodology. ***FY 2025 Plans:*** Will investigate methods for domain adaptation with focus on AiTR pipelines for Army domains to include synthetic-to-real shift and experiments with mixed data to learn 3D mesh representations for multimodal view-invariant action recognition; develop methods to integrate synthesis and machine learning to enable continual (lifelong) learning for increased robustness and adaptation; investigate machine learning paradigms based on large pre-trained models that leverage self-supervised latent spaces for computer and robot vision tasks and reduce the need for large quantities of custom training data; study methods for modifying attributes of own assets (e.g., their textures and shape) to defend against adversarial AI attacks. ***FY 2024 to FY 2025 Increase/Decrease Statement:***	5.125	5.974	4.263

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602181A *I All Domain Convergence Applied Research*	**Project (Number/Name)** CM7 *I Collaborative Convergence Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Decrease funding reflect planned lifecycle for this effort.			
Title: Data Characterization for AI-Enabled Decision Support	4.486	4.682	4.341
Description: This effort will investigate techniques for data management, characterization, curation, labeling, and classification to enable repeatable, robust performance of trained AI-enabled decision support capabilities for complex, multi-platform tactical networks in varied tactical Multi-Domain Operations (MDO) environments. Supports AI-enabled decision support capabilities for Next Generation Combat Vehicle, Network, Future Vertical Lift, and Long-Range Precision Fires Army Modernization Priorities. *FY 2024 Plans:* Will support systematic data collection and curation for continuous AI algorithm development; research and implement techniques for ingesting large, diverse data sets relevant to broad AI algorithm development across the Army; formalize methods for including synthetic data to augment real data. *FY 2025 Plans:* Will investigate data mesh connectivity across Department of Defense data sources to enable seamless access to data for continuous AI algorithm improvement; develop processes and methods to rapidly and securely transition basic and applied research to laboratory experimentation on mission relevant data; enable government research algorithms to inform mission requirement decision makers. *FY 2024 to FY 2025 Increase/Decrease Statement:* Decrease funding reflect planned lifecycle for this effort.			
Title: Lethality Architecture	7.783	-	-
Description: Designs networked lethality role-based architecture to support automated decision aids and target handoff capability for combined arms operations. Designs a hybrid distributed architecture that will ingest real-time, prioritized data for decision agents to support scalable operations with reduced processing time.			
Title: Algorithms and Environment	1.992	-	-
Description: Designs and develops a data model for commander decision aided algorithms to support integrated direct & indirect fires; defines the process and data structure to automate decision aids and target handoff for simultaneous engagements to air/ground platforms; and designs decentralized data structures and hybrid databases that can scale to echelons and user selectable input.			
Title: Fires Coordination	3.488	-	-

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602181A *I All Domain Convergence Applied Research*	**Project (Number/Name)** CM7 *I Collaborative Convergence Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: Designs and develops integrated direct/indirect effects coordination and execution. Investigates autonomous cooperative engagement methods by modeling adversary behavior to determine the optimal shooter(s) for a large number of targets to achieve tactical overmatch. Design learning behaviors capable of incorporating commander's guidance and based on enemy data and historic performance.			
Accomplishments/Planned Programs Subtotals	26.362	14.297	12.269

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602182A *I C3I Applied Research*						

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	26.913	30.659	25.839	-	25.839	27.893	28.168	28.056	25.686	0.000	193.214
CN4: *Network Enabling University Applied Research*	-	2.558	2.675	2.526	-	2.526	2.273	2.274	2.299	2.323	0.000	16.928
CN5: *Network Vuln/ Effectiveness Assess Methods (N-VEAM)*	-	4.320	4.478	4.487	-	4.487	4.493	4.496	4.546	4.591	0.000	31.411
CW2: *Exploitation of Atmospheric Impacts across Domains*	-	2.940	1.514	-	-	-	-	-	-	-	0.000	4.454
CX3: *Intelligent Env Battlefield Awareness Apl Tech*	-	3.026	2.201	1.619	-	1.619	2.098	2.021	1.418	-	0.000	12.383
CX4: *Persistent Geophysical Sensing-Infrasound Apl Tech*	-	2.660	2.576	2.085	-	2.085	3.142	2.619	2.294	2.174	0.000	17.550
CX5: *Sensing in Contested Environments Technologies*	-	0.970	1.028	0.517	-	0.517	1.118	2.082	1.600	1.616	0.000	8.931
CX6: *Subterranean Detection and Monitoring Apl Tech*	-	1.529	1.688	1.536	-	1.536	1.136	0.645	2.224	1.728	0.000	10.486
CZ6: *Assured PNT Enabling Applied Technology*	-	3.527	3.347	2.324	-	2.324	2.276	2.141	2.164	2.186	0.000	17.965
CZ7: *Convergent CEMA Technical Effects*	-	5.383	5.472	5.584	-	5.584	5.591	5.595	5.656	5.712	0.000	38.993
DA8: *Quantum PNT & Radio Frequency Sensing*	-	-	2.612	3.664	-	3.664	5.242	5.246	5.303	5.356	0.000	27.423
DB4: *Enabling Long Standoff 3D (ELS3D) Tech*	-	-	2.058	1.092	-	1.092	0.524	1.049	0.552	-	0.000	5.275
DE6: *Understanding Environment as a Threat Tech*	-	-	1.010	0.405	-	0.405	-	-	-	-	0.000	1.415

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army	**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs, validates, and conducts experimentation to establish technical solutions for creating integrated future equipment and systems that improve resiliency, survivability, operational effectiveness, mobility, sustainability, and readiness of ground forces. This PE provides mid-to-long term tactical Command, Control, Communications and Intelligence (C3I) capabilities (e.g., networking, cyber, electronic warfare, Positioning, Navigation and Timing (PNT), space, persistent surveillance) based upon promising technologies that address emerging and future threats and includes research critical and unique to the Army and DoD (e.g., atmospheric modeling and meteorological technologies). Applied research investments focus on the design and investigation of materials, processes, technologies, methodologies, and models to establish architectures, systems, and interfaces that enhance and optimize performance on the future battlefield. The outputs of these efforts inform and transition to advanced research efforts that demonstrate improved C3I capabilities.

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

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	27.868	30.659	23.868	-	23.868
Current President's Budget	26.913	30.659	25.839	-	25.839
Total Adjustments	-0.955	0.000	1.971	-	1.971
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.001	-			
• SBIR/STTR Transfer	-0.954	-			
• Adjustments to Budget Years	-	-	1.971	-	1.971

Change Summary Explanation

Increase funding reflects planned research in high-precision PNT sensors to improve the accuracy and resilience of Army PNT and GPS.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2				**R-1 Program Element (Number/Name)** PE 0602182A / *C3I Applied Research*				**Project (Number/Name)** CN4 / *Network Enabling University Applied Research*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CN4: *Network Enabling University Applied Research*	-	2.558	2.675	2.526	-	2.526	2.273	2.274	2.299	2.323	0.000	16.928

A. Mission Description and Budget Item Justification

The Project leverages applied research from academia, in the focus areas of intelligent networks, self-sensing/self-healing networks, network security, air and ground vehicle teaming and alternatives to Global Positioning System (GPS). This Project will focus on research that supports mid-to-long term tactical Command, Control, Communications and Intelligence (C3I) capabilities (e.g. networking, cyber, electronic warfare, Positioning, Navigation and Timing (PNT), space, persistent surveillance). This Project also focuses on bringing competitively selected Universities with research and development teams into Technical Alliances that will investigate and develop technologies originating from applied research in academia pertaining to intelligent networks, self-sensing/self-healing networks, and network security and artificial intelligence/machine (AI/ML) learning as applied to C3I, and other innovative communication as well as alternatives to GPS, leading to potential emerging technologies in areas of strategic importance to the Army in secure and intelligent communication and networking.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CN3 (Network Enabling University Adv Development).

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 University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Intelligent, Secure and Self-Sensing/Self-Healing Networks Applied Technology	1.227	1.291	1.344
Description: Investigate and design fused networks and decision-making architecture into intelligent networks to provide the actionable autonomous intelligence while denying corruption, and/or attack and to execute operational missions securely and reliably. *FY 2024 Plans:* Will continue to investigate AI/ML emerging technologies for Network solutions, distributed hybrid ML at various scales, adaptable network systems, unified framework for joint sensing, RF-based deceptive tactical networks, improve cyber defense systems through secure and reliable ML, and network localization. *FY 2025 Plans:* Will fund research to investigate the next generation artificial intelligence(AI)-trained predictive intelligent network Agent, incorporating continually enhanced field training of Adversarial/Network Traffic agents; fund research to investigate artificial intelligence/machine learning (ML) emerging technologies for Network solutions, distributed hybrid ML at various scales,			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CN4 *I Network Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
adaptable network systems, unified framework for joint sensing, Radio Frequency (RF)-based deceptive tactical networks, and to improve cyber defense systems through secure and reliable ML and network localization to enable a more intelligent and robust communications network. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Real-Time Tactical Networks Applied Research ***Description:*** Investigate and design an intelligent information network that will resiliently support information pathways for sensing, computing, and control in cyber-physical systems, to improve continuity of service. Design a network to adapt and maintain connectivity if critical components become disconnected or fail. ***FY 2024 Plans:*** Design and develop an information network that will resiliently support information pathways for sensing, computing, and control in cyber-physical systems, such as autonomous vehicle teams over unreliable communication networks. Design an information network that responds dynamically to changes in operating conditions through real-time adaptation and evolution to enable continuity of the core services that it provides to the networked system. ***FY 2025 Plans:*** Will investigate and develop a resilient information system that can support pathways to generate information products, including sensor fusion applications, for situational awareness, command and control, communication, and computation degradation, as well as an integration of a variety of sensors and compute capabilities for situational awareness and resource optimization. Research emerging intelligent tactical networks to enable a resilient tactical network with reduced bandwidth requirements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	0.585	0.614	0.640
Title: Alternatives to GPS Applied Research ***Description:*** Research emerging technologies for performance and assurance improvements to position, navigation and timing (PNT) both with and without GPS to improve weapons accuracy, manned and unmanned autonomous maneuver, force tracking, and other tactical functions. Investigate emerging alternate PNT technologies through academia that may be applied to dual use or military applications, for increased capability or use in GPS denied environments. ***FY 2024 Plans:***	0.746	0.770	0.542

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CN4 *I Network Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Investigates and designs GNSS global and tactical sensors, exploitation of LEO satellites for jam-resistant PNT extraction, and create a sensor fusion framework that high integrity PNT. *FY 2025 Plans:* Will research novel techniques and technologies for position, navigation, and timing (PNT) and alternatives to GPS, including performance and assurance improvements that can provide PNT technology to users in disrupted, degraded or denied GPS environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* Decrease funding reflect planned lifecycle for this effort			
Accomplishments/Planned Programs Subtotals	2.558	2.675	2.526

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** CN5 *I Network Vuln/Effectiveness Assess Methods (N-VEAM)*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CN5: *Network Vuln/ Effectiveness Assess Methods (N-VEAM)*	-	4.320	4.478	4.487	-	4.487	4.493	4.496	4.546	4.591	0.000	31.411

A. Mission Description and Budget Item Justification

This Project develops analytical methodology and capabilities to characterize hardware and software that enable Electromagnetic Warfare (EW) and Cyber capabilities to assess operations of Army Network and communication platforms and dismounts, while maintaining freedom to maneuver, communicate, and sense. This Project also develops a holistic cross-domain analysis and assessment methodology for network and communication technologies faced with advanced Cyber Electromagnetic Activity (CEMA). These investigations are critical to identifying vulnerabilities of United States systems and technologies so that network and network-enabled systems can be hardened as early in development as possible.

Work in this Project complements Program Element (PE) 0602146 (Network C3I Technology) / Project AN3 (Non- Traditional Waveforms Technology), PE 0602213 (C3I Applied Cyber) / Project 2CY (Information Trust Technology), PE 0602213 (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology), PE, 0602146 (Network C3I Technology) / Project CI3 (Mobile and Survivable Command Post (MASCP) Tech), PE 0603457 (C3I Cyber Advanced Development) / Project 8CY (Information Trust Advanced Technology), PE 0603463 (Network C3I Advanced Technology) / Project AN4 (Non-Traditional Waveforms Advanced Technology), PE 0603457 (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology), PE 0603463 (Network C3I Advanced Technology) / Project AM7 (Modular RF Communications Advanced Technology), and PE 0603463 (Network C3I Advanced Technology) / Project CI7 (Mobile and Survivable Command Post (MASCP) Adv Tech).

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 Combat Capabilities Development Command (DEVCOM) Analysis Center (DAC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Understanding, Protecting, and Enabling CEMA Effects	2.183	2.241	2.256
Description: This effort develops and continually improves methodology and approaches for estimating and predicting CEMA effects on networks and network-enabled systems during complex multi-domain operations when significant cross-domain effects can be expected. Methods include drawing upon past research concerning the interaction of cyber and Electromagnetic Warfare threats on operational networks; laboratory operations, over-the-air anechoic chamber experimentation, and open-air field experimentation; and first principles Modeling and Simulation (M&S) and engineering analysis. Abstracting, generalizing, and automating multi-domain CEMA operations will enable the development of analysis and assessment of capabilities to anticipate			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CN5 *I Network Vuln/Effectiveness Assess Methods (N-VEAM)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
the impact of future threats. Live, virtual, and simulated environments will be developed to estimate the potential operational impact of threat CEMA technologies on friendly systems. *FY 2024 Plans:* Will conduct research to assess network technologies using EW and Cyber effects at the component and system level designated for Capability Set 25 and investigate EW and Cyber techniques for converged assessment of EW and Cyber effects on network system at the component level in support of Capability Set 27 (Automation and intelligence for next generation, secure communications and network data transport) *FY 2025 Plans:* Will mature and validate the performance of analytic tools and methodologies for the assessment of emerging network technologies using EW and Cyber effects on network systems at the system and component level; investigate analytic techniques for EW and Cyber effects on Integrated Tactical Network technologies; research early developmental network technologies to gain knowledge and understanding of advanced tools and methodologies. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Vulnerability Analysis Methodology for CEMA Threats *Description:* This effort investigates threat/target interactions to develop experimental and analytical methodology for separate and cross-domain cyber and electromagnetic threat attack so that assessed vulnerabilities in a multi-domain complex environment can be reduced or eliminated before fielding new networks and network-enabled systems. Experimental and analysis methodologies will be developed to investigate vulnerabilities of specific configurations of complex future networks with multiple communications modalities, advanced deception techniques in the cyber and electromagnetic areas, and advanced Positioning, Navigation, and Timing (PNT) systems. *FY 2024 Plans:* Will develop assessment methodologies, tools, and metrics (e.g. LPD/LPI Angle of Arrival, UV line-of-sight (LOS)/beyond-line-of-sight (BLOS), inertial aided PNT) for evaluation of UV and millimeter-Wave dispersed communications in threat representative contested/congested environments; investigate and exploit Cyber vulnerabilities of Artificial Intelligence (AI)/Machine Learning (M/L) based intrusion detection systems (IDS); conduct research to develop and mature contested/congested Cyber and electromagnetic environment threat representation capabilities (e.g. adversary signal detection and identification); conduct research on emerging cloud and Elastic Compute Cloud through creation of use cases to mature methodologies and tools for evaluation of tactical and enterprise systems. *FY 2025 Plans:*	2.137	2.237	2.231

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CN5 *I Network Vuln/Effectiveness Assess Methods (N-VEAM)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will conduct experiments to mature and validate assessment tools, and methodologies (e.g. Low Probability of Detection/ Low Probability of Intercept (LPD/LPI) Angle of Arrival, optical communications, assured PNT, testbeds) for network systems performance in threat representative congested and contested environments; develop metrics that are repeatable and can be used to accurately quantify and assess Integrated Tactical Network technologies and communication systems; conduct research to determine and develop emerging Cyber and electromagnetic environment threat representation capabilities; conduct research on emerging threats required for assessing future Army capabilities. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	4.320	4.478	4.487

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** CW2 *I Exploitation of Atmospheric Impacts across Domains*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW2: *Exploitation of Atmospheric Impacts across Domains*	-	2.940	1.514	-	-	-	-	-	-	-	0.000	4.454

Note

In Fiscal Year (FY) 2025, this Project is restructured to PE 0602144A (Ground Technology)/ Project DI7 (Environmental Security Resilience Technology).

A. Mission Description and Budget Item Justification

This Project enables identification and exploitation of how atmospheric phenomena impact windows of superiority for Army capabilities by developing technologies that characterize, predict, and efficiently express atmospheric impacts in future operating environments. New sensing technologies and algorithms enable heterogeneous sensor networks to extract critical environmental information optimizing performance and reducing the need for dedicated meteorological sensors. Novel physics-based models, empirical parameterizations, and machine learning applications extrapolate this environmental information both spatially and temporally. Uncertainty-aware decision support tools leverage this situational awareness to efficiently express atmospheric effects on friendly and threat weapons systems, sensors, and operations at the point of need and across multiple domains. This information can be exploited by autonomous and human decision makers for mission planning and execution; battlefield visualization; reconnaissance, surveillance, and target acquisition; route planning to maximize stealth and efficiency; long-range precision fires; and modeling of environmental impacts for combat simulations and war games.

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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Atmospheric Impacts *Description:* This effort develops environmental exploitation capabilities though coupled sensing, numerical prediction, and decision support technologies for data-sparse, computationally-limited, and network-constrained domains. *FY 2024 Plans:* Will conclude the combination of multi-modal small Unmanned Aerial Systems (sUAS) detection, classification, and localization sensing capabilities; finalize and transition capabilities for rapid optical characterization of hazardous, biological, and non-biological aerosols. *FY 2024 to FY 2025 Increase/Decrease Statement:*	2.940	1.514	-

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CW2 *I Exploitation of Atmospheric Impacts across Domains*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned life cycle conclusion of this Science and Technology effort.			
Accomplishments/Planned Programs Subtotals	2.940	1.514	-

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** CX3 *I Intelligent Env Battlefield Awareness Apl Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CX3: *Intelligent Env Battlefield Awareness Apl Tech*	-	3.026	2.201	1.619	-	1.619	2.098	2.021	1.418	-	0.000	12.383

Note

In Fiscal Year (FY) 2025, CX3 /Hydrology Mapping and Vegetation Property Mapping Technology Funding will transition to Program Element 0603042A (C3I Advanced Technology and) / Project CX7 (Intelligent Environment Battlefield Awareness Advanced Technology).

A. Mission Description and Budget Item Justification

This Project investigates, develops, and designs technologies to allow Soldiers to maneuver faster in dynamic environments as informed by physical, geological, and biological constraints. This Project enhances visualization tools for mission planning through delivering web modules/software tools which contain crucial geochemical resources and advanced knowledge of geo-environmental infrastructure for mission planners. These technologies provide situational awareness for multi-source intelligence, particularly in anti-access/area denied (A2/AD) operational environments.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology (Adv Tech)) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).

