2024

Army Cost Analysis Manual

FOREWORD

The mission of the Office of the Deputy Assistant Secretary of the Army - Cost and Economics (ODASA-CE) is to provide Army decision-makers with cost, performance, and economic analysis. ODASA-CE is the principal advisor to the Assistant Secretary of the Army (Financial Management and Comptroller) (ASA (FM&C)) for all Army cost and economic analysis activities. Recognizing the need for timely Army reference material, ODASA-CE produced this manual to provide a solid foundation in cost analysis for Army analysts. The manual is intended to provide junior analysts with material that can be easily understood and applied, while serving as a reference for senior analysts.

This manual supersedes the May 2020 Department of the Army Cost Analysis Manual.

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Chapter 1 Introduction

1. Purpose of the Army Cost Analysis Manual (CAM)

The purpose of the Army Cost Analysis Manual (CAM) is to provide procedures for implementing Army cost analysis policies. The CAM provides specific emphasis on the cost estimation portion of cost analysis, providing a framework for the development, documentation, and use of cost estimates. Additionally, the CAM provides details on the analysis of the data that feeds the cost estimate. The CAM contains useful information for analysts involved in every stage of the cost analysis process, including those who provide input for cost analysis, those who produce cost analysis products, and those who use the results of cost analysis. The CAM is not intended to supplant the need for formal cost analysis training.

2. Overview of Cost Analysis

The Government Accountability Office (GAO) defines cost analysis as:

- the effort to develop, analyze, and document cost estimates with analytical approaches and techniques;
- the process of analyzing, interpreting, and estimating the incremental and total resources required to support past, present, and future systems—an integral step in selecting alternatives; and
- a tool for evaluating resource requirements at key milestones and decision points in the acquisition process.[1]

Cost analysis is used to produce cost estimates for materiel systems, automated information systems, force units, training, and other Army programs and projects. Cost analysis enables the Army to make cost informed decisions. Cost analysis also supports management decisions by quantifying the resource impact of alternative options. Cost analysis plays a key role in budgeting the Army's operations tempo (OPTEMPO) related costs, as well as the management of base operations. Cost analysis provides Army planners with reliable information about the cost consequences of program changes, extensions, or cancellations.

Cost analysis is not without its limitations; estimates are developed with imperfect understanding of the technical merits and limitations of the item, historic data is always subject to interpretation, and there are always future uncertainties. However, despite the limitations, cost analysis is a powerful tool. The process of cost analysis is the most rigorous approach available to evaluate the costs of alternatives for the decision maker.

Cost estimating is a specific activity within cost analysis.[2] Cost estimating is the process by which a future cost is predicted based on adjusted historical costs. The topic of cost estimating is explored in later chapters with Chapter 3 covering the cost estimating process and Chapter 4 covering cost estimating methodologies.

[1] GAO-09-3SP GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs pg. 31.

[2] GAO-09-3SP GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs pg. 31.

Chapter 2 Cost Analysis References

1. Introduction

Cost analysis is an integral part of the defense acquisition process. Effective cost estimating requires engagement and awareness of how all technical, functional disciplines influence a system's life cycle cost. This chapter provides a number of required and related materials for effective Army cost analysis.

2. Key Documents

Key documents impacting Army cost analysis include the following:

1. Planning, Programming, Budgeting, and Execution, AR 1-1, which establishes the requirements for ASA(FM&C) and the responsibility utilizing cost in the PPBE process.
2. Cost and Economics Program, AR 11-18, which specifies the policies and responsibilities for cost and economic analysis throughout the Army.
3. The Department of Defense Instruction (DoDI) 5000.02, 24 October 2019, "Operation of Defense Acquisition System," which establishes the policy for managing of acquisition programs, including cost reporting requirements and thresholds as well as Acquisition Category (ACAT) designations and descriptions.
4. DODI 5000.73, "Cost Analysis Guidance and Procedures" which provides procedures for the conduct of cost estimation and analysis within DoD.
5. The 2016 National Defense Authorization Act (NDAA), section 804, which establishes middle-tier acquisition for rapid prototyping and rapid fielding.
6. DODI 5000.75, "Business Systems Requirements and Acquisitions," which establishes policies for DBS.
7. DODI 5000.74, "Defense Acquisition of Services," which provides policies for the acquisition of services.
8. DODI 7041.03, "Economic Analysis for Decision Making," which provides policies for economic analysis.
9. DoD Cost Assessment & Program Evaluation (CAPE) memos located at https://cade.osd.mil/policy/nonacat1, which provide policies for Non-ACAT I programs.
10. MIL-STD-881D, which provides Work Breakdown Structures for commodities.
11. GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs, GAO-09-3SP, which provides best practices for cost estimating.
12. Joint Agency Cost Schedule Risk and Uncertainty Handbook, which provides policies for the treatment of risk and uncertainty.