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 at the United States Army Engineer Research and Development Center Environmental Laboratory, Geospatial Research Laboratory, Information Technology Laboratory, Cold Regions Research and Engineering Laboratory, Construction Research Engineering Laboratory, and Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Hydrology Mapping	0.991	0.679	-
Description: This effort provides data tools and models to support high-fidelity battlefield overlay maps that accurately show hydrologic/soil moisture threats (soil, hydrology, and snow/ice) not captured by current terrain mapping capabilities.			
FY 2024 Plans: Will develop Machine Learning (ML) methodologies to derive parameters for a stochastically based hydrologic model using high-resolution hydrologic and remotely sensed data.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CX3 *I Intelligent Env Battlefield Awareness Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).			
Title: Predictive Geographic Information System (GIS) Mapping (physical) *Description:* This effort develops a comprehensive GIS tool that integrates predictive models of soil, vegetation, hydrology, and permafrost conditions in Outside Continental United States (OCONUS) dark sites from the statistical analysis of known datasets and the application of geophysical principles. *FY 2024 Plans:* Will complete development of foundational data layers in a comprehensive GIS tool that integrates predictive models of soil, vegetation, hydrology, and permafrost conditions. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).	1.255	1.010	-
Title: Vegetation Property Mapping Tech *Description:* This effort investigates and develops the required data to build geospatial overlays that describe forest type and structure as it relates to maneuver and concealment. *FY 2024 Plans:* Will characterize non-forested (single-strata) vegetation attributes at multiple vegetation analog sites relevant for open terrain mobility and proxies in threat area terrain attributes. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology) / Project CX7 (Intelligent Env Battlefield Awareness Adv Tech).	0.199	0.261	-
Title: Extreme Environments Environmental Effects on Operations Tech *Description:* This effort designs and develops modeling of natural terrain following extreme disturbances that impact operational environments such as wildfires, flash floods, earthquakes and landscape changes induced by high intensity military conflict. *FY 2024 Plans:* Will investigate existing data algorithms ability to predict extreme events and will identify which events cause anomalies in model accuracy. *FY 2025 Plans:*	0.581	0.251	0.617

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CX3 *I Intelligent Env Battlefield Awareness Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will develop and deploy training data sets for machine learning algorithms for extreme event post disturbance detection. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned milestones for development of machine learning based tools.			
Title: Terrestrial Ice Operations *Description:* This effort will design and develop a capability to effectively utilize frozen inland water bodies, specifically located in complex Arctic and sub-Arctic environments, in the projection of forces and materials in support of homeland defense, humanitarian assistance and disaster relief. The incorporation of wide area to localized remote sensing assets for the determination of ice thickness, continuity, and strength will inform the development of tactical scale geospatial overlays. Data maturation and algorithm refinement will result in a near real time level-of-risk assessment for the safe and effective performance of on ice operations. *FY 2025 Plans:* Will investigate primary variables needed for the determination of ice thickness, continuity, and strength. Will investigate applicable stand-off technologies to assist with desktop ice characterization, and the ice properties that control quality of the stand-off acquisitions. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.	-	-	1.002
Accomplishments/Planned Programs Subtotals	3.026	2.201	1.619

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I* C3I Applied Research				**Project (Number/Name)** CX4 *I Persistent Geophysical Sensing-Infrasound Apl Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CX4: *Persistent Geophysical Sensing-Infrasound Apl Tech*	-	2.660	2.576	2.085	-	2.085	3.142	2.619	2.294	2.174	0.000	17.550

A. Mission Description and Budget Item Justification

This Project designs and develops algorithms, hardware, and software components to provide passive, persistent, non-line-of-sight, multi-modal sensing capable of providing fused battlefield intelligence for increased situational awareness in a dynamic operational environment. These technologies provide near-real-time data collection, processing, and alerting on evolving cross-domain threats including strategic and tactical fires, air and ground platforms, as well as critical transportation infrastructure (bridges) and explosive events with applications for deep sensing.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CX8 (Persistent Geophysical Sensing-Infrasound Adv Tech).

The work cited 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 United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory, Coastal and Hydraulics Laboratory, Construction Engineering Research Laboratory, Cold Regions Research and Engineering Laboratory, Environmental Laboratory, and Information Technology Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Battlefield Intelligence by Geophysical Sensing (BIGS) *Description:* This effort develops a suite of geophysical and geo-sensing technologies to persistently assess battlefield elements to include infrastructure and additional sources of interest such as explosive and fires events and various air platforms; refines terrain, topography, and meteorological models related to acoustic propagation detected by the employed sensor suite as well as detection and classification signal processing algorithms for a broader range of sources and/or threats. Technologies provide Commander's situational awareness for multi-modal intelligence, particularly in anti-access/area denied (A2/AD) operational environments. *FY 2024 Plans:* Will mature algorithm components utilizing multiple laboratory and field experiments in conjunction with various array configurations and will design and develop a sensor placement tool with capabilities to account for terrain/topography and meteorological effects. *FY 2024 to FY 2025 Increase/Decrease Statement:*	2.660	2.576	-

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CX4 *I Persistent Geophysical Sensing-Infrasound Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology) / Project CX8 (Persistent Geophysical Sensing-Infrasound Adv Tech).			
Title: Multi-Domain Operations for Adaptable Wide Area Reconnaissance (MDO AWARe) *Description:* This effort develops an easily emplaced, rapidly deployable, multi-modal geophysical tactical array for persistent, wide area, remote, non-line-of-sight monitoring for potential deep sensing to extend monitoring ranges and investigate new processing techniques to allow for the battlespace awareness needed in Multi-Domain Operations in both Competition and Armed Conflict phases. *FY 2025 Plans:* Will investigate edge computing methods and hardware applicability to tactical deployments while maintaining ability to detect, classify, and localize sources of interest such as explosive and fires events and various air platforms. Will design fielding support tools for the geophysical tactical array to enable optimized employment. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort.	-	-	2.085
Accomplishments/Planned Programs Subtotals	2.660	2.576	2.085

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** CX5 *I Sensing in Contested Environments Technologies*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CX5: *Sensing in Contested Environments Technologies*	-	0.970	1.028	0.517	-	0.517	1.118	2.082	1.600	1.616	0.000	8.931

A. Mission Description and Budget Item Justification

This Project characterizes through direct or inferential methods the identification of non-weaponized biological hazards posed to Soldiers in operational environments by advancing sensor technologies and software modules that will detect and characterize hazards within confined environments. This research provides Soldiers the capability to understand biological hazards present in subterranean environments and take necessary steps to mitigate or avoid these threats.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CX9 (Sensing in Contested Environments Advanced (Adv) Technologies).

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 at the United States Army Engineer Research and Development Center Environmental Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Non-traditional Threat Detection in Contested Environments Tech	0.970	1.028	0.517
Description: This effort identifies, examines and prioritizes previously developed sensor packages as well as commercial of the shelf (COTS) capabilities from multiple sources that can accurately detect biological hazards relevant to operations in subterranean environments from point of ingress/egress to evaluate exposure potential and effects. *FY 2024 Plans:* Will develop alternative zoonotic assays and antibody/antigen methods; and will assess potential sample techniques for standoff collection and select most appropriate for modification. *FY 2025 Plans:* Will determine the ability of trained users to successfully complete microbiological analyses using selected sensor packages and developed protocols that accurately detect biological hazards. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort and transition to PE 0603042A (C3I Advanced Technology) / Project CX9 (Sensing in Contested Environments Adv Technologies).			
Accomplishments/Planned Programs Subtotals	0.970	1.028	0.517

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I* C3I Applied Research	**Project (Number/Name)** CX5 *I Sensing in Contested Environments Technologies*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602182A I C3I Applied Research					Project (Number/Name) CX6 I Subterranean Detection and Monitoring Apl Tech		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CX6: Subterranean Detection and Monitoring Apl Tech	-	1.529	1.688	1.536	-	1.536	1.136	0.645	2.224	1.728	0.000	10.486

A. Mission Description and Budget Item Justification

This Project designs and develops an integrated suite of tunnel detection, subterranean monitoring solutions, and vulnerability assessment technologies to detect, identify, and monitor subterranean threat activities in urban environments through advanced sensing and rapid analysis capabilities. This Project also develops and investigates enhanced technologies to detect tunnels and tunneling activity in complex and varied environments. This research is critical to provide greater situational awareness of the subterranean domain and enhanced survivability for the Soldier.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project CZ5 (Subterranean Detection and Monitoring Adv Tech).

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 United States Army Engineer Research and Development Center Geotechnical and Structures Laboratory, Construction Engineering Research Laboratory, Coastal and Hydraulics Laboratory and Cold Regions Research and Engineering Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Cavity Assessment in Variable Environments-Subterranean (CAVES)	1.529	1.688	1.536
Description: This effort will extend current tunnel detection and perimeter security systems beyond austere environments for application in variable terrain, and complex geologic environments, such as mountains, and hard rock geology common in the western pacific.			
FY 2024 Plans: Will conduct hardware assessment of tunnel detection and perimeter security technologies proven feasible in variable and complex geologic environments, such as mountains, and hard rock geology common in the United States Pacific Command area of responsibility.			
FY 2025 Plans: Will mature selected hardware components and detection algorithms of subsystem components for subterranean detection in hard rock.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I* C3I Applied Research	**Project (Number/Name)** CX6 *I Subterranean Detection and Monitoring Apl Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects the planned reduction of workflows as technologies transition to Program Element 0603042A (C3I Advanced Technology) / Project CZ5 (Subterranean Detection and Monitoring Adv Tech).			
Accomplishments/Planned Programs Subtotals	1.529	1.688	1.536

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Project (Number/Name)
CZ6 / Assured PNT Enabling Applied Technology

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CZ6: Assured PNT Enabling Applied Technology	-	3.527	3.347	2.324	-	2.324	2.276	2.141	2.164	2.186	0.000	17.965

A. Mission Description and Budget Item Justification

Assured Positioning Navigation and Timing (APNT) Enabling Technologies project investigates and develops technologies for Space-enabled, Deep Sensing, Counter Surveillance and Reconnaissance (C-SR) and High Altitude applications for Army tactical ground forces. Focus areas include but are not limited to modeling and simulation for C-SR and Deep Sensing technologies, investigate the utilization of space data for Army tactical applications, and developing actionable PNT situational awareness information.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project CJ8 (Assured PNT Communications Advanced Tech).

The research 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 United States Army Space and Missile Defense Technical Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Assured PNT Enabling Applied Technology	3.527	3.347	2.324

Description: This effort supports development of hardware and software components, models and simulations to further Space-enabled, HA, C-SR and Deep Sensing capabilities.

FY 2024 Plans:
Will continue to develop, and validate an advanced laboratory testbed that will be utilized to mature payloads for APNT, ground launched assets and optical/quantum secure communications on multiple simulated platforms simultaneously with hardware and software in the loop. Testbed will be applicable for Quantum Entanglement (QE) and HA applications.

FY 2025 Plans:
Will mature initial Global Positioning System (GPS) Interference database efforts that will support actionable PNT situational awareness information. Investigate innovative techniques to utilize space-based data for Army Applications. Will conduct modeling and simulation for C-SR, Navigation Warfare, and Deep Sensing applications.

FY 2024 to FY 2025 Increase/Decrease Statement:

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I* *C3I Applied Research*	**Project (Number/Name)** CZ6 *I* *Assured PNT Enabling Applied Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects funds realigned from High Altitude (HA) payload work to C-SR.			
Accomplishments/Planned Programs Subtotals	3.527	3.347	2.324

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** CZ7 *I Convergent CEMA Technical Effects*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CZ7: *Convergent CEMA Technical Effects*	-	5.383	5.472	5.584	-	5.584	5.591	5.595	5.656	5.712	0.000	38.993

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops hardware and software to enable cyber and radio frequency (RF) technical effects along with inconspicuous Cyber Electromagnetic Activity (CEMA) and network operations of Army platforms and dismounts, while maintaining freedom to maneuver, communicate, and sense. This research will investigate and develop methods to protect blue platforms from adversarial detection and attack. This research is critical to counter near-peer adversary ability to geo-locate and put indirect fires onto blue force positions.

Work in this Project complements Program Element (PE) 0602146A (Network C3I Technology) / Project AM6 (Non Modular RF Communications Technology) and Project AN3 (Non Traditional Waveforms Technology), Program Element (PE) 0602213A (C3I Applied Cyber) / Project CI6 (Network Obscuration and Deception Tech) and Project CY6 (Autonomous Cyber Technology), Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology), and Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AM7 (Modular RF Communications Advanced Technology) and Project AN4 (Non Traditional Waveforms 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: RF-Enabled CEMA Sensing and Technical Effects	3.168	3.335	3.457
Description: This effort develops technologies to avoid geolocation of blue force RF emissions by peer/near- peer adversaries. Research will focus on developing low probability of detection (LPD) communications and RF transceivers to increase freedom of maneuver while maintaining effective communications. *FY 2024 Plans:* Will validate RF emulator techniques in relevant outdoor environment; investigate antenna architecture to enhance performance in accordance with RF emulator requirements; validate effectiveness of converged cyber and RF emulation effects in relevant environment; validate performance of non-RF integrated breadboard communication demonstrator. *FY 2025 Plans:* Will develop antenna architecture to include higher frequencies by integrating pixel antenna into base wideband antenna; investigate reconfigurable wideband power dividers that can be integrated into wideband antenna; validate advanced RF emulator techniques in operationally realistic environments; investigate antenna integration to enhance performance in accordance with			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** CZ7 *I Convergent CEMA Technical Effects*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
RF emulator requirements; validate effectiveness of converged cyber and RF emulation and proximal access techniques; validate performance of non-RF integrated breadboard communication demonstrator and alternate communication pathways. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Convergent Networking and CEMA Effects *Description:* This effort investigates techniques and develops methods for combining the physical (Radio Frequency) and network (cyber) layers for enhanced effects when coupled with electromagnetic technical effects. Research also investigates methods of adaptive networking using unconventional communication channels and active tactical cyber defense methods to anticipate adversarial activities and effective responses. *FY 2024 Plans:* Will investigate radio-frequency low-probability-of-detection techniques and network-level metrics for hybrid coding and diversity approaches to covert communications; develop protocols for and conduct experiments on hybrid radio-frequency/ultraviolet communications networks; develop methods that build asymmetric advantages for defenders over intelligent, near-peer adversaries, to deal with dynamic environments and fast changing mission context that results in uncertainties and partial information; continue to build attack graphs to understand the interdependencies among all known target vulnerabilities and analyze attacker's potential courses of action; develop an architecture of a cyber misrepresentation decision making system in a tactical environment that incorporates graph-based friendly network representation and game theory approaches. *FY 2025 Plans:* Will investigate techniques for low probability of detection in partial and uncertain information/defense scenarios based on adversary understanding; integrate cyber misrepresentation decision-making system suitable for the tactical environment, including monitoring and redirection network agents, dynamic honeynet infrastructure, and rapid/automatic content customization encompassing the RF spectrum; investigate the relation between dynamic games and normal games on randomly determined attack graphs to leverage reinforcement learning for deceptive strategies and artificial intelligence (AI)-enabled cyber deception. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.	2.215	2.137	2.127
Accomplishments/Planned Programs Subtotals	5.383	5.472	5.584

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

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D. Acquisition Strategy

  N/A

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Appropriation/Budget Activity 2040 *I* 2				R-1 Program Element (Number/Name) PE 0602182A *I C3I Applied Research*				Project (Number/Name) DA8 *I Quantum PNT & Radio Frequency Sensing*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DA8: *Quantum PNT & Radio Frequency Sensing*	-	-	2.612	3.664	-	3.664	5.242	5.246	5.303	5.356	0.000	27.423

A. Mission Description and Budget Item Justification

This project will investigate quantum sensing approaches for positioning, navigation, timing (PNT), and field sensing. The focus is improving the accuracy and resilience of both Army PNT capabilities independent of Global Positioning System (GPS) and situational awareness, including awareness of electromagnetic signals across the entire frequency spectrum. The payoff of this work will be the development of sensing capabilities and approaches that are beyond classical limits enabling a new paradigm of systems that are more secure, resilient, and precise.

Work in this Project complements Program Element (PE) 0603463A (Network C3I Advanced Technology) / Project AW6 (Modular GPS Independent Sensors Advanced Tech) and Program Element (PE) 0602146A (Network C3I Technology) / Project AW5 (Modular GPS Independent Sensors 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 Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Quantum-Enhanced Sensing and PNT	-	2.612	3.664

Description: This effort will investigate quantum sensors based on atoms and atom-like color centers in solid state hosts for use as clocks and electromagnetic field sensors. Reducing the size, weight, and power (SWAP) is a primary objective as most quantum devices are still large laboratory-grade experiments. This work will investigate paths to transportable quantum devices that can be tested outside of lab environments and still maintain their high-accuracy performance. The benefits of this effort are more compact quantum sensing components that can be further integrated into systems while preserving quantum enhancements.

FY 2024 Plans:
Will model, design, and assess solid-state sensors for low-size, weight, and power (SWaP) magnetometry and PNT sensing applications; model, design, and develop Rydberg electric field sensors for comparison with conventional receiver antennas.

FY 2025 Plans:
Will develop and mature sensor architectures based on solid-state defects; investigate trade-offs between nitrogen vacancies (NV) in diamond and silicon vacancies, within silicon carbide (SiC), for sensing characteristics; model and design ruggedized

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I* C3I Applied Research	**Project (Number/Name)** DA8 *I* Quantum PNT & Radio Frequency Sensing

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
magnetometry and high-precision PNT sensors; develop fiber-coupled Rydberg electric field sensor head for future assessment; build portable Rydberg electronics capability for future assessment. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned research milestones in the area of sensor architectures and high-precision PNT sensors.			
Accomplishments/Planned Programs Subtotals	-	2.612	3.664

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*				**Project (Number/Name)** DB4 *I Enabling Long Standoff 3D (ELS3D) Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DB4: *Enabling Long Standoff 3D (ELS3D) Tech*	-	-	2.058	1.092	-	1.092	0.524	1.049	0.552	-	0.000	5.275

A. Mission Description and Budget Item Justification

This Project investigates and develops a low size, weight, and power (SWAP) laser transmitter, processing algorithms and calibration models tailored for higher resolution 3D data collections over larger areas from longer stand-off for mapping, Intelligence Surveillance and Reconnaissance (ISR) and targeting. Long standoff airborne collection of high-resolution quick turnaround 3D data is vital for mission planning, target detection and identification, fire control, autonomous navigation, kinetic targeting, and battle damage assessment. Existing light detection and ranging (LIDAR) systems are limited to short standoff and/or near-nadir collection, limiting their use against near-peer adversaries and restricting the provision of 3D data. The payoff will enable long standoff airborne collection of high-resolution quick turnaround 3D data through the development LIDAR subsystems and processing algorithms.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project DB5 (Enabling Long Standoff 3D Adv Tech).

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 United States Army Engineer Research and Development Center Geospatial Research Laboratory, and Geotechnical and Structures Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Signal Processing for Forward Looking Mapping Systems	-	2.058	1.092
Description: This effort will design and develop hardware and software to enable long standoff airborne collection of high-resolution quick turnaround 3-Dimensional Data to provide advanced Geospatial Engineering capabilities that generate timely, more accurate, mission relevant digital information and sharable knowledge products across the Army Common Operating Environment.			
FY 2024 Plans: Will investigate advanced signal processing and calibration models for new configurations for high quality 3D data coverage for standoff airborne collection.			
FY 2025 Plans: Will validate advanced signal processing algorithms and calibration models tailored for higher resolution 3D data collections over larger areas from longer stand-off for mapping, ISR and targeting.			
FY 2024 to FY 2025 Increase/Decrease Statement:			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** DB4 *I Enabling Long Standoff 3D (ELS3D) Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology)/Project DB5 (Enabling Long Standoff 3D (ELS3D) Adv Tech).			
Accomplishments/Planned Programs Subtotals	-	2.058	1.092

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				R-1 Program Element (Number/Name) PE 0602182A *I C3I Applied Research*					Project (Number/Name) DE6 *I Understanding Environment as a Threat Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DE6: *Understanding Environment as a Threat Tech*	-	-	1.010	0.405	-	0.405	-	-	-	-	0.000	1.415

A. Mission Description and Budget Item Justification

This Project designs and advances mission planning software enabling the Soldier to identify, track, and plan for industrial or commercial chemical/environmental threats. Software modules will increase capability of mission based planning technologies providing new operational routing options for mission execution with environmental threat overlays.

Work in this Project complements Program Element (PE) 0603042A (C3I Advanced Technology) / Project DE7 (Understanding the Environment as a Threat Adv Tech).

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 Engineer Research and Development Center Environmental Laboratory, Geospatial Research Laboratory, and Information Technology Laboratory.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Subsurface Forensics *Description:* This effort will prepare Soldiers for the risks of deliberate or accidental release of toxic industrial chemicals and materials by investigating and developing methods to collect data to characterize and predict the fate and transport of hazards of concern. *FY 2024 Plans:* Will develop new techniques to achieve ultra-low detection levels of explosive constituents, non-weaponized hazards for reverse point sourcing threats increasingly wet, protein rich environments. *FY 2025 Plans:* Will validate techniques for ultra-low detection levels of explosive constituents, non-weaponized hazards for reverse-point sourcing threats in dense urban and subterranean environments. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603042A (C3I Advanced Technology) / Project DE7 (Understanding the Environment as a Threat Adv Tech).	-	1.010	0.405
Accomplishments/Planned Programs Subtotals	-	1.010	0.405

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602182A *I C3I Applied Research*	**Project (Number/Name)** DE6 *I Understanding Environment as a Threat Tech*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										Date: March 2024	

Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602183A *I Air Platform Applied Research*						

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	40.372	48.163	53.206	-	53.206	59.078	57.223	57.450	57.284	0.000	372.776
CL5: *Air Platform Enabling University Applied Research*	-	0.872	0.526	0.959	-	0.959	1.294	1.296	1.310	1.323	0.000	7.580
CL8: *Aviation Teaming Autonomy Concepts & Technologies*	-	4.093	4.249	4.387	-	4.387	4.392	4.395	4.444	4.488	0.000	30.448
CN1: *Disruptive Countermeasure Concepts for Aviation*	-	7.342	7.546	7.668	-	7.668	7.245	7.249	7.328	7.401	0.000	51.779
CU7: *Control & Autonomy for Tactical Superiority Tech*	-	4.321	4.796	5.783	-	5.783	8.404	10.467	9.985	10.858	0.000	54.614
CU8: *Structures Tech for Enduring Efficient Resilience*	-	1.588	1.682	1.048	-	1.048	1.050	1.050	1.061	1.072	0.000	8.551
CU9: *Systems Design Technology*	-	2.996	3.135	4.435	-	4.435	5.237	5.345	5.405	5.459	0.000	32.012
CW3: *Advanced Rotors Applied Technology*	-	2.495	2.614	2.015	-	2.015	2.017	2.650	2.678	2.705	0.000	17.174
CW4: *Air Vehicle Structures and Dynamics Tech*	-	2.876	3.042	3.078	-	3.078	3.083	3.085	3.119	3.150	0.000	21.433
CW5: *Experimental and Computational Aeromechanics Tech*	-	6.359	6.835	6.918	-	6.918	6.927	6.930	7.007	7.077	0.000	48.053
CW6: *Future UAS Propulsion Technology*	-	3.289	3.560	3.602	-	3.602	3.605	3.608	3.647	3.683	0.000	24.994
CW7: *High Speed and Efficient VTOL Vehicle Tech*	-	1.492	1.580	1.583	-	1.583	1.585	1.587	1.604	1.620	0.000	11.051
CW8: *Next Generation Aviation Transmission Apl Tech*	-	1.428	1.511	-	-	-	-	-	-	-	0.000	2.939

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*				**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*							
DC2: *High Performance Computing for Rotorcraft Apl Tech*	-	1.221	1.293	1.309	-	1.309	1.311	1.312	1.326	1.339	0.000	9.111
DE2: *Airborne Threat Defeat*	-	-	5.794	7.423	-	7.423	6.505	-	-	-	0.000	19.722
DK1: *Air Vehicle Integrated & Alternative Tech (AVIATe)*	-	-	-	2.998	-	2.998	6.423	8.249	8.536	7.109	0.000	33.315

Note

Air Vehicle Integrated & Alternative Tech (AVIATe) is a new start within the Air Platform Applied Research program in FY 2025.

A. Mission Description and Budget Item Justification

This Program Element (PE) undertakes applied research efforts that support and enable the overall Army Aviation portfolio in general, and the Army's modernization priority for future vertical lift (FVL). Vital and enduring applied research is conducted in the air portfolio that supports mid-to-long term requirements in contested operational environments and technologies that have broad application to FVL modernization, as well as overall Army and specific Department of Defense (DoD) aviation needs.

Research 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 Technology), PE 0603465A (Future Vertical Lift Advanced Technology) and PE 0603043A (Air Platform Advanced Technology).

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

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	41.588	48.163	42.393	-	42.393
Current President's Budget	40.372	48.163	53.206	-	53.206
Total Adjustments	-1.216	0.000	10.813	-	10.813
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	0.001	-			
• SBIR/STTR Transfer	-1.217	-			
• Adjustments to Budget Years	-	-	10.813	-	10.813

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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	

Change Summary Explanation

In Fiscal Year (FY) 2025 a portion of this Program Element (PE) was realigned from PE 0603465A (Future Vertical Lift Advanced Technology), Project AL1 (Advanced (Adv) Teaming for Tactical Aviation Operations (Oper) Advanced (Adv) Technology (Tech) and Program Element (PE) 0602148A (Future Vertical Lift Technology), Project CH2 (Air Launched Effects Technology) and realigned from PE 0602183A (Air Platform Applied Research) / Project CW8 (Next Generation Aviation Transmission Applied (Apl) Tech).

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** CL5 *I Air Platform Enabling University Applied Research*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CL5: *Air Platform Enabling University Applied Research*	-	0.872	0.526	0.959	-	0.959	1.294	1.296	1.310	1.323	0.000	7.580

A. Mission Description and Budget Item Justification

This Project focuses on applied research originating from extramural applied research in academia pertaining to navigation/routing, autonomous robotic vehicles, artificial intelligence and machine learning as applied to aerial mobility and maneuver, holistic survivability, teaming, integrated mission systems, air-launched effects, and other innovative air enabling applied research technologies that will accelerate the Army modernization in next generation aerial vehicles. This Project will perform discovery research efforts to focus more on mid to far-term Army modernization priorities while also maintaining delivery of near-term technologies fundamental to the modernization priorities. This Project conducts applied research and development leading to all the potential emerging technologies in areas of strategic importance to Army Aviation in artificial intelligence / machine learning (AI/ML), autonomous teaming systems, survivability, aeromechanics, advanced vertical take-off and landing(VTOL) design & concepts, flight dynamics, vibration & noise control, propulsion, human factor engineering and structures & materials, etc., by bringing competitively selected Universities with research and development teams into Technical Alliances. The Project will also continuously experiment with methods to identify, demonstrate and transition novel technology from entities that might not otherwise collaborate with the Department of Defense (DoD), with the end goal of accelerating the adoption of cutting-edge applied research technology for the warfighter in the Army aviation portfolio.

Work in this Project complements Program Element (PE) 0602148A (Future Vertical Lift Technology), PE 0603465A (Future Vertical Lift Advanced Technology Development), PE 0603043A (Air Platform Advanced Technology) and PE 0602144A (Ground Technology).

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 University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Vertical Lift Applied Research *Description:* Conduct applied research in academia to elevate Vertical Lift research and continue to investigate promising and emerging technologies *FY 2024 Plans:* Will continue to conduct applied research in rotorcraft emerging technologies through autonomous teaming systems, aeromechanics, advanced VTOL design & concepts, flight dynamics models to extend reach, and agility. *FY 2025 Plans:*	0.872	0.526	0.959

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CL5 *I Air Platform Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will fund research to develop capabilities to enable the coordination of multiple land and air vehicles participating in an unmanned long-term reconnaissance operation using distributed command/control architecture despite communication delays and/or failures; fund research to conduct academic applied research in rotorcraft emerging technologies through autonomous teaming systems, aeromechanics, advanced Vertical Takeoff and Landing (VTOL) design & concepts, flight dynamics models to extend reach, and agility. The benefit of this effort is it enables future vertical lift capability improvements. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is consistent with the planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	0.872	0.526	0.959

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** CL8 *I Aviation Teaming Autonomy Concepts & Technologies*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CL8: *Aviation Teaming Autonomy Concepts & Technologies*	-	4.093	4.249	4.387	-	4.387	4.392	4.395	4.444	4.488	0.000	30.448

A. Mission Description and Budget Item Justification

This Project establishes multi-level simulations, physics-based models, and artificial intelligence/machine learning (AI/ML) algorithms and methods to inform and advance capabilities for heterogeneous advanced teaming concepts to support operations in complex and peer contested environments. Innovative solutions, knowledge, and understanding generated from this effort informs Program Element (PE) 0602148A Future Vertical Lift Technology / Project AK9 (Adv Teaming for Tactical Aviation Operations Tech).

Research in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Technology) and PE 0603465A (Future Vertical Lift Advanced Technology Development), Project AL1 (Adv Teaming for Tactical Aviation Oper Adv Tech).

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

Work in this Project is performed by Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Intelligent Unmanned Aerial System Teaming Technologies	4.093	4.249	4.387
Description: Enables the establishment of component technologies to support resilient, multi-modal, survivable Unmanned Aircraft System (UAS) teams that can plan and act on time-scales beyond human capability and have a robust shared understanding of contested and dynamic environments to support effective tactical engagement. Specific topics include 1) novel artificial-intelligence algorithms and methods for adaptive team composition and control, 2) increased team knowledge base and understanding of local and global world models, 3) hierarchical, composable, and adaptive learning methods for increased mission resilience, and 4) understanding interaction and scalability between, amongst, and across heterogeneous team members and the environment.			
FY 2024 Plans: Will develop multi-agent tactics for autonomous teams of unmanned air vehicles to autonomously detect, identify, locate, and report radio frequency (RF) signals of opportunity. Will develop multi-agent tactics, path planning, and controls for tethered UAS teams. Will develop multi-agent behaviors for executing cooperative localized tasks. Will implement machine learning on the battery management system to achieve improved performance over multiple charging/discharging cycles. Will investigate novel			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CL8 *I Aviation Teaming Autonomy Concepts & Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
UAS vertical take-off and landing (VTOL) design for increased endurance and effects on optimization algorithms for mission planning under fixed energy constraints. ***FY 2025 Plans:*** Will validate multi-agent seek and strike on defended radio frequency (RF) emitting targets in field experiments deploying small unmanned aerial systems (UAS); validate collaborative and deceptive behaviors to penetrate adversary defenses; assess the relative performance of analytically derived and machined-learned algorithms; sustain multi-target engagement with energy-aware autonomy algorithms; refine development of multi-agent tactics for autonomous teams of unmanned air vehicles to autonomously detect, identify, locate, and report RF signals of opportunity; assess improved sub-system and system level models on mission energy aware planning algorithms; implement wind and terrain awareness into coordinated UAS - unmanned ground vehicle (UGV) landing and recharge maneuvers; utilize high-fidelity physics and aerodynamics simulation environment to support autonomy and teaming development. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	4.093	4.249	4.387

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 *I* 2					R-1 Program Element (Number/Name) PE 0602183A *I Air Platform Applied Research*				Project (Number/Name) CN1 *I Disruptive Countermeasure Concepts for Aviation*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CN1: *Disruptive Countermeasure Concepts for Aviation*	-	7.342	7.546	7.668	-	7.668	7.245	7.249	7.328	7.401	0.000	51.779

A. Mission Description and Budget Item Justification

This Project investigates advanced technologies to reduce Future Vertical Lift (FVL) platform susceptibility and vulnerability to damage from guided and unguided threats, as well as technologies to defeat small arms, rocket, and missile threats. This Project performs research and develops innovative detect and defeat technologies against next -generation threats to the FVL. Areas of research include new laser materials and designs for in-band, low size, weight, power, and cost (SWaP-C) precision laser soft-kill countermeasures operating in the mid- and long-wave infrared, lethality effects of ultrashort pulsed lasers, and sensitive radio frequency (SeRF) detection modality for use as aircraft survivability equipment (ASE). In addition, this Project will also perform research and development on the use of remotely-deployed, passive multi-modal sensors to localize threat ground vehicles and discriminate decoys.

Research in this Project is fully coordinated with Program Element (PE) 0602146A (Network C3I Technology) / Project AN7 (COE - Every Receiver is a Sensor Technology), PE 0602148A (Future Vertical Lift Technology) / Project CH3 (Holistic Team Survivability Technology), PE 0603463A (Network C3I Advanced Technology) / Project AN8 (COE - Every Receiver is a Sensor Advanced Tech), and PE 0603465A (Future Vertical Lift Advanced Technology) / Project AL1 (Adv Teaming for Tactical Aviation Oper Adv Tech).

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

Work in this Project is performed by Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Cognitive Countermeasures Technology Development	2.064	2.095	2.109
Description: This effort investigates and matures novel materials, components, and techniques to counter legacy and emerging threats to FVL platforms. Emphasis will be placed on technologies and approaches to enable a robust, holistic countermeasure capability for target defeat, regardless of threat characteristics or guidance mode.			
FY 2024 Plans: Will investigate optimal approaches to multi-band sensitive radio frequency (SeRF) novel detection modalities and integrate multi-band components for system assessments. Will investigate the feasibility of realizing state-of-the-art Microelectromechanical (MEMS) Radio Frequency (RF) power and phase detection for augmented range and signals intelligence capabilities of related SeRF systems. Will design and develop optimized pulsed laser sources based on selected best Midwave Infrared (MWIR)			

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Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CN1 *I Disruptive Countermeasure Concepts for Aviation*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
approach. Will mature Q-switching and cooling design components. Will conduct experiments to identify best pathways toward pulsed Longwave Infrared (LWIR) sources. Will improve experimental techniques in LWIR region using Ultra-Short Pulse Lasers (USPL) to further study optical and non-optical RF effects. *FY 2025 Plans:* Will design and develop tandem-pumped, high energy pulsed mid-wave infrared (MWIR) laser sources optimized for pulse-burst regime to further minimize laser system SWAP; design and develop direct-diode-pumped, ultra-low SWAP, MWIR laser sources optimized for pulse-burst regime with advanced phase-change cooling; mature wavelength conversion materials and techniques for longwave infrared (LWIR) sources; validate ultra-short pulse lasers (USPL) non-optical effects measurements, such as radio frequency (RF) generation and damage at multiple wavelengths; advance highly sensitive RF detection components conforming to an ultra-low SWaP-C architecture through the incorporation of thin film materials. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Deep Autonomous Sensing *Description:* This effort investigates the ability to localize and recognize the formation of threat ground vehicles deep in the battlefield in support of the FVL platform. Emphasis will be placed on developing novel, passive multi-modal sensors on aerial, ground, and re-locatable platforms to enable high fidelity, low false alarm target recognition and counter concealment and camouflage with decoy discrimination. *FY 2024 Plans:* Will conduct experiments to validate approaches to teaming between multi-modal ground-based sensor constellations with FVL airborne platforms (manned and/or unmanned) by integrating prototype sensor constellations with Army aviation prototype and surrogate platforms. Will investigate and conduct experiments with air-deployed sensor concepts and methodologies to ensure low-cost mechanical designs. Will investigate and experiment with implementations of cost effective Position, Navigation, and Timing (PNT) techniques in the ground constellation of fixed and relocatable sensors in support of position and attitude determination for cost effective geolocation of threats. Will enhance methods of multi-modal sensor fusion, classification, and tracking of threat vehicles insensitive to obscurant, camouflage, and jamming. *FY 2025 Plans:* Will develop novel, multi-modal sensor fusion algorithms to detect, locate, and track formations of mechanized vehicles; advance cross modal sensing algorithms to enhance classification confidence and detect anomalies; research and investigate efficient methods to discriminate real targets using passive, non-imaging sensors networked together to extend range and reject clutter; assess autonomy in teaming between unmanned ground sensors and unmanned ground and aerial vehicles in collaboration with	5.278	5.451	5.559

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CN1 *I Disruptive Countermeasure Concepts for Aviation*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Aviation and Missile Center (AvMC); validate the implementation of algorithms on low-size, weight, power, and cost (SWAP-C) sensor platforms for targeting threat vehicles. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	7.342	7.546	7.668

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*			**Project (Number/Name)** CU7 *I Control & Autonomy for Tactical Superiority Tech*				
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CU7: *Control & Autonomy for Tactical Superiority Tech*	-	4.321	4.796	5.783	-	5.783	8.404	10.467	9.985	10.858	0.000	54.614

A. Mission Description and Budget Item Justification

This Project will develop and flight-validate new approaches and tools applicable to advanced high-speed configurations being considered for Future Vertical Lift (FVL) and transition to industry to ensure that FVL aircraft meet Army requirements. Work in this Project may also address and be applied to the needs of other Army and specific Department of Defense (DoD) aviation systems.

Research in this Project is fully coordinated with Program Element (PE) 0603043A (Air Platform Advanced Technology), Project CV1 (Control & Autonomy for Tactical Superiority Adv).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Adaptive Tactical Autonomy and Control (ATAC) Tech	4.321	4.796	5.422
Description: Develop advanced vehicle management, flight control, and autonomy technologies that enable FVL aircraft to achieve superior maneuverability and agility at all speeds, effectively exploit extreme/degraded environmental conditions as a force multiplier, fight and win in presence of failure or damage, and operate on a cognitive-loading-spectrum from piloted to fully autonomous.			
FY 2024 Plans: Will develop flight control concepts that intelligently adjust aircraft response characteristics based on configuration, mission, and pilot input. Will mature concepts for transition of control between pilot and autonomous system and back to normalize pilots' utilization of autonomous functions. Will develop an architecture for the interface between autonomy algorithms and flight controls for over-actuated FVL-relevant configurations that enable control re-allocation schemes developed to enhance survivability and damage tolerance to be extended to autonomous flight.			
FY 2025 Plans:			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
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B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will update AvMCs high-fidelity flight-dynamics modeling tool to run in real time with selectable levels of fidelity. Will develop methods for using estimation to compensate for failed sensors to enable graceful degradation. Will continue developing handling qualities requirements for high-speed flight. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase in FY25 supports software and simulation activities associated with advanced flight controls and autonomy efforts.			
Title: Perception Enhanced Autonomous Control (PEAC) *Description:* Develop autonomous systems that maintain real time representation of flight environment and use AI- and ML-based perception to "understand" the environment, detect and identify threats, and take action based on aircraft state to enhance survivability. ***FY 2025 Plans:*** Will conduct research into sensor range, field of view, and performance needed for high-speed flight. Will start evaluating non-emitting sensors for position determination and autonomous navigation. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** This effort begins in FY25 with funding realigned from PE 0603465A (Future Vertical Lift Advanced Technology), Project AL1 (Adv Teaming for Tactical Aviation Oper Adv Tech).	-	-	0.361
Accomplishments/Planned Programs Subtotals	4.321	4.796	5.783

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2				**R-1 Program Element (Number/Name)** PE 0602183A / *Air Platform Applied Research*				**Project (Number/Name)** CU8 / *Structures Tech for Enduring Efficient Resilience*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CU8: *Structures Tech for Enduring Efficient Resilience*	-	1.588	1.682	1.048	-	1.048	1.050	1.050	1.061	1.072	0.000	8.551

A. Mission Description and Budget Item Justification

This Project will ensure critical structures technologies providing improved weight efficiency, fatigue tolerance, parasitic weight avoidance, and integration / synergy opportunities will transition to Advanced Technology Development tasks to later provide Future Vertical Lift (FVL) Project Management Offices and Original Equipment Manufacturers mission performance benefit in terms of range/payload, survivability, sustainment, and operational availability. Research in this Project may also address and be applied to the needs of other Army and specific DoD aviation systems.