Chapter 3 Cost Estimating Process

1. Introduction

As briefly explained in Chapter 1, cost estimating is the process by which historical costs are used to predict future costs. During the cost estimating process, analysts estimate the value of individual elements using established methodologies to project future costs from historical values. Cost estimation enables system and functional requirements to be translated to budget requirements. Cost estimating provides a quantitative basis for management decisions regarding optimal allocation of resources.

The following diagram, Figure 1, provides a view of the Cost Estimating Process:

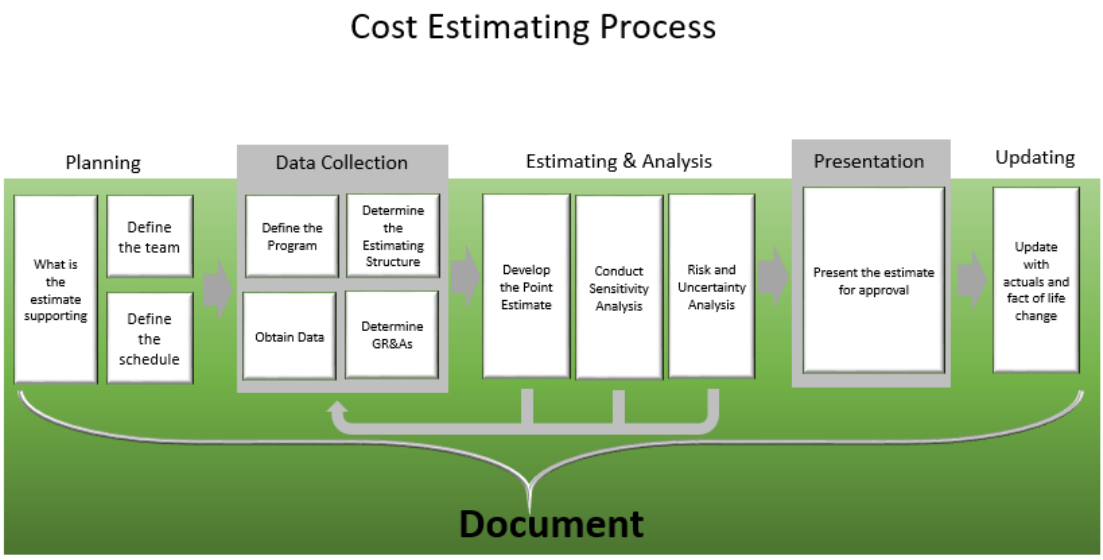

Figure 1: The Cost Estimating Process

As Figure 1 demonstrates, documentation is important during every stage of the process.

2. Planning

i. Define the Estimate's Purpose

The first step in the cost estimating process is to define the purpose of the estimate. An estimate's purpose dictates the estimate's scope, time requirements, level of detail, estimate techniques, and type of documentation required. There are two general reasons for an Army analyst to engage in cost estimation:

1. Budget Formulation
2. Comparative Studies.

Chapter 13 provides additional information on a specific type of comparative study, known as a cost-benefit analysis (C-BA).