Research in this Project is fully coordinated with Program Element (PE) 0603043A (Air Platform Advanced Technology), Project CV2 (Structures Platform Int Resilience & Efficiency).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Multifunctional Advanced Structural Concepts (MASC)	1.588	1.682	1.048

Description: Develop innovative, critical, highly weight-optimized, durable, fatigue-resistant, damage-tolerant structural concepts exploiting multifunctionality for weight savings and broad multi-scale FVL benefit impact.

FY 2024 Plans:
Will apply advanced composite material forms and titanium additive manufacturing to develop innovative concepts enhancing structural weight efficiency applicable to FVL across size classes. Will develop enhanced analysis of structural composites.
Will continue to apply integration methodology in guiding development of technologies to optimize benefits of reduced weight, increased resilience, and reduced maintenance.

FY 2025 Plans:
Will develop optimized structural concepts with innovative internal stiffening and health monitoring for UAS and other platform applications. Will develop innovative composite structure manufacturing technologies and FVL-relevant fabricate proof-of-concept component.

FY 2024 to FY 2025 Increase/Decrease Statement:

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CU8 *I Structures Tech for Enduring Efficient Resilience*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease in FY25 corresponds to decrease in breadth of structural concepts developed.			
Accomplishments/Planned Programs Subtotals	1.588	1.682	1.048

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** CU9 *I Systems Design Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CU9: *Systems Design Technology*	-	2.996	3.135	4.435	-	4.435	5.237	5.345	5.405	5.459	0.000	32.012

Note

In Fiscal Year (FY) 2025 a portion of this Project was restructured from Program Element (PE) 0602148A (Future Verticle Lift Technology), Project CH2 (Air Launched Effects Technology).

A. Mission Description and Budget Item Justification

This Project will leverage large datasets and advances in multi-disciplinary optimization techniques, incorporate higher fidelity analysis, and machine learning techniques to improve predictions of emerging aviation requirements and system complexity.

Research in this Project is fully coordinated with Program Element (PE) 0603043A (Air Platform Advanced Technology).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Concept Design and Optimization Methods	2.996	3.135	4.435
Description: Expand scope of design and assessment support across Future Vertical Lift (FVL) lines of effort (LOEs) and the science and technology portfolio. Incorporate method enhancements to improve timeliness, accuracy, and detail of conceptual design (performance, weight, and cost).			
FY 2024 Plans: Will further develop tools and methods to improve rotorcraft design and optimization with advanced component models and improved modeling framework. Will apply tools to trade studies to explore aircraft concepts for Future Vertical Lift (FVL) as well as electric and hybrid rotorcraft concepts.			
FY 2025 Plans: Will further develop tools and methods for rotorcraft design and optimization methods. Will continue to develop advanced component and cost models for rotary wing and fixed wing aircraft. Will apply tool sets to future air vehicle trade studies to support			

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CU9 *I Systems Design Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Future Vertical Lift (FVL), electric Vertical Take Off and Landing (eVTOL) and hybrid-electric concepts and will explore concepts for contested logistics. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** FY25 funding increase supports application of design and optimization methods to multiple lines of effort including Future Vertical Lift (FVL), eVTOL, hybrid-electric, and Contested Logistics air vehicle concepts. In Fiscal Year (FY) 2025 a portion of this effort was restructured from Program Element (PE) 0602148A (Future Verticle Lift Technology), Project CH2 (Air Launched Effects Technology).			
Accomplishments/Planned Programs Subtotals	2.996	3.135	4.435

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

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Appropriation/Budget Activity 2040 I 2				R-1 Program Element (Number/Name) PE 0602183A I Air Platform Applied Research					Project (Number/Name) CW3 I Advanced Rotors Applied Technology		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW3: Advanced Rotors Applied Technology	-	2.495	2.614	2.015	-	2.015	2.017	2.650	2.678	2.705	0.000	17.174

A. Mission Description and Budget Item Justification

This Project investigates Future Vertical Lift (FVL) and other Army and Department of Defense (DoD) aviation systems technologies that mature high speed and highly efficient rotor and hub system designs.

Research in this Project is fully coordinated with PE 0603043A (Air Platform Advanced Technology) / Project CX1 (Advanced Rotors Advanced Tech).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Advanced Hubs Tech	2.495	2.614	-
Description: Investigate advanced rotor system and hub technologies to support goals of increased speed and lift by developing configurations and technologies that reduce drag and enable more efficient rotor system performance. **FY 2024 Plans:** Will refine advanced rotor hub conceptual designs. Will conduct detailed analysis on hub to determine performance benefits. **FY 2024 to FY 2025 Increase/Decrease Statement:** Funding decrease reflects planned conclusion of this effort and transition to PE 0603043A (Air Platform Advanced Technology), Project CX1 (Advanced Rotors Advanced Tech). Funding realigned to Innovative Rotor Blade Manufacturing Processes within this project.			
Title: Innovative Rotor Blade Manufacturing Processes	-	-	2.015
Description: Develop more automated processes such as automated fiber placement, additive manufacturing, lower cost and fabrication time. **FY 2025 Plans:** Will conduct initial rotor blade manufacturing technology screening and down select. Start component test planning. **FY 2024 to FY 2025 Increase/Decrease Statement:**			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW3 *I Advanced Rotors Applied Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
This effort begins in FY25 with funding realigned from Advanced Hubs Tech within this project.			
Accomplishments/Planned Programs Subtotals	2.495	2.614	2.015

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** CW4 *I Air Vehicle Structures and Dynamics Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CW4: *Air Vehicle Structures and Dynamics Tech*	-	2.876	3.042	3.078	-	3.078	3.083	3.085	3.119	3.150	0.000	21.433

A. Mission Description and Budget Item Justification

This Project develops modeling tools and methodologies needed to research low noise and aero elastically stable rotor technologies. Research in this Project enables high speed flight, longer flight envelopes, and lower noise signatures in Future Vertical Lift (FVL) platforms and is also applicable to the family of FVL manned and unmanned platforms.

Research in this Project is fully coordinated with Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology Development).

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

Research in this Project is performed by Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Air Vehicle Structures and Dynamics Technologies *Description:* Establish improved experimentally validated modeling tools and methodologies that can be used to understand the physics of aeroelastic stability and design in next generation rotorcraft platform configurations for FVL platforms. This involves the development of an experimental capability, the Tiltrotor Aeroelastic Stability Test (TRAST), which will be used to generate novel experimental data. This data will be used to increase fundamental understanding of the whirl flutter instability, which currently limits the high speed performance of tiltrotor rotorcraft. This effort will inform FVL requirement definition and technology maturation. This effort also establishes low noise rotor concepts and investigates the intersection of artificial intelligence and classical mechanics to enable novel mechanics and new approaches in structural dynamics for FVL applications to enable higher Operating Tempo (OPTEMPO) operations. *FY 2024 Plans:* Will conduct Tiltrotor Aeroelastic Stability Test (TRAST) in NASA's Langley Transonic Dynamics Tunnel (TDT) to explore effects of the rotor and control system parameters on tiltrotor aircraft whirl flutter boundaries. Will explore experimentally and analytically, the active control technology-Generalized Predictive Control (GPC) on tiltrotor stability augmentation. Will explore analytically, winglet and wing extension for tiltrotor aircraft performance and stability improvement. Will investigate aeroelastic stability and vibratory loads of lift-offset coaxial rotor at high flight speed. Will develop a tool chain to analyze the boundary layer noise from	2.876	3.042	3.078

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW4 *I Air Vehicle Structures and Dynamics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
rotor airfoils, including multi element airfoils and use the tools to find low noise rotor blade designs; assess the low noise designs experimentally. Will develop crashworthy navigation and flight controls algorithms to adapt to congested environments. *FY 2025 Plans:* Will investigate aeroelastic stability and vibratory loads of a hinge less tiltrotor utilizing the Tiltrotor Aeroelastic Stability Test (TRAST) wind tunnel capability; investigate the effectiveness of the Generalized Predictive Control (GPC) on the control and reduction of the hinge less tiltrotor's vibratory loads; conduct TRAST wind tunnel assessments in the Transonic Dynamics Tunnel (TDT) to explore the effects of wing extension on tiltrotor performance and aeroelastic stability; document the design of the lift-offset coaxial rotor aeroelastic stability assessment bed; develop a machine learning model to provide fast and accurate airfoil/rotor aerodynamic loads for a wide range of airfoil/rotor configurations; investigate novel rotor concepts with the potential for quiet operation and improve accuracy and range of acoustic modeling capabilities; enable Air Launch Effects and other platforms to reject atmospheric disturbances as well as navigate within the wake of air or ground platforms for launch and recovery. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	2.876	3.042	3.078

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** CW5 *I Experimental and Computational Aeromechanics Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW5: *Experimental and Computational Aeromechanics Tech*	-	6.359	6.835	6.918	-	6.918	6.927	6.930	7.007	7.077	0.000	48.053

A. Mission Description and Budget Item Justification

This Project investigates new high fidelity computational methods to simulate aerodynamic effects and test methods of emerging rotorcraft lift technologies that could be incorporated into Future Vertical Lift (FVL) designs and other Army and Department of Defense (DoD) aviation systems.

Research in this Project is fully coordinated with PE 0603043A (Air Platform Advanced Technology).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Experimental Aeromechanics	4.044	4.366	4.463

Description: Develop and explore new methods to simulate aerodynamic effects for aircraft and other future FVL configurations.

FY 2024 Plans:
Will develop a powered tail rotor test stand for more accurate physical modeling of winged compound rotorcraft interactional aeromechanics to provide fundamental understanding and validation data for computational tools. Will investigate advanced high speed compound rotorcraft wing designs to provide improved hover and forward flight performance. Will investigate state of the art measurement & data analysis techniques for rotorcraft to provide new or improved data sets for computational tool validation. Will conduct tests to investigate methods of rotorcraft hub drag reduction on FVL relevant configurations.

FY 2025 Plans:
Will mature advanced high speed compound rotorcraft wing designs to provide improved hover and forward flight performance; conduct tests to investigate methods of rotorcraft hub drag reduction; investigate state of the art measurement & data analysis techniques for rotorcraft to provide new or improved data sets for computational tool validation; investigate passive and active methods for rotor performance improvements.

FY 2024 to FY 2025 Increase/Decrease Statement:
Funding increase is an economic adjustment.

| *Title:* Computational Aeromechanics | 2.315 | 2.469 | 2.455 |

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW5 *I Experimental and Computational Aeromechanics Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: Verify, validate and apply high-fidelity modeling and simulation software tools for rotorcraft aeromechanics. *FY 2024 Plans:* Will verify and validate reduced-order and surrogate computational aeromechanics models for Future Vertical Lift (FVL) aircraft that provide high accuracy while running fast enough for use in rotorcraft design applications. Will demonstrate and test these new design-oriented computational models by addressing engineering problems for relevant FVL aircraft configurations.			
FY 2025 Plans: Will test and validate the higher-order computational models for FVL and FTUAS configurations for improved accuracy. Will perform validation of permeable-surface formulation for acoustics predictions for FVL configurations. Will conduct a performance evaluation of the GPU version of rotorcraft computational model for Future Vertical Lift (FVL) configurations.			
FY 2024 to FY 2025 Increase/Decrease Statement: Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	6.359	6.835	6.918

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 I 2	R-1 Program Element (Number/Name) PE 0602183A I Air Platform Applied Research	Project (Number/Name) CW6 I Future UAS Propulsion Technology

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW6: *Future UAS Propulsion Technology*	-	3.289	3.560	3.602	-	3.602	3.605	3.608	3.647	3.683	0.000	24.994

A. Mission Description and Budget Item Justification

This Project designs and assesses advanced engine and power system component technologies to support the goals of multi-fuel capability, reduced fuel consumption, and reduced engine size, weight, and cost in current and Future Unmanned Aircraft Systems (FUAS).

Research in this Project is fully coordinated with PE 0602148A (Future Vertical Lift Technology), Project CH4 (Power & Thermal Management for FVL Tech).

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

Work in this Project is performed by Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Multi-Fuel Capable Hybrid Electric Propulsion *Description:* Applied research to enable intelligent and robust propulsion performance and noise signature reduction via multi-fuel and optimized hybrid electric capability for small engines (20kW to 150kW) powering future aircraft systems. The research focuses on the establishment of concepts to enable reduced fuel consumption, engine size, weight, and cost as well as improved group three and four FUAS reliability, survivability, and maintainability. *FY 2024 Plans:* Will integrate combustion and fuel property sensing, explore control strategy for varied ignition quality fuels to enable multi-fuel capability, and assess novel ignition assistant in relevant engine environment. Will validate oil-free bearing analysis tool and turbocharger aeroelasticity tool. Will extend validation of motor design tools to higher rotational speeds. Will validate and verify system level hybrid-electric architectures. Will continue augmenting hybrid-electric optimization and integration tool capabilities by introducing new higher fidelity models. *FY 2025 Plans:* Will assess improved ignition assistant with oxidation resistant coating; implement real time combustion sensing and machine learning based methods to improve engine control algorithms; assess and validate system level simulation results from the Gas Lubricated Interactive Design Environment tool; assess combined radial bearing-less motor and axial gas bearing for hybrid	3.289	3.560	3.602

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW6 *I Future UAS Propulsion Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
electric applications; implement super-critical carbon dioxide thermal management module and validate optimized hybrid-electric optimization and integration tool (HEART) outputs. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	3.289	3.560	3.602

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 I 2			R-1 Program Element (Number/Name) PE 0602183A I *Air Platform Applied Research*			Project (Number/Name) CW7 I *High Speed and Efficient VTOL Vehicle Tech*				

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW7: *High Speed and Efficient VTOL Vehicle Tech*	-	1.492	1.580	1.583	-	1.583	1.585	1.587	1.604	1.620	0.000	11.051

A. Mission Description and Budget Item Justification

This Project designs and develops material component technologies and dynamic models to enable future generation capabilities for Future Vertical Lift (FVL) platforms. This Project is focused on improving range, payload, and endurance performance as well as reliability and maintainability metrics. The outcomes from the efforts within this Project will be applicable to the Family of Future Vertical Lift manned and unmanned platforms.

Research in this Project is fully coordinated with PE 0602183A (Air Platform Applied Research), Project CW8 (Next Generation Aviation Transmission Apl Tech).

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

Work in this Project is performed by Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Speed Efficient Vertical Take-Off and Landing (VTOL)Vehicle Technologies	1.492	1.580	1.583

Description: This effort establishes propulsion concepts for vertical take-off and landing to enable improved, efficient hover and high-speed cruise at longer range without added weight.

FY 2024 Plans:
Will continue to develop experimental techniques to assess hybrid gear failure modes. Will continue to develop a dynamic model of a transmission topology that is non-conventional for rotorcraft. Will prepare the Vehicle Innovative Powertrain Experimental Research (VIPER) facility to perform hybrid-electric propulsion transmission experiments. Will assess tribolological performance of functionally-graded ceramic/metal materials at the coupon level. Will expand the machine learning (ML) toolbox for investigating failure modes of electric rotating machinery.

FY 2025 Plans:
Will compare and validate data-driven condition indicators from simulated data with experimental rig and field system data; expand fault models to second fault type/location for training artificial intelligence towards a fully computational implementation; conduct parametric study to exercise models of conventional and non-conventional transmissions to determine fault sensitivity and detection method optimization (damage location, sensor types, and sensor location).

FY 2024 to FY 2025 Increase/Decrease Statement:

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW7 *I High Speed and Efficient VTOL Vehicle Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	1.492	1.580	1.583

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602183A: *Air Platform Applied Research*
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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*			**Project (Number/Name)** CW8 *I Next Generation Aviation Transmission Apl Tech*			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CW8: *Next Generation Aviation Transmission Apl Tech*	-	1.428	1.511	-	-	-	-	-	-	-	0.000	2.939

Note

In FY25 this Project is restructured to Program Element (PE) 0602183A (Air Platform Applied Research), Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe)).

A. Mission Description and Budget Item Justification

This Project investigates Future Vertical Lift (FVL) and other Army and Department of Defense (DoD) advanced drive train technologies that increase performance and double current drivetrain life cycles while improving their reliability and maintainability.

Research in this Project is fully coordinated with PE 0603043A (Air Platform Advanced Technology).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: High Reduction Ratio Transmission (HRT) Components	1.428	1.511	-
Description: Effort investigates advanced materials and component designs that allow a 60:1 reduction ratio two-stage gearbox design that provides significant weight and volume reduction for extended range and component life for manned and unmanned applications. *FY 2024 Plans:* Will perform tribology testing and analysis of advanced gear/bearing materials using in-house testing facilities. *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY25 this effort is restructured to Program Element (PE) 0602183A (Air Platform Applied Research), Project DK1 (Air Vehicle Integrated & Alternative Tech (AVIATe)).			
Accomplishments/Planned Programs Subtotals	1.428	1.511	-

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** CW8 *I Next Generation Aviation Transmission Apl Tech*
C. Other Program Funding Summary ($ in Millions)		
Remarks		
D. Acquisition Strategy N/A		

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2				**R-1 Program Element (Number/Name)** PE 0602183A I *Air Platform Applied Research*				**Project (Number/Name)** DC2 I *High Performance Computing for Rotorcraft Apl Tech*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DC2: *High Performance Computing for Rotorcraft Apl Tech*	-	1.221	1.293	1.309	-	1.309	1.311	1.312	1.326	1.339	0.000	9.111

A. Mission Description and Budget Item Justification

This Project investigates and validates aeromechanics modeling and simulation tools for Future Vertical Lift (FVL) and other Army and DoD aviation systems and platforms. Research efforts in this Project are also applicable to the family of FVL manned and unmanned platforms.

Research in this Project is fully coordinated with PE 0603043A (Air Platform Advanced Technology), Project DC3 (HPC for Army Aviation Concepts).

The cited research 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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: High Performance Computing for Aviation Applications *Description:* Develop automated, high-fidelity computational tools for rotorcraft analysis and design. *FY 2024 Plans:* Will develop and demonstrate new high-fidelity aeromechanics modeling and simulation tools to address relevant rotorcraft design problems for FVL-relevant aircraft. Will ensure that these new aeromechanics modeling and simulation tools run efficiently and effectively on state-of-the-art new heterogeneous high-performance computing systems. *FY 2025 Plans:* Will develop and validate a GPU performance portable version of rotorcraft computational model to reduce the simulation time for FVL configurations from weeks to days. Will ensure that the new models run efficiently on the new state-of-the-art high-performance computing systems. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	1.221	1.293	1.309
Accomplishments/Planned Programs Subtotals	1.221	1.293	1.309

C. Other Program Funding Summary ($ in Millions)
N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** DC2 *I High Performance Computing for Rotorcraft Apl Tech*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy
 N/A

PE 0602183A: *Air Platform Applied Research*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 / 2				**R-1 Program Element (Number/Name)** PE 0602183A / *Air Platform Applied Research*					**Project (Number/Name)** DE2 / *Airborne Threat Defeat*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
DE2: *Airborne Threat Defeat*	-	-	5.794	7.423	-	7.423	6.505	-	-	-	0.000	19.722

A. Mission Description and Budget Item Justification

Airborne Threat Defeat addresses the need to engage and disorient guided threats.

Work in this Project complements Program Element (PE) 0603465A (Future Vertical Lift Advanced Technology) / Project CA8 (Adv Rotorcraft Armaments Protection Sys).

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 Armaments Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Airborne Threat Defeat Tech	-	5.794	7.423
Description: This effort develops novel weapon, munition and fire control system technology required to increase standoff distance and engagement time to decoy or defeat guided threats. *FY 2024 Plans:* Will investigate concepts to decoy and defeat advanced, agile, and guided aerial threats with novel weapon, munition, and fire control system technologies. Will develop modeling and simulation tools to evaluate potential decoy and defeat techniques. Will investigate miniaturized electro-chemical-mechanical payloads for advanced threat decoy or threat. *FY 2025 Plans:* Will investigate combined electro-chemical-mechanical payloads and targeting concepts for decoy and defeat of current and emerging aerial threats; design and develop armament components and systems to decoy and defeat aerial threats through algorithms and conceptualization techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects the planned investigation of electro-chemical-mechanical payloads and targeting concepts for the decoy and defeat of aerial threats.			
Accomplishments/Planned Programs Subtotals	-	5.794	7.423

C. Other Program Funding Summary ($ in Millions)

N/A

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 **/** 2	**R-1 Program Element (Number/Name)** PE 0602183A **/** *Air Platform Applied Research*	**Project (Number/Name)** DE2 **/** *Airborne Threat Defeat*

C. Other Program Funding Summary ($ in Millions)

Remarks

D. Acquisition Strategy
  N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*				**Project (Number/Name)** DK1 *I Air Vehicle Integrated & Alternative Tech (AVIATe)*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
DK1: *Air Vehicle Integrated & Alternative Tech (AVIATe)*	-	-	-	2.998	-	2.998	6.423	8.249	8.536	7.109	0.000	33.315

Note

Air Vehicle Integrated & Alternative Tech (AVIATe) is a new start within the Air Platform Applied Research program in FY 2025.

A. Mission Description and Budget Item Justification

This project enhances Army aviation mission capability and addresses operational energy and environmental challenges. Includes the development, maturation, and system design of technologies including advanced engines, hybrid and electric systems, power and control allocation, propulsive power delivery, electric actuation, structures, and other technologies that enhance performance, efficiency or are critical to implementation.

Work in this Project is fully coordinated with PE 0603043A (Air Platform Advanced Technology) / Project DK2 (Air Vehicle Improvements & Advanced Tech (AVIATe)).

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 Aviation & Missile Center (AvMC).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Hybrid-Electric Aviation Technology (HEAT) ***Description:*** This effort focuses on building a knowledge base within Army aviation to assess the viability of meeting future rotorcraft motive and mission equipment power needs through design, architecture, system alternatives and technology trade studies, investigating and developing hybrid-electric component and sub-system technologies. Emphasis is on knowledge building, analytical tools, performance improvement, and to address Army unique technology gaps. ***FY 2025 Plans:*** Will perform system architecture and hybrid electric technology trade studies to address Army aviation unique gaps. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In FY25, this effort is a new start.	-	-	1.796
Title: Supplemental Power Efficient Engines and Drives (SPEED)	-	-	1.202

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602183A *I Air Platform Applied Research*	**Project (Number/Name)** DK1 *I Air Vehicle Integrated & Alternative Tech (AVIATe)*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort develops supplemental power, engine, and drives systems component technologies to improve power-to-weight ratio, efficiency, and provide improved mission capability for Army aircraft systems. Technology will be validated through component level test. *FY 2025 Plans:* Will perform design of propulsion and power component technology to consist of advanced supplementary power, engines, and/or drive system technology for application to Future Vertical Lift aircraft. *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY25, this effort is a new start.			
Accomplishments/Planned Programs Subtotals	-	-	2.998

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602183A: *Air Platform Applied Research*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	

Appropriation/Budget Activity
2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*

R-1 Program Element (Number/Name)
PE 0602184A *I Soldier Applied Research*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	15.427	18.986	21.069	-	21.069	29.231	30.140	30.491	30.022	0.000	175.366
CK9: *Advancing Concepts and Technology Forecasting Tech*	-	2.521	2.586	2.577	-	2.577	2.581	2.582	2.611	2.637	0.000	18.095
CN2: *Intelligent Weapons Concepts and Technologies*	-	3.312	4.474	4.484	-	4.484	4.490	4.493	4.533	4.578	0.000	30.364
CN9: *Soldier Enabling University Applied Research*	-	0.382	0.457	2.175	-	2.175	2.782	2.784	2.814	2.843	0.000	14.237
CO1: *Soldier Power And Energy Concepts and Technologies*	-	2.384	4.442	4.492	-	4.492	8.148	9.465	10.104	10.205	0.000	49.240
CO2: *Soldier-Intelligent Technology Research*	-	1.504	-	-	-	-	-	-	-	-	0.000	1.504
CV9: *Technical-SAVVY Soldier Applied Research*	-	2.246	3.396	3.665	-	3.665	3.775	3.356	2.888	2.143	0.000	21.469
CW9: *Syn Bio for Reactive-Resp Matls-Soldiers & Sys*	-	3.078	3.631	3.676	-	3.676	7.455	7.460	7.541	7.616	0.000	40.457

A. Mission Description and Budget Item Justification

This Program Element (PE) investigates, designs, and performs research focused on technologies necessary for capability enhancements for the Soldier and Squad over the long-term well beyond those technologies planned within the Soldier Lethality Cross- Functional Team. Applied research projects investigate nascent and enduring science and technology areas that are applicable to the individual Soldier and Squads of Soldiers needs with emphasis on maximizing Soldier and Squad performance, lethality, mobility and survivability. This PE also designs and validates technologies that are necessary and foundational for future capabilities with far-reaching impact on mission success. The outputs of these efforts transition to advanced research efforts that mature and demonstrate potential opportunities to realize improved Soldier performance and inform technical requirements for future Soldier systems.

The PE will fund civilian salaries for in-house researchers/scientists and program managers collaborating with external subject matter experts in academia and industry who are leaders in these technology research areas. This PE is coordinated with PE 0602143A (Soldier Lethality Technology), 0602785A (Manpower, Personnel and Training Technology), 0603007A (Manpower, Personnel and Training Advanced Tech), 0603044A (Soldier Advanced Technology), and 0603118A (Soldier Lethality Advanced Technology).

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

PE 0602184A: *Soldier Applied Research*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	15.716	18.986	21.027	-	21.027
Current President's Budget	15.427	18.986	21.069	-	21.069
Total Adjustments	-0.289	0.000	0.042	-	0.042
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-0.001	-			
• SBIR/STTR Transfer	-0.288	-			
• Adjustments to Budget Years	-	-	0.042	-	0.042

Change Summary Explanation

Funding increase is an economic adjustment.

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*				**Project (Number/Name)** CK9 *I Advancing Concepts and Technology Forecasting Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CK9: *Advancing Concepts and Technology Forecasting Tech*	-	2.521	2.586	2.577	-	2.577	2.581	2.582	2.611	2.637	0.000	18.095

A. Mission Description and Budget Item Justification

This Project works across the Army Futures Command Combat Capabilities Development Command (DEVCOM), with the Futures & Concepts Center (FCC), and the Directorate of Intelligence and Security to explore current and future emerging and disruptive applied scientific research to translate, integrate, and ingrain applied research outcomes with the Army.

Warfighting Concepts to describe how the Army will fight in the mid and far-term future while the Future Operational Environment contextualizes projected applied research outcomes in the deep future. Applied research outcomes describe the projected future operational effects of science in the context of Army concepts and probable operational capabilities to mitigate risk for future Army capabilities and enable informed decision making across the Army Modernization Enterprise. This Project ensures Army Concepts are grounded by recent and anticipated advances in applied scientific research, Army applied research is capability use-inspired to deliver the right future capability identified in the Army Concepts, and learning opportunities are created to advance Army Concepts and operationalize science for transformational overmatch.

This Project also performs long-range technology forecasts and trend analysis, informed by the threat and the predicted future state of technology, of Army-relevant applied research topics to enable informed decision making for the near-, mid-, and far-terms.

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

Research in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Advancing Concepts and Technology Forecasting	2.521	2.586	2.577
Description: Advancing Concepts and Technology Forecasting identifies and translates emerging and disruptive applied scientific research current and future outcomes in order to integrate and ingrain applied scientific data and knowledge with Army Warfighting Concepts which describe how the Army will fight in the mid- and far-term future. This effort also provides long-range, scientifically grounded technology forecasts and trend analysis, informed by the threat and future predicted state of technology, of applied research topics to enable informed decision-making for the near-, mid-, and far-terms.			
FY 2024 Plans: Will provide objective estimates of anticipated applied research advances of emerging scientific areas with high relevance to the Army. Broad technology areas include extensions to the Army Priority Research Areas and other topics such as Army-unique autonomous behaviors, cross-domain sensor modalities, and agile manufacturing technologies; integrate outcomes of mid-			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CK9 *I Advancing Concepts and Technology Forecasting Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
and far-term Army Warfighting Concept priorities for decision advantage into emerging applied scientific research programs in distributed sensing and artificial intelligence for agile command and control, and for sustained operations into emerging applied scientific research programs in energy sciences. *FY 2025 Plans:* Will integrate mid- and far-term Army Concept priorities, including offensive and defense fires and platform survivability, to guide applied scientific research program development; participate in warfighting assessments to inform Army operability within continental environments of varying density and terrain. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	2.521	2.586	2.577

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602184A: *Soldier Applied Research*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*				**Project (Number/Name)** CN2 *I Intelligent Weapons Concepts and Technologies*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CN2: *Intelligent Weapons Concepts and Technologies*	-	3.312	4.474	4.484	-	4.484	4.490	4.493	4.533	4.578	0.000	30.364

A. Mission Description and Budget Item Justification

This Project focuses on far-term, overarching lethality technologies by investigating techniques for Soldiers to guide the in-field adaptation of intelligent small arms technologies to respond to changing mission requirements, novel environments, and adversarial actions. Research areas include cognition-centric displays to ensure Soldiers maintain appropriate situational awareness in augmented reality (AR) environments, opportunistic shooter sensing, and interactive machine learning techniques to ensure small arms technologies can adapt to changing situations quickly and with reduced data requirements as compared to non-human guided machine learning and Artificial Intelligence (AI). The results of this Project will enhance operational performance of individuals and teams of Soldiers in the future operational environment through novel weapon and human-agent interaction technologies.

The cited research 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 Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Human-Agent Interactions for Intelligent Squad Weapons *Description:* This effort investigates enhanced target acquisition, situational awareness, and shooting performance through Soldier-centered integration of intelligent technologies and distributed information in augmented squad weapons. Enhances operational performance of individuals and teams of Soldiers through novel weapon and human-agent interaction technologies. *FY 2024 Plans:* Will mature algorithms for fusion of opportunistically sensed data from intelligent weapons and small unmanned aerial systems; develop adaptive small arms fire control capabilities using integrated opportunistic sensing within artificial intelligence (AI)-enhanced small arms ecosystems; develop methods for using opportunistic sensing to quantify emergent behaviors from dismounted, heterogenous human-autonomy squads during realistic scenarios; investigate approaches for providing contextualized Soldier-weapon-squad state data for enhanced squad-level task prioritization and command-level decision making. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding realigned from Human-Agent Interactions for Intelligent Squad Weapons in FY 2025 to support the creation of Distributed Information for Enhanced Squad Lethality within this Project.	3.312	4.474	-
Title: Distributed Information for Enhanced Squad Lethality	-	-	4.484

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CN2 *I Intelligent Weapons Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: This effort investigates how multimodal data from heterogenous small units of Soldiers and systems can be combined and leveraged to provide actionable information for squad lethality and survivability, including enhanced target acquisition and engagement, situational awareness, tactical maneuver, and decision-making performance. Enhances operational performance at scale and complexity through novel human-agent interaction techniques over distributed formations of Soldier technologies. *FY 2025 Plans:* Will design and develop algorithms for fusion of opportunistically sensed data, including weapon data and gaze direction, from dismounted Soldier-systems to expand situational awareness capabilities; quantify relationships between heterogenous human-autonomy squad behaviors and cross-platform small-arms target detection and prioritization approaches to inform learning techniques; design and develop algorithms for fusion of opportunistically sensed data for small unit Soldier-systems to inform tactical options; investigate approaches for leveraging contextualized squad state data to expand autonomous learning across formations. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of the effort. Funding realigned from Human-Agent Interactions for Intelligent Squad Weapons in FY 2025 to support the creation of Distributed Information for Enhanced Squad Lethality within this Project.			
Accomplishments/Planned Programs Subtotals	3.312	4.474	4.484

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*					**Project (Number/Name)** CN9 *I Soldier Enabling University Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CN9: *Soldier Enabling University Applied Research*	-	0.382	0.457	2.175	-	2.175	2.782	2.784	2.814	2.843	0.000	14.237

A. Mission Description and Budget Item Justification

This Project investigates technologies from academia that will improve capabilities and systems to advance Soldier and Squad lethality-overmatch and Soldier performance. This Project funds collaborative, enduring applied extramural university-based research and brings together competitively selected universities with Army research teams into Technical Alliances. This Project will determine discovery solutions and inform capabilities development for mid- to far-term Army modernization priorities while also maintaining delivery of near-term technologies fundamental to the modernization priorities. The technical scope of this Project includes the investigation and design of overarching Soldier-centric technologies including, human systems integration, robotics, synthetic environments for training, advanced materials, power management, energy, Warfighter endurance, and computational technologies. This Project conducts applied research for potential emerging technologies in areas of strategic importance to the Army in Soldier capabilities related to increased protection, performance, agility, situational awareness, and lethality. This Project will also continuously strive to engage and collaborate with entities that might not otherwise collaborate with the Department of Defense (DoD) to identify and determine novel Soldier-centric technologies for accelerating the adoption of emerging technologies for the Warfighter in the Army Soldier portfolio.

Work in this Project complements Program Element 0603044A (Soldier Advanced Technology)/Project CN8 (Soldier Enabling University Advanced Development)

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 University Technology Development Division.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Soldier Training and Performance *Description:* Collaboratively investigate technologies for Soldier capabilities related to increased protection, performance, agility, situational awareness, training, and lethality. *FY 2024 Plans:* Collect, label, warehouse, and analyze training data for the development of synthetic training environment. Continue to investigates technologies to monitor health, cognitive state and readiness of Warfighters through digital biosensor/biomarkers and their wireless charging capabilities. *FY 2025 Plans:* Will fund research that enables the capture, warehousing, and manipulation of synthetic training data to support Commanders in making training and operational readiness decisions; investigate emergent technologies to monitor health, cognitive state and	0.382	0.457	2.175

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CN9 *I Soldier Enabling University Applied Research*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
readiness of Warfighters through digital biosensor/biomarkers and their wireless charging capabilities; fund academic applied research in emerging Soldier related technologies related to increased protection, performance, agility, situational awareness, training, and lethality. The benefit of this effort is improved realistic training for decision making and improved understanding of a Soldier's cognitive load. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects a planned increase in applied research activity to support investigation of emerging technologies for military application.			
Accomplishments/Planned Programs Subtotals	0.382	0.457	2.175

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / Soldier Applied Research				Project (Number/Name) CO1 / Soldier Power And Energy Concepts and Technologies			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CO1: *Soldier Power And Energy Concepts and Technologies*	-	2.384	4.442	4.492	-	4.492	8.148	9.465	10.104	10.205	0.000	49.240

A. Mission Description and Budget Item Justification

This Project conducts applied research to improve safe, compact, efficient, rugged, lightweight, and energy dense power sources for increased capabilities for the mounted and dismounted force. This Project also investigates materials, processes, and component level energy storage and conversion technologies that enable tactical overmatch and reduce the physical and cognitive burden on Soldiers. Research will focus on safe electrochemical energy storage, high specific energy storage and conversion, novel materials and processing for energy and power, and new cell designs that address the power needs of future capabilities including advanced sensors, communications systems, and electronic Warfighting capabilities. Enabling and emerging technologies are supported in this Project to address future Soldier power needs necessary for increased lethality, increased mobility, and longer mission durations at reduced physical burden to the Soldier in the future operating environment.

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

Research in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Tactical Energy Sources and Energy Materials *Description:* This effort conducts overarching power and energy research to determine and design alternative energy capabilities to replace current energy systems. Research focuses on new materials and processing techniques as well as energy storage technologies that support advanced sensors, communications systems, and electronic Warfighting capabilities. *FY 2024 Plans:* Will characterize nickel and nickel-based alloy catalyst parameters for ethanol partial oxidation; investigate alumina and ceria-based materials as support substrate for ethanol partial oxidation catalysts; design and develop baseline characterization methods to explore catalyst and catalyst support combinations for the reduction of ethanol reformation temperature; design and develop large area, high capacity rechargeable batteries utilizing aqueous, hybrid, and inorganic electrolytes and additives; determine temperature driven phase and transport behavior in aqueous, hybrid, and inorganic electrolytes and investigate conductivity, transference number, capacity, recharge rate, and cycle life at high and low temperatures; investigate incorporation of high energy anodes for rechargeable aqueous batteries including silicon, metal, and alloy chemistries; identify routes to synthetically protect	2.384	2.442	2.488

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CO1 *I Soldier Power And Energy Concepts and Technologies*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
and passivate from electrolyte decomposition at high energy anodes; design and develop binders and methods for scalable processing and integration of battery material; mature high capacity halide-based cathode and supporting electrolyte interface. *FY 2025 Plans:* Will investigate stability, passivation, and cycle characteristics of high energy lithium-ion anode materials such as silicon, aluminum alloy, lithium metal, and copper foil in aqueous lithium-ion battery cells; explore integration and scaling of high energy anodes into higher capacity aqueous lithium-ion cells; assess aqueous lithium-ion component and cell performance to include capacity, capacity utilization, rate capability, and temperature dependences; mature anode protection electrolytes, aqueous electrolyte composition, and material suitability for high-throughput scalable processing and manufacturing; investigate emerging electrode processing techniques including electron beam curing to produce electrodes and electrolyte-in-electrode materials for aqueous and solid-state battery construction and performance; validate integration of halide-based cathode materials into lithium-ion cells; explore experimental conditions for nickel-based catalysts and other catalyst candidates on alumina and ceria-based supports to investigate ethanol reformation activity and the carbon deposition mechanism. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.			
Title: Materials and Technologies for Electrochemical Alternative Power *Description:* This effort investigates materials for electrolyzers and alternative power sources for small unit energy and power needs. Research is focused on materials and technologies that will reduce the dependence on fossil fuels while diversifying the energy sources for soldier platforms. *FY 2024 Plans:* Will investigate electrocatalysts and membranes for open cell electrolysis; perform analysis on candidate fuel products and associated production rates constrained by size, weight, and power and reduced carbon footprint; design and develop the button cell fabrication process for electrochemical alternative power sources. *FY 2025 Plans:* Will explore and assess methods for energy and material harvesting from local resources; investigate processes for conversion of harvested energy and materials into chemical fuels; determine the energy conversion efficiencies related to chemical fuel synthesis and overall efficiency to electrical power. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase is an economic adjustment.	-	2.000	2.004
Accomplishments/Planned Programs Subtotals	2.384	4.442	4.492

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CO1 *I Soldier Power And Energy Concepts and Technologies*

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 / 2					R-1 Program Element (Number/Name) PE 0602184A / Soldier Applied Research				Project (Number/Name) CO2 / Soldier-Intelligent Technology Research		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CO2: Soldier-Intelligent Technology Research	-	1.504	-	-	-	-	-	-	-	-	0.000	1.504

A. Mission Description and Budget Item Justification

This Project investigates research gaps related to human and intelligent systems to enhance decision making in response to changing conditions. Applied research is conducted on novel and emerging visualization technologies as well as methodologies for intelligent systems and Soldier to co-adapt for the real-time quantification, prediction, and enhancement of squad-level shared situational awareness (SA) and situational understanding (SU) across dynamic, complex, and uncertain operating environments, leading to demonstrated increases in mission effectiveness. The result of this Project will inform various efforts that rely on human and intelligent system interactions including systems that adapt the behavior of autonomous assets and intelligent Soldier tools, based on dynamic needs of the Soldier/squad, using real-time opportunistic measures of Soldier SA and changing mission environment. In addition, this Project will design novel approaches to represent uncertain and dynamically changing information, to increase Soldier comprehension and enhanced mission effectiveness, with reduced Soldier/squad burden and training requirements.