1. Budget Formulation

Budget formulation estimates can support a number of activities, including acquisition, base support operations, installation management, and personnel requirements. The types of activities will vary based on a variety of factors including the system acquisition category (ACAT) and stage of the system's life cycle. The types of estimates associated with budget formulation include:

- Program Office Estimate (POE): The program office develops the POE to support specific acquisition milestone requirements. The POE should reflect the program described in the Cost Analysis Requirements Description (CARD), or other system definition documents, if a CARD is not available.
- Component Cost Analyses (CCA): An agency not in the acquisition community develops the CCA to support specific regulatory acquisition milestone requirements. Analysts use the CCA to test the reasonableness of the POE.
- Component Cost Estimate (CCE): DoDI 5000.02 requires the DoD Component to develop an estimate that covers the entire life cycle of the program for all MDAPs prior to Milestone A, B,

and C reviews and the Full-Rate Production Decision and for all Major Automated Information Systems (MAIS) programs at any time an Economic Analysis is due.[3]

- Component Cost Position (CCP): DoDI 5000.02 requires the DoD Component and the Service Cost Agency to establish a documented CCP that covers the entire life cycle of the program for all MDAPs and MAIS programs prior to the Milestone A, B, and C reviews, and the FRP (Full-Rate Production) Decision or Full Deployment Decision Review. The DoD Component Cost Position must be signed by the appropriate DoD Component Deputy Assistant Secretary for Cost and Economics (or defense agency equivalent) and must include a date of record. [4] Additionally, the DoD Component must fully fund the program to the CCP in the current Future Years Defense Program (FYDP) or commit to full funding within the next FYDP while identifying offsets to address shortfalls within the current FYDP. The CCP for the Army is known as the Army Cost Position (ACP).
- Independent Cost Estimate (ICE): The ICE is required by 10 USC 2434. The Office of the Secretary of Defense Cost Assessment and Program Evaluation (OSD CAPE) conducts or approves ICEs at the following points:
    - (a) In advance of any Milestone A certification under section 2366a of Title 10, U.S.C., or Milestone B certification under section 2366b of Title 10, U.S.C.
    - (b) In advance of any decision to enter low-rate initial production (LRIP) or full-rate production (FRP).
    - (c) In advance of any certification for critical Nunn-McCurdy breaches under section 2433a of Title 10, U.S.C.
    - (d) At any other time considered appropriate by the Director of Cost Assessment and Program Evaluation (DCAPE) or upon the request of the Undersecretary of Defense for Research and Engineering USD(R&E), the Under Secretary of Defense for Acquisition and Sustainment USD(A&S), or the Milestone Decision Authority (MDA).

  Additionally, the CAPE conducts or delegates ICEs for the remainder of the life-cycle of the program for sustainment reviews required by section 2441 of Title 10, United States Code (U.S.C.). Generally, the CAPE conducts the ICE for ACAT ID programs but delegates the ICE to the Service Cost Center or equivalent for ACAT IC programs.
- Army Cost Position (ACP): The ACP is the Army's approved Life Cycle Cost (LCC) estimate for the materiel system. It is the basis for Army planning, contracting, programming, budgeting, and execution. For DoD milestone reviews, the ACP satisfies the requirement for a CCP.
- What-if Exercises /Should Cost Analysis: Per DODI 5000.02, program managers develop Should Cost estimates as a management tool to control and reduce cost by targeting cost reduction and driving productivity improvement into systems.
- Feasibility Study: A Feasibility Study is used to determine whether a given alternative is viable given constraints such as cost, schedule, or technical performance.
- Rough Order of Magnitude (ROM): ROMs are used for decision making purposes when limited specific information is available and only high-level requirements have been identified. They are appropriate to support such requirements as an Initial Capability Document (ICD). Army

[3] DoDI 5000.02 Enclosure 10 Section 2 d.
[4] DoDI 5000.02 Enclosure 10 Section 2e.

ROM Guidelines are established in Deputy Assistant Secretary of the Army (Cost and Economics) memo dated 1 March 2018 and are further detailed at the end of this Chapter.