The cited research 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 2023	FY 2024	FY 2025
Title: Soldier Performance in Sociotechnical Environments	1.504	-	-
Description: Technologies for squad-level situational awareness assessment (information visualization) that provide command-level decision support with communication and intervention capabilities. Research focuses on algorithms for the quantification and visualization of collective uncertainty at the squad level for mission command decision making. This effort also supports the monitoring and assessing of Soldier tactical readiness and effectiveness through technologies and approaches for opportunistic human sensing.			
Accomplishments/Planned Programs Subtotals	1.504	-	-

C. Other Program Funding Summary ($ in Millions)
N/A
Remarks

D. Acquisition Strategy
N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										Date: March 2024	
Appropriation/Budget Activity 2040 I 2					R-1 Program Element (Number/Name) PE 0602184A I *Soldier Applied Research*				Project (Number/Name) CV9 I *Technical-SAVVY Soldier Applied Research*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CV9: *Technical-SAVVY Soldier Applied Research*	-	2.246	3.396	3.665	-	3.665	3.775	3.356	2.888	2.143	0.000	21.469

A. Mission Description and Budget Item Justification

This Project conducts applied research to provide critical breakthroughs in developing a "technologically" fluent force. This research will develop models of technological fluency(TF) (TF Modeling), methods and measures to assess and develop the technological fluency of Soldiers across a career (TF Personnel Assessments), and technologies to maximize technological fluency resilience and performance in Soldiers and units (Maximizing TF). TF is defined as the ability of Soldiers and units to use and rapidly adapt new and intelligent technologies without formal training on these technologies, and it will be a decisive factor in a future operating environment in which Soldiers and squads are teamed with increasingly sophisticated and evolving technologies. Soldiers and leaders in specialty areas (e.g., Cyber and Emerging Tech) and General Purpose Forces will require increased technological aptitudes and skills to adapt emerging technologies to evolving mission sets and avoid being overmatched by Artificial Intelligence (AI)-enabled "smart" technologies.

This Project supports key Army needs and will coordinate with and/or leverage findings of several Program Elements (PEs) to include PE 0602785A (Manpower, Personnel and Training Technology), 0602143A (Soldier Lethality Technology), and 0602145A (Next Generation Combat Vehicle 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 Army Research Laboratory (ARL) and the Army Research Institute (ARI) for Behavioral and Social Sciences.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Soldier Technical Enhancement Applied Research - ARL	1.469	2.096	2.356
Description: This effort enables TF through three areas of focus: TF Modeling through the creation and utilization of novel future-focused laboratory experimental test-beds; TF Personnel Assessments through methodologies and technologies for "opportunistic" (no Soldier burden) sensing and TF interpretation; and Maximizing TF through creating TF training approaches and in-field performance aids. *FY 2024 Plans:* Will mature human-system interaction experimental environment to include prototype adaptive intelligent system interactions and initial technology integration for opportunistic sensing capability; conduct validation experiments on initial TF models using human-system interaction test-beds. *FY 2025 Plans:*			

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CV9 *I Technical-SAVVY Soldier Applied Research*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will investigate approaches to opportunistically sense measures of technological fluency (TF) that can be extracted from in-field sources without creating additional operational burden; explore enhancements to experimental environments to enable validation of TF models that include degradations and enhancements of individuals. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Title: Soldier Technical Enhancement Applied Research - ARI *Description:* This effort enables TF through three areas of focus: TF Modeling by identifying and understanding the critical human knowledge, skills, abilities, and characteristics that enable TF in Soldiers and teams; TF Personnel Assessments by developing and validating personnel tests to assess knowledge, skills, and abilities, and characteristics to promote TF for talent management; and Maximizing TF by creating and validating TF training approaches to improve TF at both the individual and team levels of performance. ***FY 2024 Plans:*** Will continue to develop a competency model of Technological Fluency (TF) that identifies the critical knowledge, skills, abilities, and characteristics that enable TF; will initiate development of proof-of-concept training methods for maximizing TF competencies; will develop and define the individual personnel testing requirements needed to measure TF model competencies. ***FY 2025 Plans:*** Will develop and validate a competency model of Technological Fluency (TF) that identifies the critical knowledge, skills, abilities, and characteristics that enable TF; will develop proof-of-concept training methods for maximizing TF competencies; will develop personnel testing requirements and test blueprints to measure identified TF competencies. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.	0.777	1.300	1.309
Accomplishments/Planned Programs Subtotals	2.246	3.396	3.665

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2					R-1 Program Element (Number/Name) PE 0602184A *I Soldier Applied Research*				Project (Number/Name) CW9 *I Syn Bio for Reactive-Resp Matls-Soldiers & Sys*			
COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CW9: *Syn Bio for Reactive-Resp Matls-Soldiers & Sys*	-	3.078	3.631	3.676	-	3.676	7.455	7.460	7.541	7.616	0.000	40.457

A. Mission Description and Budget Item Justification

This Project designs and investigates materials through the application of biotechnology and synthetic biology advances to develop material capabilities that respond and/or can adapt to a wide range of external stimuli and biological processes. Research into innovative materials that are capable of sensing, responding, and adapting to a broad spectrum of environmental variables will be conducted. This Project will explore new biology-based methods for controlled synthesis and assembly to create multi-functional materials and advanced composites as well as develop materials that are able to self-monitor, self-heal, and self-sustain. This Project also focuses on developing models, materials characterization techniques, non-destructive testing methods, and advanced fabrication and processing methodologies as well as the identification of unique material properties.

The cited research is consistent with the Undersecretary of Defense for Research and Engineering priority focus areas and the Army Modernization Strategy.

Research in this Project is performed by the Army Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Biological Bio-Composite Materials and Processes **Description:** This effort conducts applied research through the application of biotechnology advances to develop materials with capabilities to respond and adapt to a wide range of external stimuli and biological processes. Research will explore new biology-based methods for controlled synthesis and assembly to create materials with precise chemistries, microstructures, properties, and responsive functionalities through controlled molecular placement, spatial architectures, and interfacial structures. Investment in bio-enabled materials research allows for the design of materials that are capable of sensing and responding, as well as adapting to a broad spectrum of environmental variables with the ability to self-monitor, self-heal, self-sustain, and self-degrade. Investments in this area could lead to future applications in Soldier performance, situational awareness, protection, and sustainment. **FY 2024 Plans:** Will design and develop biological building blocks to interface with military equipment, electronics, and platforms (i.e. coatings, textiles, metals) for advance sensing, protection, and deception, and investigate signal output for sensors; investigate and tune novel biomaterials for control in electro-optical/electromagnetic (EO/EM) and determine shielding for protection; continue to tune and assess novel structural composites for scale and integration for down-stream processing (e.g. energetics, protective coatings); investigate strategies to integrate biomaterials into composites for protection, situational awareness,	3.078	3.631	3.676

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602184A *I Soldier Applied Research*	**Project (Number/Name)** CW9 *I Syn Bio for Reactive-Resp Matls-Soldiers & Sys*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
and communication to determine utility of novel biomaterials for advanced composites and protective coatings; understand biodegradation mechanisms of protective coatings and identify strategies to tune effects and delivery mechanisms. *FY 2025 Plans:* Will use synthetic biology to develop sense-and-respond cascades, and investigate addressable and potentially specific interactions for composite assembly relevant to electro-optical/electromagnetic (EO/EM) materials; tie aforementioned capabilities back to traditional material science structure-property relationships; mature novel biomaterials for advanced composites and protective coatings; mature understanding of how biological interfaces can be leveraged for military platforms (i.e., coatings, textiles, and metals), and use synthetic biology to tune signal output for advanced sensing, reporting, and protection; develop novel synthetic biology enabled bio-capabilities for material manipulation and tune for desired capabilities. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase Is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	3.078	3.631	3.676

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602184A: *Soldier Applied Research*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*						
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	13.605	22.714	28.656	-	28.656	24.273	22.855	17.549	16.871	0.000	146.523
2CY: *Information Trust Technology*	-	0.858	3.054	7.838	-	7.838	2.505	2.167	-	-	0.000	16.422
3CY: *Network Access and Effects Technology*	-	7.798	10.588	12.550	-	12.550	11.848	12.257	12.390	12.514	0.000	79.945
5CY: *Offensive Cyber Operations (OCO) Mirror Technology*	-	1.022	-	-	-	-	-	-	-	-	0.000	1.022
CY1: *Information Assurance and Network Resiliency Tech*	-	3.927	-	-	-	-	-	-	-	-	0.000	3.927
CY6: *Autonomous Cyber Technology*	-	-	9.072	8.268	-	8.268	9.920	8.431	5.159	4.357	0.000	45.207

Note

2CY / Information Trust Technology (Tactical Zero Trust) - Funding is realigned from Program Element (PE) 0602213A (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology), and PE 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology).

CY6 / Autonomous Cyber Technology(Network Obscuration) - In Fiscal Year (FY) 2025, this Project has a skip year.

A. Mission Description and Budget Item Justification

This Program element (PE) investigates, designs, and develops cyber architectures, software, tools, and techniques to enable Cyber Electromagnetic Activities (CEMA) to counter adversary communications and harden the Army's tactical communications networks against cyber attacks. For offensive cyber effort against adversary communications, efforts investigate capabilities to identify and capture data traversing targeted networks for detection, identification, exploitation, direction finding, geolocation, and denial of service. Defensive cyber efforts in this PE focus on hardening the Army's tactical network by investigating and applying robust cyber security technologies and techniques to advance software, algorithms and protocols utilized within tactical networks, to protect against nation state level cyber-attacks and maintain Warfighter confidence in network information by hardening the blue force attack surface.

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

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*		

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	13.605	22.714	32.949	-	32.949
Current President's Budget	13.605	22.714	28.656	-	28.656
Total Adjustments	0.000	0.000	-4.293	-	-4.293
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Adjustments to Budget Years	-	-	-4.293	-	-4.293

Change Summary Explanation

Funding decrease realigned for PE 06022146A Quantum Sensing.

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*				**Project (Number/Name)** 2CY *I Information Trust Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
2CY: *Information Trust Technology*	-	0.858	3.054	7.838	-	7.838	2.505	2.167	-	-	0.000	16.422

Note

2CY / Information Trust Technology (Tactical Zero Trust) - Funding is realigned from Program Element (PE) 0602213A (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology), and PE 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology).

A. Mission Description and Budget Item Justification

This Project develops defensive cyber technology to ensure that data traversing the network remains verified and has not been modified through unauthorized means. Project enhances system access without affecting personnel authentication processes, enhances awareness of user actions and intent within the network, and maintains information provenance from originator to consumer. It will also integrate zero trust principles where access to resources is granted based on continuous risk assessments.

Work in this Project complements Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 8CY (Information Trust 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: PKI-Modernization & Dynamic Access Control for Tactical (DAC-T) Technology	0.858	3.054	-
Description: This effort will investigate cryptographic algorithms that address Program Manager (PM) Mission Command gap of native ability to support PKI digital signature and Online Certificate Status Protocol (OCSP) certificate validation for the Variable Message Format (VMF) standard MIL-STD-2045-47001D in Disconnected, Interrupted, and Low-bandwidth (DIL) Networks.			
Furthermore, this effort will investigate methods to enhance, speed up and automate account provisioning and access for people and Non-Person entities (NPE) (e.g. sensors, devices, web services, etc.). This will significantly reduce the workload/ burden for the soldier and improve the networks security posture by enforcing least privilege & just-in-time network access.			
FY 2024 Plans: Will validate OCSP stapling techniques and certificate validation methods that can be integrated with the PM MC variable message format (VMF) parser; design and develop the DAC-T Provisioning functions and conduct experiments on merging and synchronizing of ICAM data from data sources across the DOD, Army and tactical levels in accordance with the Army ICAM			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*	**Project (Number/Name)** 2CY *I Information Trust Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Requirements Definition Package (RDP), Army ICAM Strategy, Army ICAM Attribute Specification and DoD ICAM Reference Design. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned conclusion of this effort and transition to Program Element 0603457A (C3I Cyber Advanced Development) / Project 8CY (Information Trust Advanced Technology).			
Title: Tactical Zero Trust *Description:* Investigate concepts of Zero Trust that can be adapted to tactical network architectures. Extend concepts developed under current Dynamic Access Control - Tactical (DAC-T) to include non-person entities (NPE) (e.g., systems, applications, devices, robotic process automation (RPA) & services). Create an efficient data-in-use service to limit decryption and exfiltration of high value information. Include graceful degradation of capability for Person/NPE access based on Indicators of Compromise (IoC). Investigate open standard methods to create playbooks while assuring safe parallel execution of such playbooks. Effort will mature a capability that performs adversarial assessments on machine learning models to make them more robust to adversarial manipulation. *FY 2025 Plans:* Will investigate novel methods and techniques for uniquely identifying non-personnel entities (NPE's) (e.g., systems, applications, devices,?robotic process automation (RPA) & services) where Public Key Infrastructure (PKI) certificates are not feasible, (ie. Physical Unclonable Functions (PUF's), Fast Identity Online (FIDO2), etc.) and provide the ability to map them to the Master Device Record (MDR); investigate novel methods and techniques for providing protections of Data in Use; investigate advanced ways to provide graceful, degraded access of resources based on indicators of compromise; research and investigate novel adversarial machine learning methods and techniques. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase reflects planned initiation of this effort. Funding is realigned from Program Element (PE) 0602213A (C3I Applied Cyber) / Project CY6 (Autonomous Cyber Technology), and PE 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber Advanced Technology).	-	-	7.838
Accomplishments/Planned Programs Subtotals	0.858	3.054	7.838

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602213A / C3I Applied Cyber				**Project (Number/Name)** 3CY / Network Access and Effects Technology			
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
3CY: Network Access and Effects Technology	-	7.798	10.588	12.550	-	12.550	11.848	12.257	12.390	12.514	0.000	79.945

A. Mission Description and Budget Item Justification

This Project investigates the application of machine learning technologies to assist in capability development and mission execution processes with respect to Offensive Cyber Operations (OCO)/Radio Frequency (RF) Enabled capabilities.

Work in this Project complements Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 9CY (Network Access and Effects 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 Command, Control, Computer, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Applied OCO Techniques and Analytics *Description:* This effort investigates the application of machine learning technologies to assist in capability development and mission execution processes with respect to OCO/RF Enabled capabilities.	7.798	-	-
Title: Network Exploitation Research and Development (NERD) Technology *Description:* This effort investigates computer assisted/automated methodologies and tools to reduce the timelines associated with the exploitation of emerging and validated targets of interest, the development of courses of action, and the execution of offensive attack capabilities in the cyber and radio frequency domains at the pace of a near-peer engagement on a highly complex battlefield of ever evolving cyberspace threats. *FY 2024 Plans:* Will investigate and characterize vulnerabilities of targets of interest to determine the effectiveness of existing access and effect capabilities; investigate the use of artificial intelligence reasoning engines, informed by battlefield intelligence/situation awareness data, and the feasibility of their application to interpreting commander's intent and deriving offensive cyber and/or RF platform firing solutions. *FY 2025 Plans:*	-	10.588	12.550

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*	**Project (Number/Name)** 3CY *I Network Access and Effects Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will investigate non-traditional access and effect vectors against emerging targets of interest that account for and circumvent traditional computer security practices. Will investigate software component designs that expedite the characterization of vulnerabilities with an increased likelihood of holding targets of interest at risk. Will determine necessary data enrichment from Offensive Cyber and RF platforms to identify the ideal non-kinetic firing options for increased target effectiveness. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned research and characterization activities. In Fiscal Year (FY) 2025 funding is realigned from Program Element (PE) 0602213A (C3I Applied Cyber) / Project 5CY (Offensive Cyber Operations (OCO) Mirror Technology).			
Accomplishments/Planned Programs Subtotals	7.798	10.588	12.550

C. Other Program Funding Summary ($ in Millions)

 N/A

Remarks

D. Acquisition Strategy

 N/A

PE 0602213A: *C3I Applied Cyber*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*						**Project (Number/Name)** 5CY *I Offensive Cyber Operations (OCO)* *Mirror Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
5CY: *Offensive Cyber Operations (OCO) Mirror Technology*	-	1.022	-	-	-	-	-	-	-	-	0.000	1.022

Note

In Fiscal Year (FY) 2023, this Project was completed.

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops emerging cyber techniques and cyber situational awareness technologies to enhance Army capabilities. This Project leverages behavioral Modeling and Simulation to mitigate risks and investigates cyber collection and mapping technologies to offer real time cyber situational awareness to enable interpretation of current threats and predict future enemy activities. This allows commanders to develop operational courses of action in time to act decisively.

Work in this Project complements Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project CB4 (Offensive Cyber Operations (OCO) Mirror Adv Tech).

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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Offensive Cyber Operations Mirror Technology	1.022	-	-
Description: Designs and develops emerging internet technologies that enable OCO infrastructure maneuver within the neutral (gray) cyberspace environment; conduct experiments within a modeling and simulation environment (to include behavioral components) to enhance rapid offensive cyber developed capabilities, cyber mission rehearsal, and training.			
Accomplishments/Planned Programs Subtotals	1.022	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

PE 0602213A: *C3I Applied Cyber*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2						**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*				**Project (Number/Name)** CY1 *I Information Assurance and Network Resiliency Tech*		
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CY1: *Information Assurance and Network Resiliency Tech*	-	3.927	-	-	-	-	-	-	-	-	0.000	3.927

Note

In Fiscal Year (FY) 2024 this Project is restructured to Program Element (PE) 0602213A (C3I Applied Cyber Technology) / Project CY6 (Autonomous Cyber).

A. Mission Description and Budget Item Justification

This Project investigates, designs, and develops techniques for detecting, disrupting, understanding and predicting complex adversarial activities and their impacts for developing agile, adaptive maneuvers in defense of information and networks (Agile Cyber Maneuver and Resilience).

Work in this Project complements Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 8CY (Information Trust 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 Command, Control, Computers, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Information Assurance and Network Resiliency Technology	3.927	-	-
Description: This effort designs and characterizes software for the protection of information and networks in wireless tactical environments. The goal is to develop software algorithms that detect and defeat malicious activities of adversaries in bandwidth constrained tactical networks.			
Accomplishments/Planned Programs Subtotals	3.927	-	-

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

PE 0602213A: *C3I Applied Cyber*
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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 / 2				**R-1 Program Element (Number/Name)** PE 0602213A / *C3I Applied Cyber*					**Project (Number/Name)** CY6 / *Autonomous Cyber Technology*		

COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
CY6: *Autonomous Cyber Technology*	-	-	9.072	8.268	-	8.268	9.920	8.431	5.159	4.357	0.000	45.207

Note

CY6 / Autonomous Cyber Technology(Network Obscuration) - In Fiscal Year (FY) 2025, this Project has a skip year.

A. Mission Description and Budget Item Justification

This Project investigates and applies robust cyber security techniques and applications to advanced communications and networking devices, software, algorithms and protocols utilized within wireless tactical networks to protect against nation state level cyber effects and maintain Warfighter confidence in network information, resources, identities and mission partners by hardening the blue force attack surface.

Work in this Project complements Program Element (PE) 0603457A (C3I Cyber Advanced Development) / Project 6CY (Autonomous Cyber 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 Army Research Laboratory (ARL) and Command, Control, Computer, Communications, Cyber, Intelligence, Surveillance, and Reconnaissance (C5ISR) Center.

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Title: Predictive Intelligent Networking (PIN)	-	1.739	3.833
Description: Investigate and develop various design patterns of Network Micro-segmentation given constraint of tactical network, conduct various experiments to determine the lowest viable level of Micro-segmentation for the tactical network, as there are different levels of fidelity of Micro-segmentation, and provide an implementation in support of advanced zero trust concepts. This project researches methods to enable the tactical network to autonomously identify, learn, predict, and react to changes in network operating conditions and network threats to ensure end-to-end network resiliency against adversarial AI-driven electronic attacks (EA), electronic warfare (EW), and cyberattacks. *FY 2024 Plans:* Will investigate hardware/software modules that are compatible with the current Mounted Mission Command Software (MMC-S) program of record, that can process collected spectrum data from multiple receivers and feed the predictive decision software with spectrum-aware information software *FY 2025 Plans:*			

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024	
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602213A / *C3I Applied Cyber*	Project (Number/Name) CY6 / *Autonomous Cyber Technology*	

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will conduct experiments with various network micro-segmentation solutions, based on the current Department of Defense (DOD) Zero Trust Reference Architecture, to define logical network enclaves at the lowest levels that support the visibility and dynamic adaptations necessary to support security and trust while continuing to provide optimum network traffic flow and services at the tactical level. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase reflects planned experiment activities to determine lowest viable level for tactical networks.			
Title: Network Obscuration ***Description:*** Develops the capability to obscure cyberspace operations to delay/deter adversaries that attack and exploit blue cyberspace in enterprise or tactical networks. This project creates cyber obscuration technologies that imitate networks, systems, hosts, users and files that evolve as the network and missions change to distract/disrupt cyber attackers, mitigate or delay their attacks, increasing network resiliency and supporting operations in highly contested, DIL and cyberspace environments. ***FY 2024 Plans:*** Will leverage industry and National Security Agency's (NSA) Camouflage (CAMO) project, begin to investigate the use of machine learning to build obscuration techniques and modeling concepts for pre-placed, remotely administered network obscurations at the systems, applications, users, and data levels. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** In Fiscal Year (FY) 2025, this Project has a skip year.	-	2.959	-
Title: Proactive Cyber Defense ***Description:*** This effort designs and characterizes software for the protection of information and networks in wireless tactical environments. The goal is to develop software algorithms that detect and defeat malicious activities of adversaries in bandwidth and highly resource constrained tactical networks and maintain agile, adaptive cyber maneuver. This research provides automated active defense (e.g., machine learning, anomaly detection, and decision aids) and adversarial resilient techniques to maintain cyber superiority (e.g., improved attack detection, advanced network traffic analysis, and predictive decision aids) against a large attack surface at the edge. ***FY 2024 Plans:*** Will develop algorithms and methodologies for machine learning enabled network analysis tools; experiment with feature extraction, selection, and generation in testing phase of machine learning models for deep packet inspection; investigate network modality based Adversarial Machine Learning (AML) poisoning threats and defenses; develop techniques to improve the Intrusion Detection Systems (IDS) model performance through adversarial retraining; investigate the use of cyber agility and misrepresentation algorithms and methodologies as well as additional evasion defensive algorithms against Adversarial Machine	-	4.374	4.435

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602213A *I C3I Applied Cyber*	**Project (Number/Name)** CY6 *I Autonomous Cyber Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Learning (AML) in order to make tactical and enterprise systems resistant to attacks on their cyber defenses that rely on machine learning. ***FY 2025 Plans:*** Will investigate semi-supervised and self-supervised learning techniques for network intrusion detection that are resilient to adversarial attacks, do not require large amounts of labeled training data, and operate on resource constrained devices; investigate the use of cyber agility and misrepresentation algorithms and methodologies; investigate additional evasion defensive algorithms to make tactical and enterprise systems resistant to attacks on machine learning, which is heavily used by cyber defenses; develop machine learning based algorithms and methodologies to mitigate adversarial poisoning attempts on critical systems; develop high interaction honeynets/pots to misrepresent current networks and systems in tactical environments. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increase is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	-	9.072	8.268

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

PE 0602213A: *C3I Applied Cyber*
Army

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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army											**Date:** March 2024	

| **Appropriation/Budget Activity** 2040: *Research, Development, Test & Evaluation, Army I BA 2: Applied Research* | | | | | | **R-1 Program Element (Number/Name)** PE 0602386A *I Biotechnology for Materials - Applied Research* | | | | | | |

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
Total Program Element	-	21.015	16.736	11.780	-	11.780	8.269	8.254	12.356	12.479	Continuing	Continuing
CP6: *Foundational Biotechnology Design and Dev*	-	21.015	16.736	10.814	-	10.814	7.260	7.264	7.343	7.416	Continuing	Continuing
SM1: *Scale-Up Microbial Products for Biomanufacturing*	-	-	-	0.966	-	0.966	1.009	0.990	5.013	5.063	0.000	13.041

Note

 Project SM1/Scale-Up Microbial Products for Biomanufacturing is a new start within PE 0602386A / Biotechnology for Materials - Applied Research.

A. Mission Description and Budget Item Justification

 This Program Element (PE) investigates, designs, and performs research focused on novel biotechnological methods, techniques, and materials to increase the resiliency of the military supply chain. The Army is responsible for centrally managing funding for Tri-Service Biotechnology for a Resilient Supply Chain (T-BRSC) efforts. T-BRSC leverages bio-industrial manufacturing to ensure critical domestic supply chain resilience for defense needs through domestic production of raw materials and critical products. Efforts under this PE collaborate with sister Services and select allied partners to create a cohesive biotechnology architecture to enable defense needs. Applied research projects investigate and design bio-engineered materials to ensure domestic sourcing for critical supply chain resiliency. This PE designs and validates technologies to enable rapid prototyping and evaluating of bio-engineered and bio-manufactured materials. Also under this PE are efforts determine and validate a digital architecture to secure biotech data and create computer aided design software to support the safe design and enhanced biosecurity of biotechnology products and applications.

 Research in this PE is coordinated with PE 0603386A (Biotechnology for Materials - Advanced Research).

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

PE 0602386A: *Biotechnology for Materials - Applied Re...*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army				**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*			**R-1 Program Element (Number/Name)** PE 0602386A *I Biotechnology for Materials - Applied Research*	

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	21.811	16.736	10.956	-	10.956
Current President's Budget	21.015	16.736	11.780	-	11.780
Total Adjustments	-0.796	0.000	0.824	-	0.824
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.796	-			
• Adjustments to Budget Years	-	-	0.824	-	0.824

Change Summary Explanation

Funding increase reflects new start effort, Scale-Up Microbial Products for Biomanufacturing (SM1) to develop biomanufacturing capabilities of mission-critical materials for military use.

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602386A *I Biotechnology for Materials - Applied Research*				**Project (Number/Name)** CP6 *I Foundational Biotechnology Design and Dev*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
CP6: *Foundational Biotechnology Design and Dev*	-	21.015	16.736	10.814	-	10.814	7.260	7.264	7.343	7.416	Continuing	Continuing

A. Mission Description and Budget Item Justification

This Project works collaboratively with Joint Service partners to investigate and determine novel biotechnology methods and processes to establish a domestic resilient supply chain for defense needs. Applied research designs and conducts experiments on bio-derived, bio-functionalized, and bio-manufactured materials and biosynthetic precursors. Efforts under this Project investigate and validate models for design of defense applications. Areas of focus may include reclamation or sequestration of rare Earth/critical elements in the defense supply chain and drop-in replacements for currently employed military materials.

Work in this Project compliments Program Element (PE) 0603386A (Biotechnology for Materials - Advanced Research) / CP7 (Biotechnology Demonstration and Evaluation).

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 2023	FY 2024	FY 2025
Title: Biotechnology Safety by Design for Defense *Description:* This task designs and investigates novel and emerging biotechnologies related to bio-engineered or bio-manufactured materials and their precursors to address vulnerabilities in the critical material supply chain for military needs. *FY 2024 Plans:* Will refine models based on experiments and iterate on design to unlock more rapid, innovative, and diverse biotechnology applications than currently recognize or realize, and determine the direction of biotechnology solutions for defense needs. Operationalize safety-by-design measures to protect biotechnology capabilities throughout the product and program lifecycle through implementation of the final product. Operationalize biosecurity methods to develop the foundation for the secure use of biotechnology solutions in the future. Operationalize a digital framework enabling interchange of data amongst the collaborators across the biotechnology ecosystem to promote interoperability and critical partnership. Exploit biotechnologies to recover rare earth elements (REE) necessary for critical defense components and advanced technologies. Develop processes and improve the performance for a biotechnology pipeline. *FY 2025 Plans:* Will fund research to determine feasibility of biotechnology use in military munitions, fuel & lubricants to reduce the logistics burden by investigating the point-of-need manufacturing; design and develop biotechnology derived ceramics and composite materials to enhance the capability of DoD systems and structures in hypersonic an/or high temperature environments; research	21.015	16.736	10.814

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 I 2	**R-1 Program Element (Number/Name)** PE 0602386A I *Biotechnology for Materials - Applied Research*	**Project (Number/Name)** CP6 I *Foundational Biotechnology Design and Dev*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
biotechnology materials to increase the signature management capability of military fabrics; continue to exploit biotechnologies to recover rare earth elements (REE) necessary for critical defense components and advanced technologies; continue to mature software pipelines for data ingestion, data homogenization across bioindustrial manufacturing DoD/industry community allowing the interoperability and collaboration within the biotechnology ecosystem. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflects planned maturation of workflows with work continuing in PE 0603386A (Biotechnology for Materials - Advanced Research) / Project CP7 (Biotechnology Demonstration and Evaluation) and begin work in PE 0604386A (Biotechnology for Materials - Dem/Val) / Project CQ9 (Biotechnology for Materials - Dem/Val).			
Accomplishments/Planned Programs Subtotals	21.015	16.736	10.814

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

PE 0602386A: *Biotechnology for Materials - Applied Re...*
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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602386A *I Biotechnology for Materials - Applied Research*					**Project (Number/Name)** SM1 *I Scale-Up Microbial Products for Biomanufacturing*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
SM1: *Scale-Up Microbial Products for Biomanufacturing*	-	-	-	0.966	-	0.966	1.009	0.990	5.013	5.063	0.000	13.041

Note

 Scale-Up Microbial Products for Biomanufacturing is a new start within the Biotechnology for Materials - Applied Research program in FY 2025.

A. Mission Description and Budget Item Justification

 This project develops biomanufacturing capabilities of mission-critical materials for military use. This project enables the Army to achieve Multi-Domain Operations by securing the supply chain and bridging the gap between laboratory-scale material production and large-scale manufacturing for mission-critical materials.

 This 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 performed by the Chemical Biological Center (CBC).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Scale-Up Microbial Products for Bio Manufacturing of Mission Critical Materials *Description:* This effort investigates the methodologies for the generation of chemicals and/or proteins for use by other Department of Defense research and development organizations. This effort delivers materials from the laboratory-scale (less than 100 gram) to manufacturing prototype levels (between 100 gram and 1 kilogram) as well as large-scale production (greater than 1 kilogram) of mission-critical materials for military use. Products include foods, fabrics, fuels, firepower, resins, coatings, adhesives, and lubricants. *FY 2025 Plans:* Will develop and deliver 100-gram to multi-kilogram purified materials via biomanufacturing that will be ready for incorporation into existing prototypes and programs either as drop-in replacements or new solutions. *FY 2024 to FY 2025 Increase/Decrease Statement:* In FY25, this effort is a new start.	-	-	0.966
Accomplishments/Planned Programs Subtotals	-	-	0.966

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602386A / Biotechnology for Materials - Applied Research	**Project (Number/Name)** SM1 / Scale-Up Microbial Products for Biomanufacturing

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

PE 0602386A: *Biotechnology for Materials - Applied Re...*
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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army											**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*					**R-1 Program Element (Number/Name)** PE 0602785A *I Manpower/Personnel/Training Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	19.343	19.969	19.795	-	19.795	19.426	19.449	19.668	20.638	0.000	138.288
790: *Personnel Performance & Training Technology*	-	19.343	19.969	19.795	-	19.795	19.426	19.449	19.668	20.638	0.000	138.288

A. Mission Description and Budget Item Justification

This Program Element (PE) designs and validates applied behavioral and social science research to enhance the Soldier Lifecycle (e.g., selection, assignment, training, and leader development) and human relations (e.g., unit cohesion). This PE develops new personnel measures and methods 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 develops new performance measures and metrics for individuals and units, designs innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Research 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.

Research in this PE complements PE 0603007A (Manpower, Personnel and Training Advanced Technology).

The cited research 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.

Research is performed by the Army Research Institute (ARI) for the Behavioral and Social Sciences at Fort Belvoir, VA.

B. Program Change Summary ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**
Previous President's Budget	19.649	19.969	18.334	-	18.334
Current President's Budget	19.343	19.969	19.795	-	19.795
Total Adjustments	-0.306	0.000	1.461	-	1.461
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.306	-			
• Adjustments to Budget Years	-	-	1.461	-	1.461

PE 0602785A: *Manpower/Personnel/Training Technology*
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Exhibit R-2, **RDT&E Budget Item Justification:** PB 2025 Army	**Date:** March 2024
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602785A I *Manpower/Personnel/Training Technology*

Change Summary Explanation

Funding decreased due to economic assumptions.

PE 0602785A: *Manpower/Personnel/Training Technology*
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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army											Date: March 2024	

Appropriation/Budget Activity
2040 / 2

R-1 Program Element (Number/Name)
PE 0602785A / *Manpower/Personnel/Training Technology*

Project (Number/Name)
790 / *Personnel Performance & Training Technology*

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
790: *Personnel Performance & Training Technology*	-	19.343	19.969	19.795	-	19.795	19.426	19.449	19.668	20.638	0.000	138.288

A. Mission Description and Budget Item Justification

This Project conducts applied behavioral and social science research to enhance the Soldier Lifecycle (e.g., selection, assignment, training, leader development) and human relations (e.g., unit cohesion). This Project develops new personnel measures and methods 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 develops new performance measures and metrics for individuals and units, designs innovative training methods, and conducts scientific assessments to inform Human Capital policy and programs. Research 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 research is consistent with the Under Secretary of Defense for Research and Engineering priority focus areas, the Army Vision, the Army People Strategy, the Army's Talent Management Strategy, Army Human Capital Strategy, and the Army Modernization Strategy.

Research is performed by the United States Army Research Institute (ARI) for the Behavioral and Social Sciences in Fort Belvoir, VA.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Talent Assessment and Development	19.343	19.969	19.795

Description: This effort conducts applied research that provides the Army with innovative approaches to personnel assessment, improved prediction and modeling of personnel outcomes (e.g., attrition, retention) and an improved capability to improve prediction and modeling (e.g., potential performance, behaviors, attitudes, and resilience of Soldiers). Conducts applied research to provide the Army with effective leader assessment and development methods to measure, develop, and sustain individual/leader competencies and performance across the Soldier life cycle. Conducts research to create scientifically valid models, tools and techniques for team assignment and development to optimize team effectiveness in-garrison and future operational environments.

FY 2024 Plans:
Will continue to design in-service assessment proof-of-concept measures to improve enlisted personnel assignment; will continue to develop predictive models of career progression and retention; will continue to design innovative and novel methods to

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602785A *I Manpower/Personnel/Training Technology*	**Project (Number/Name)** 790 *I Personnel Performance & Training Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
generate job analysis content; will continue to develop competency assessments for junior officers and senior NCOs. Will develop composition frameworks for team-based personnel assignment and develop measures for small unit performance. ***FY 2025 Plans:*** Will develop proof-of-concept in-service assessments to improve enlisted personnel assignment; will develop predictive models of career trajectories and retention; will design innovative methods to generate job analysis content; will develop leader competency assessments for junior officers and senior NCOs; will analyze composition frameworks for team-based personnel assignment; will develop measures for small unit performance. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease is an economic adjustment.			
Accomplishments/Planned Programs Subtotals	19.343	19.969	19.795

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*				**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*							
COST ($ in Millions)	**Prior Years**	**FY 2023**	**FY 2024**	**FY 2025 Base**	**FY 2025 OCO**	**FY 2025 Total**	**FY 2026**	**FY 2027**	**FY 2028**	**FY 2029**	**Cost To Complete**	**Total Cost**
Total Program Element	-	79.851	66.266	68.481	-	68.481	19.897	20.897	21.129	21.340	0.000	297.861
BS7: *Medical Technology (CA)*	-	46.680	-	-	-	-	-	-	-	-	0.000	46.680
MK4: *Warfigher Health Applied Rsch Technology*	-	31.166	64.326	67.250	-	67.250	17.492	18.196	18.399	18.583	0.000	235.412
MM4: *Cbt Casualty Care Applied Rsch Technology*	-	1.885	1.815	1.112	-	1.112	2.285	2.582	2.610	2.636	0.000	14.925
MM6: *Medical Technologies to Support Dispersed Ops Tech*	-	0.120	0.125	0.119	-	0.119	0.120	0.119	0.120	0.121	0.000	0.844

A. Mission Description and Budget Item Justification

This Program Element (PE) supports application of knowledge gained through basic research to refine drugs, vaccines, medical devices, diagnostics, medical practices/ procedures, and other preventive measures essential to the protection and sustainment of Warfighter health. Research is conducted in five principal areas: Combat Casualty Care, Military Operational Medicine, Military Relevant Infectious Diseases, Clinical and Rehabilitative Medicine, Medical Capabilities to Support Dispersed Operations, and Systems Biology/Network Sciences. Projects are coordinated with the Defense Health Agency.

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

All medical applied research is conducted in compliance with Food and Drug Administration (FDA) or Environmental Protection Agency (EPA) regulations. The FDA requires thorough testing in animals (preclinical testing) to ensure safety and, where possible, effectiveness prior to evaluation in controlled human clinical trials (upon transition to Advanced Technology Development). This PE focuses on research and refinement of technologies such as product formulation and purification and laboratory test refinement with the aim of identifying candidate solutions. This work often involves testing in animal models. The EPA also requires thorough testing of products, such as sterilants, disinfectants, repellents, and insecticides to ensure the environment is adequately protected before these products are licensed for use. Program refinement and execution is externally peer-reviewed and fully coordinated with all Services as well as other agencies through the Joint Technology Coordinating Groups of the Biomedical Community of Interest. The Biomedical Community of Interest, 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 Defenses (DoD) biomedical research community, as well as their associated enabling research areas.

Exhibit R-2, RDT&E Budget Item Justification: PB 2025 Army					Date: March 2024	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 2: *Applied Research*				**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*		

B. Program Change Summary ($ in Millions)	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total
Previous President's Budget	80.656	66.266	73.066	-	73.066
Current President's Budget	79.851	66.266	68.481	-	68.481
Total Adjustments	-0.805	0.000	-4.585	-	-4.585
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-0.805	-			
• Adjustments to Budget Years	-	-	-4.585	-	-4.585

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2023	FY 2024
Project: BS7: *Medical Technology (CA)*		
Congressional Add: *Program Increase - Center for Excellence in Military Health and Performance Enhancement*	5.000	-
Congressional Add: *Program Increase - Holistic Health and Fitness*	5.680	-
Congressional Add: *Program Increase - RNA Therapeutics for Infectious Disease Threats*	8.000	-
Congressional Add: *Program Increase - BIOMATERIALS FOR COMBAT WOUND CARE*	3.000	-
Congressional Add: *Program Increase - ENGINEERED ANTIBODIES FOR SKIN AND SOFT-TISSUE INFECTIONS*	5.000	-
Congressional Add: *Program Increase - PHOTONIC INTEGRATED CIRCUIT PLATFORM*	5.000	-
Congressional Add: *Program Increase - SURGICAL INSTRUMENT STERILIZATION*	5.000	-
Congressional Add: *Program Increase - TRAUMA IMMUNOLOGY*	10.000	-
Congressional Add Subtotals for Project: BS7	46.680	-
Congressional Add Totals for all Projects	46.680	-

Change Summary Explanation
Funding decrease reflect planned lifecycle for this effort.