2. Comparative Studies

Comparative Studies are a process of making cost and benefit comparisons among alternatives. The following studies are some examples associated with comparative studies:

- Economic Analyses (EA): An EA is defined by DODI 7041.3 as a systematic approach to the problem of choosing the best method of allocating scarce resources to achieve a given objective.[5]
- Business Case Analysis (BCA): A BCA includes relevant assumptions, constraints, and analysis used to develop a product support strategy.[6]
- Analyses of Alternatives (AoA): An AoA is an analytical comparison of the operational effectiveness, suitability, and Life-Cycle Cost of alternatives that satisfy established capability needs. An AoA provides a comparison between the cost and operational parameters of a program and one or more alternative programs. An AoA also provides a structure to review design, acquisition, and life cycle cost options.
- Cost-Benefit Analysis (C-BA): A C-BA allows a decision maker to make resource-informed decisions by providing an analysis of needs and problems, reviewing proposed alternative solutions, including total cost, benefits, bill payers, and second and third order effects, and providing risk analysis, all leading to a recommended choice. Chapter 13 provides additional information on C-BAs.
- Force Structure Analysis: A Force Structure Analysis is a study to determine the implications of force structure concepts.
- Tradeoff Study: A Tradeoff Study allows a program to compare a variety of alternatives based on evaluation criteria.
    - One specific type of tradeoff study is Cost as an Independent Variable (CAIV). CAIV is used is to balance mission needs with available resources. CAIV has the user community identify a limited number of Key Performance Parameters (KPPs), which establish non-negotiable limits for system performance, from among all of the desired performance parameters. As long as the KPPs are met, cost, schedule, and performance trade-offs can be made.

ii. Define the Estimating Team

In order to ensure that all necessary stakeholders can be provide input, the estimating team should be defined and cost estimating team members selected early in the cost estimating process. The cost estimating team does not only contain cost estimators. Instead, when forming a cost estimating team, one should consider including participants from a wide variety of communities, such as environmental commands, testing centers, training centers, the logistics community, and the user base. Having a robust cost estimating team ensures that the cost estimate considers all relevant factors. The estimating team can sometimes be referred to as the Cost Working Group Integrated Product Team (CWIPT).

iii. Define the Estimating Schedule

The schedule for the cost estimating activity should be developed early on in the cost estimating process. The schedule for the cost estimating activity should contain all major events prior to estimate finalization,

[5] DoDI 7041.3 E3.1
[6] DOD 5000.02 Enclosure 6, 3(c) 5d(1)

as well as the various linkages between events so that stakeholders understand the impact of slipped event or deliverables. In Chapter 11, the Cost Review Board (CRB) section provides a notional schedule for developing the Army Cost Position (ACP), one of a materiel solution's most important cost estimates.

3. Data Collection

i. Define the Program

After an analyst has established the background for the cost estimation process by determining the purpose of the estimate, the makeup of the estimating team, and the schedule for conducting estimation, the focus turns to the estimate itself. An analyst needs relevant data to create an estimate. However, in order to determine what data is relevant for any given estimation effort, an analyst needs to possess an understanding of the effort being estimated.

Per the DoDI 5000.02, the "foundation of a sound and credible cost estimate is a well-defined program."[7] A program definition provides the analyst with an understanding of the effort to be estimated. A program's definition requires physical and performance characteristics, as well as development, production, and deployment schedules.

For an ACAT I program, a Cost Analysis Requirements Description (CARD) traditionally provides the program definition. Per Department of Defense Instruction 5000.02, a CARD is required whenever there is a requirement for either an ICE or an EA. In 2017, the Cost Assessment and Program Evaluation (CAPE) provided additional CARD guidance which included the requirement for annual CARD updates.[8] For ACAT II and below programs, the DoD component, with CADE concurrence, is responsible for determining CARD requirements. Accordingly, program definition for non ACAT I programs can take the form of a "CARD-like" document as opposed to an official CARD.

A CARD includes milestone schedule, procurement strategy, and additional pertinent information. Figure 2 shows the basic structure of the CARD. Detailed CARD guidance can be found at https://cade.osd.mil/policy/card. For programs without an official CARD requirement, analysts will still be interested in the same types of information, subject to data availability.