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2					**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*			**Project (Number/Name)** BS7 *I Medical Technology (CA)*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
BS7: *Medical Technology (CA)*	-	46.680	-	-	-	-	-	-	-	-	0.000	46.680

Note
Congressional Interest Item funding provided for Medical Technology.

A. Mission Description and Budget Item Justification
Congressional Interest Item funding provided for Medical 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 2023**	**FY 2024**
Congressional Add: Program Increase - Center for Excellence in Military Health and Performance Enhancement	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Center for Excellence in Military Health and Performance Enhancement		
Congressional Add: Program Increase - Holistic Health and Fitness	5.680	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Holistic Health and Fitness		
Congressional Add: Program Increase - RNA Therapeutics for Infectious Disease Threats	8.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for RNA Therapeutics for Infectious Disease Threats		
Congressional Add: Program Increase - BIOMATERIALS FOR COMBAT WOUND CARE	3.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for BIOMATERIALS FOR COMBAT WOUND CARE		
Congressional Add: Program Increase - ENGINEERED ANTIBODIES FOR SKIN AND SOFT-TISSUE INFECTIONS	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for ENGINEERED ANTIBODIES FOR SKIN AND SOFT-TISSUE INFECTIONS		
Congressional Add: Program Increase - PHOTONIC INTEGRATED CIRCUIT PLATFORM	5.000	-

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*	**Project (Number/Name)** BS7 / *Medical Technology (CA)*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024
FY 2023 Accomplishments: Congressional Interest Item funding provided for PHOTONIC INTEGRATED CIRCUIT PLATFORM		
Congressional Add: Program Increase - SURGICAL INSTRUMENT STERILIZATION	5.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for SURGICAL INSTRUMENT STERILIZATION		
Congressional Add: Program Increase - TRAUMA IMMUNOLOGY	10.000	-
FY 2023 Accomplishments: Congressional Interest Item funding provided for Trauma Immunology		
Congressional Adds Subtotals	46.680	-

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army										**Date:** March 2024		
Appropriation/Budget Activity 2040 *I* 2							**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*			**Project (Number/Name)** MK4 *I Warfigher Health Applied Rsch Technology*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
MK4: *Warfigher Health Applied Rsch Technology*	-	31.166	64.326	67.250	-	67.250	17.492	18.196	18.399	18.583	0.000	235.412

A. Mission Description and Budget Item Justification

This Project conducts research to prevent and protect Warfighters from training and operational injuries; refine mechanisms for detection of physiological (human physical and biochemical function) and psychological (mental) health problems; reduce the effects of trauma and promote rapid recovery from acute stress in far forward operational environments; evaluate hazards to head, neck, spine, eyes, and ears; set the standards for rapid return to duty; and determine new methods to sustain and enhance performance and readiness across the operational spectrum. This research provides medical information important to the design and operational use of military systems, and this work forms the basis for behavioral, training, and nutritional interventions.

The four main areas of study are:
(1) Physiological Health and Performance
(2) Environmental Health and Protection
(3) Injury Prevention and Reduction
(4) Psychological Health and Resilience

Research in this Project is coordinated with and complimentary to work done in Program Element (PE) 0602143A (Soldier Lethality Technology) and PE 0603118A (Soldier Lethality Advanced Technology).

The cited research 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 Research Laboratory (ARL).

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Operational Risk Planning Tools for Battlefield Environmental Threats	1.349	1.277	1.820
Description: This effort investigates and incorporates mechanisms for health risks of heat, cold, and altitude injuries to develop guidelines and advise countermeasure development for operations in extreme environments. Investigates health risks from industrial chemicals and pollutants found in dense urban and subterranean (SubT) environments in which Soldiers operate. ***FY 2024 Plans:***			

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*	**Project (Number/Name)** MK4 *I Warfigher Health Applied Rsch Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Will develop risk profiles for exposures in extreme environments including sub zero/artic conditions; will identify individual factors that make an individual more susceptible to environmental injury (including age, sex, etc); mature "smart" fabrics that detect temperature & moisture in real-time to prevent frostbite injury. *FY 2025 Plans:* Determine the influences of long-acting reversible contraceptives on physiological responses to extreme environments in women. Provide knowledge to optimize Soldier performance in Arctic Environments. Determine the influence of race and dietary supplementation on skin perfusion in the cold. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase change reflects planned lifecycle of this effort.			
Title: Prevention of Soldier Performance Degradation in Extreme Environments *Description:* This effort develops and matures non-invasive technologies, decision-aid tools, and other countermeasure to prevent and enhance Soldier performance in extreme environments of heat, cold, altitude, dense urban and SubT environments. This effort includes validation of approved pharmaceuticals as well as provides improved sensors and predictive algorithms models. *FY 2024 Plans:* Design physiological modes to predict the state of men and women during complex military scenarios; evaluate cold habituation as an intervention to augment peripheral blood flow in cold exposure; study the effects of vascular preconditioning to reduce cold-induced peripheral vasoconstriction and improve manual dexterity. Will develop risk profiles for exposures in extreme environments including sub zero/artic conditions; determine the influence of female sex hormones on physiological responses and adaptations during heat acclimation; Investigate and validate physiological mechanisms for design and development of rapid heat acclimation protocols; validate transcriptomic signatures to predict individual susceptibility to acute mountain sickness and acclimatization status prior to high altitude ascent *FY 2025 Plans:* Determine physiological and biochemical markers of exertional heat stroke (EHS) and non -EHS responses to high-risk events. Identify genomic and transcriptomic signature for predicting exertional heat stroke/illness. Determine sex differences in the physiological and metabolic response to strenuous military training in the cold. Develop an early warning hypoxia monitoring tool for use at high altitude. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase change reflects planned lifecycle of this effort.	4.005	3.331	3.413
Title: Leader Decision Aid to Manage Blast Head Injury in All Settings	0.853	1.135	1.162

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*	**Project (Number/Name)** MK4 *I Warfigher Health Applied Rsch Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Description: Develop injury risk assessment/guidance/criteria that will inform the development of technologies (i.e., personal protection equipment, vehicles) and strategies (i.e., health hazard assessments) to protect the Soldier against current and emerging operational threats (i.e., blast, blunt, ballistic, and accelerative). Improve the prevention of and reduce the severity of spinal injuries experienced by military vehicle occupants and dismounted Warfighters during non-underbody blast operational exposures (aircrew crash, vibration, head-supported mass) through the development of improved, biomedically valid spinal injury criteria and health hazard assessments. *FY 2024 Plans:* Will continue to develop and refine cervical spine injury risk criteria for head supported technologies and protective equipment in multiple military operational environments (mounted and dismounted). *FY 2025 Plans:* Develop whole body health injury risk criteria for protecting Warfighters (male and female) in all military operational environments (e.g. SubT, underwater, open air) against emerging multi- threats. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase change reflects planned lifecycle of this effort.			
Title: Physical Fitness Standards to Prevent Musculoskeletal Injuries *Description:* Develops validated standards and strategies to optimize Soldier readiness and performance related to musculoskeletal injury (MSKI) in order to provide military leadership with strategies and standards to mitigate musculoskeletal injuries, facilitate quick return to combat effectiveness after MSKI, and decrease risk of re-injury once been cleared to return after injury to increase the probability of mission success. *FY 2024 Plans:* Will continue to support TRADOC CIMT and FORSCOM in development of accurate and reliable physical assessment strategies after musculoskeletal injury. *FY 2025 Plans:* Investigate biomechanical and sex-based differences during the ACFT deadlift; continue to determine risk factors for re-injury following a musculoskeletal injury to provide recommendations for preventing subsequent injuries. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease reflect planned lifecycle for this effort.	0.869	1.258	0.954
Title: Leader Tools to Reduce Musculoskeletal Injury In All Settings	2.383	2.088	2.827

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army				**Date:** March 2024		

Appropriation/Budget Activity
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R-1 Program Element (Number/Name)
PE 0602787A / *Medical Technology*

Project (Number/Name)
MK4 / *Warfigher Health Applied Rsch Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Description: Enhances the Army's understanding of the physiological mechanisms underlying musculoskeletal injuries and identifies countermeasures to mitigate injury risk in order to reduce musculoskeletal injuries in new recruits, thereby directly impacting force readiness and improving lethality. *FY 2024 Plans:* Will complete model development of musculoskeletal injury (stress fracture risk) for validation. *FY 2025 Plans:* Quantify the role of physiological factors, such as fiber type and metabolic elements, contributing to the development of muscle fatigue and decreased performance and risk and mitigation interventions; continue to determine the extent to which sleep extension reduces musculoskeletal injury; continue to identify non-physical factors contributing to injury, and potential interventions to reduce those factors' influence. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase change reflects planned lifecycle of this effort.			
Title: Forward Neuro-Muscular Skeletal Injury Assessment *Description:* Focus on developing portable imaging technologies to identify soft tissue musculoskeletal injury severity in the field and generate capabilities to guide musculoskeletal injury management to inform appropriate evacuation vs. return to duty (RTD) decisions. *FY 2024 Plans:* Will develop recommendations for evidence-based guidance detailing the predictive metrics of those physical/ physiological, cognitive/psychological, and behavioral contributions that optimize Soldiers' MSKI tolerance and risk. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease change reflects planned lifecycle of this effort.	0.311	0.297	-
Title: Biomedical Performance Enhancement *Description:* This effort evaluates strategies and technologies that enhance Soldier physical and mental performance in Multi-Domain operations. Additional efforts concentrate on characterization of physiological and genetic factors that contribute to physiological resilience to military stressors. *FY 2024 Plans:*	4.725	5.013	5.990

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Exhibit R-2A, RDT&E Project Justification: PB 2025 Army		Date: March 2024
Appropriation/Budget Activity 2040 / 2	R-1 Program Element (Number/Name) PE 0602787A / Medical Technology	Project (Number/Name) MK4 / Warfigher Health Applied Rsch Technology

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Will complete investigation of pharmacological strategies for improving Soldier vigilance & endurance; Will finalize identification of the physiological responses of elite female and male soldiers to continuous prolonged military operations. *FY 2025 Plans:* Will initiate investigation of machine learning and artificial intelligence analysis to predict individual Soldier and echelon-based medical readiness and impact on physical and mental military performance. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding increase change reflects planned lifecycle of this effort.			
Title: Expeditionary Force Nutrition to Improve Performance *Description:* Characterizes and refines field fueling and garrison practices to sustain Medical readiness, military performance and recovery from military operations. Evaluates combat ration components to sustain Medical Readiness and performance in deployed, disaggregated and dispersed operations. *FY 2024 Plans:* Will finalize experiments to; investigate the effects of protein source on muscle mass growth, strength and maintenance; evaluate nutritional requirements for maintenance of cognitive, physical and immune function during arduous military training. *FY 2025 Plans:* Inform the development of targeted nutritional countermeasures for mitigating MSKI-mediated atrophy and inform recovery. *FY 2024 to FY 2025 Increase/Decrease Statement:* Funding decrease change reflects planned lifecycle of this effort.	1.462	1.727	1.484
Title: Energy Field Biological Effects and Mechanisms *Description:* Investigate the area of emerging directed energy threat mechanisms and biological effects. Conduct research to support the Department of Defense and US Government's threat mitigation strategy. *FY 2024 Plans:* Will continue to develop and validate threat-relevant directed energy source technologies for laboratory investigation; investigate fundamental biophysical and physiological mechanisms; identify relevant biological mechanisms for accelerated study; mature cross-cutting / multi-disciplinary research processes to allow rapid advances; investigate component technologies necessary to complete laboratory research; complete infrastructure improvements for unclassified and classified laboratory space and equipment; investigate fundamental limitations on directed energy coupling, penetration, and absorption in surrogate structures and at relevant protocol levels; investigate low frequency electromagnetic bioeffects; validate the design of directed energy biological effect modeling and simulation tools; conduct experiments on previous investigation of biological effects of directed	15.209	48.200	49.600

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*	**Project (Number/Name)** MK4 *I Warfigher Health Applied Rsch Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
energy exposure; conduct research to compare biological effects theories and models against real world data; transition data on biological mechanisms and effects to DoD medical community to support research and development efforts for directed energy induced injury prevention and treatment. ***FY 2025 Plans:*** Will establish comprehensive understanding of biophysical mechanisms (cellular to system level) of adverse bioeffects discovered in prior years; perform characterization of toxicity for new threat mechanisms prioritized from modeling and simulation and intelligence community inputs; continue thorough biophysical theoretical and computational analyses on identified threat mechanisms (acoustic and electromagnetic); establish high-throughput biological effects assessment platforms to accelerate threat characterization; mature threat proxy energy field source technologies for laboratory testing including high frequencies; develop integrated multi-scale (molecular to organismal) modeling and simulation techniques for enhanced biophysical understanding; integrate the component technologies necessary to complete laboratory research identified in FY24; derive and start the validation of methods to optimize directed energy coupling, penetration, and absorption in surrogate structures and at relevant protocol levels; investigate electromagnetic bioeffects; validate directed energy biological effect modeling and simulation tools based on laboratory results; conduct research to compare biological effects theories, models and laboratory data against real world data; identify pre-clinical diagnostics methods (imaging, functional testing, biomarkers) for detecting exposure to pathological energy fields; transition information and parameters related to validated energy field threat sources to the DoD community for medical and materiel (sensors/detectors, shielding material) countermeasure development; continue to collaborate with the intelligence community to drive research objectives, support threat assessments, transition bioeffects data, and mitigate technological surprise; continue to transition data on biological mechanisms and effects to DoD community to support research and development efforts for directed energy detection and protection as well as induced injury prevention and treatment. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding increased to support additional research in the area of Energy Field Biological Effects and Mechanisms.			
Accomplishments/Planned Programs Subtotals	31.166	64.326	67.250

C. Other Program Funding Summary ($ in Millions)
 N/A

Remarks

D. Acquisition Strategy
 N/A

Exhibit R-2A, RDT&E Project Justification: PB 2025 Army										**Date:** March 2024	
Appropriation/Budget Activity 2040 *I* 2				**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*				**Project (Number/Name)** MM4 *I Cbt Casualty Care Applied Rsch Technology*			

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
MM4: *Cbt Casualty Care Applied Rsch Technology*	-	1.885	1.815	1.112	-	1.112	2.285	2.582	2.610	2.636	0.000	14.925

A. Mission Description and Budget Item Justification

This Project refines and assesses concepts, techniques, and materiel that improve survivability and treatment outcomes for Warfighters wounded during combat operations and treated under austere field conditions, including prolonged field care, and during medical evacuation, and maintains laboratory capability to perform these functions. Combat casualty care research addresses control of severe bleeding; resuscitation and stabilization; advanced automated life support systems suitable for use in forward areas, treatment of severe orthopedic injuries, treatment of severe burns, and combat-related brain injury.

Promising efforts identified in this Project are further matured under Program Element (PE) 0603002A (Medical Advanced Technology).

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

Research in this Project is performed by the United States Army Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Future En Route Casualty Care Sustainment System Cap Set *Description:* This effort performs applied research to support development of technologies that will increase capability and capacity to provide combat casualty care from point of injury to final point of care. *FY 2024 Plans:* Will evaluate use of patient-specific medical device alarms during multi-patient medical evacuation scenarios. Will determine effect of vehicle vibration and jolt on medical provider performance in a simulated en route care environment. *FY 2025 Plans:* Will evaluate new technologies designed to reduce the rate of acute or chronic injury experienced by litter bearers during extended litter transport. Will continue evaluation of patient-specific medical device alarms used during multi-patient medical evacuation scenarios. Will continue studies to determine effect of vehicle vibration and jolt on medical provider performance in simulated en route care environments. *FY 2024 to FY 2025 Increase/Decrease Statement:*	1.885	1.815	1.112

Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*	**Project (Number/Name)** MM4 *I Cbt Casualty Care Applied Rsch Technology*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
Funding decrease reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	1.885	1.815	1.112

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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Appropriation/Budget Activity 2040 / 2					**R-1 Program Element (Number/Name)** PE 0602787A / *Medical Technology*					**Project (Number/Name)** MM6 / *Medical Technologies to Support Dispersed Ops Tech*		

COST ($ in Millions)	Prior Years	FY 2023	FY 2024	FY 2025 Base	FY 2025 OCO	FY 2025 Total	FY 2026	FY 2027	FY 2028	FY 2029	Cost To Complete	Total Cost
MM6: *Medical Technologies to Support Dispersed Ops Tech*	-	0.120	0.125	0.119	-	0.119	0.120	0.119	0.120	0.121	0.000	0.844

A. Mission Description and Budget Item Justification

This Project supports applied research in two task areas: 1) Medical Robotic and Autonomous Systems (Med-RAS) - will a) leverage emerging technologies in biomedical engineering, robotics, autonomy, unmanned systems, and assured position navigation and timing, to improve capabilities and expand capacity to deliver prolonged care, perform evacuation, delivery emergency resupply of medical material supplies (Class VIII), such as blood products, by ground or air, in dispersed and Multi-Domain Operations and b) establish medical performance criteria to ensure Soldiers are able to effectively perform manned-unmanned teaming tasks; and, 2) Virtual Health - will leverage emerging technologies in information science, artificial intelligence, telecommunications network engineering, and cyber security to enable prolonged care, remote telemonitoring, automated decision support, and telementoring between providers in Role of Care 3 and 4 to patients in Role of Care 1 and 2. Promising work in this Project will be further matured in PE 0603002A (Medical Advanced Technology) / Project MM7 (Enabling Med Cap to Support Dispersed OPS Adv Tech).

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 Medical Research and Development Command (USAMRDC), Fort Detrick, MD.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2023	FY 2024	FY 2025
Title: Medical Robotic and Autonomous Systems	0.120	0.125	0.119
Description: Research, design, and validate autonomous and unmanned capabilities to deliver high quality combat casualty care in dispersed operations with limited or absent medical care personnel, and future medical robotic systems capable of providing autonomous combat casualty care while optimizing the medical logistic footprint in far-forward and dispersed geographic environments in support of the Army Multi-Domain Operations (MDO) concept and the Army Force 2025 and Beyond vision documents.

FY 2024 Plans:
Utilizing the identified candidate for emerging semi-autonomous en route care technologies for providing patient management during UAS missions, will validate designs for integrating autonomous critical casualty care and management systems with common user, multi-purpose, unmanned aerial system platforms. Will also advance the interoperable data systems.

FY 2025 Plans:
Utilizing selected en route care technologies to provide patient management during UAS (Unmanned Aerial Systems) missions, will continue design validation for integration of autonomous critical casualty care and management systems with unmanned aerial | | | |

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Exhibit R-2A, **RDT&E Project Justification:** PB 2025 Army		**Date:** March 2024
Appropriation/Budget Activity 2040 *I* 2	**R-1 Program Element (Number/Name)** PE 0602787A *I Medical Technology*	**Project (Number/Name)** MM6 *I Medical Technologies to Support Dispersed Ops Tech*

B. Accomplishments/Planned Programs ($ in Millions)	**FY 2023**	**FY 2024**	**FY 2025**
system platforms. Will advance interoperable data systems and conduct ground-based and in-flight testing. Will integrate decision support to aid ground personnel preparing for UAS patient transport. ***FY 2024 to FY 2025 Increase/Decrease Statement:*** Funding decrease change reflects planned lifecycle of this effort.			
Accomplishments/Planned Programs Subtotals	0.120	0.125	0.119

C. Other Program Funding Summary ($ in Millions)
 N/A
Remarks

D. Acquisition Strategy
 N/A

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