[7] DoDI 5000.02
[8] https://cade.osd.mil/policy/card

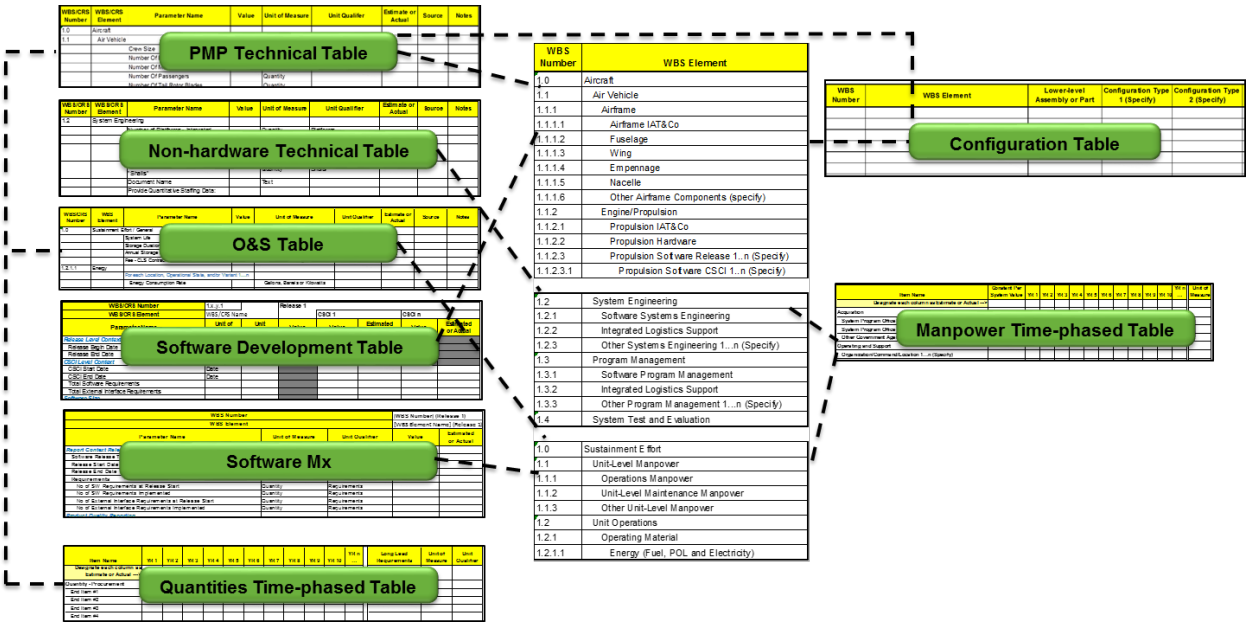

Figure 2: Cost Analysis Requirements Description (CARD)

In addition to obtaining the program definition, an analyst must determine the ground rules and assumptions (GR&A) that will control the estimate. GR&A are statements or conditions that establish the boundaries of the estimate by clarifying what the estimate includes and excludes. GR&A will vary from estimate to estimate. Examples of potential GR&A include:

- Base Year Dollars
- Colors of Money
- Inflation Indices
- Technology Assumptions
- Scope and Limitations
- Acquisition Strategy
- System Economic Useful Life (EUL)[9]
- Procurement/Fielding Schedule
- Time Phasing
- Training Strategy
- Support Concept
- Software Assumption
- Government Furnished Equipment (GFE)

ii. Determine the Cost Structure

After the program has been defined, the analyst must determine the structure for the cost estimate. Defining a cost structure ensures that all elements of a program are costed and double counting is eliminated. Additionally, use of a common cost structure across systems allows for the efficient comparison and reconciliation of estimates. A common structure also provides a format for reporting actuals and building a historical database.

[9] Assistant Secretary of the Army (Acquisition, Logistics and Technology) (ASA (ALT)) recommendations for EUL are provided in Appendix 8.

For Army material systems there are two different applicable cost structures. The first is the Army Cost Estimating Structure (ACES), as outlined in Appendix 3. Army cost estimates must use the ACES. The second structure is the MIL-STD-881D Work-Breakdown Structure (WBS). ACES is a phase-driven structure that provides system-specific and appropriation-discrete cost elements. MIL-STD-881D is a product driven structure that defines general WBS elements by commodity. ACES is specific to Army programs while MIL-STD-881D WBS provides a framework for defense materiel systems and is used for cost collection activities.

iii. Obtain the Data

1. Data Sources

Once the program has been defined, and cost structure has been determined, the analyst must collect data. As data provides the basis for cost estimates and data collection efforts can take a great deal of time, plans for data collection efforts should occur as early in the process as possible.

There are a wide variety of potential data sources. The following represents a number of potential data sources, but is not meant to provide an all-inclusive list.

- Cost Assessment Data Enterprise (CADE) https://cade.osd.mil/
    - Contractor Cost Data Reports (CCDR)
        - Cost and Software Data Reports (CSDR)
        - Software Resource Data Reports (SRDR)
- Earned Value Management Central Repository (EVM-CR) https://www.acq.osd.mil/evm
- Defense Acquisition Management Information Systems (DAMIR) https://ebiz.acq.osd.mil/DAMIR/PortalMain/DamirPortal.aspx
    - Selected Acquisition Reports (SAR)
    - Defense Acquisition Executive Summary Reports (DAES)
    - Acquisition Program Baseline Reports (APB)
    - Program Objective Memorandum (POM)
- O&S Cost Web: https://www.osmisweb.army.mil/
    - Operations and Support Management Information System (OSMIS)
    - Army Military-Civilian Cost System (AMCOS)
    - Force & Organization Cost Estimating System (FORCES)
- Army Publications (e.g., field manuals)
- Professional Briefings (e. g., Department of Defense Cost Analysis Symposium (DoDCAS))
- Past DoD, Department of Homeland Security (DHS), Army Corps of Engineers, Environmental Protection Agency (EPA) projects or studies
- Contractor Accounting Records
- Cost proposals/bids
- Other sources within industry and government (i.e. GSA for per diem rates, U.S. General Services Administration for general service wage information)

Whenever possible, analysts should use actual cost data. Two main sources of actual cost data are Contractor Cost Data Reports (CCDRs) and Earned Value Management (EVM). Contractor Cost Deliverables and Data Item Descriptions (DIDs) are used to ensure that a program collects actual cost data.

CCDRs

Contractor Cost Data Reports (CCDRs) include data collected by the Cost and Software Date Report (CSDR) system. In the CSDR plan, the PM tailors cost data collection to satisfy program and DoD requirements. The plan identifies the reportable WBS elements, the type of reports required, and reporting frequency.

The traditional form of cost reporting includes the Cost Data Summary Report (DD Form 1921) and the Functional Cost-Hour Report (DD Form 1921-1). There is also an updated FlexFile format. CCDRs also include Software Resource Data Reports (SRDR). These cost reports provide actual costs at a level of detail required to develop credible cost-estimating relationships, such as hours and dollars by type of labor, material, and subcontract costs.

CCDRs are housed in the Cost Assessment Data Enterprise (CADE). ODASA-CE provides instructions on CSDR planning and submissions in the Deputy Assistant Secretary of the Army-Cost & Economics (DASA-CE) Cost and Software Data Reporting (CSDR) Planning and Review Standard Operating Procedure (SOP). The current version of the CSDR SOP is version 1.1, dated 15 May 2019.

EVM

Earned Value Management (EVM) is a widely accepted industry best practice for program management. EVM provides joint situational awareness of program status and allows a program manager to assess the cost, schedule, and technical performance of programs for proactive course correction.

EVM data is collected and stored in the EVM Central Repository (EVM-CR). The EVM-CR is a joint effort between DCARC and OUSD/AT&L, managed by the Office of Acquisition, Analytics, and Policy (AAP), which provides centralized reporting, collection, and distribution for Key Acquisition EVM data; a reliable source of authoritative EVM data and access for OSD, the Services, and the DoD Components. The EVM-CR houses IPMR (Integrated Program Management Reports) Cost & Schedule reports as well as Contract Funds Status Reports (CFSR) submitted by contractors (and reviewed by Program Management Offices) for ACAT 1C & 1D (MDAP) and ACAT 1A (MAIS) programs.

Contractor Cost Deliverables and Data Item Descriptions (DIDs)

The analyst should be part of the Statement of Work (SOW) development process to ensure that the government will receive data to support cost estimation. Important contract deliverables include the Integrated Program Management Report (IPMR) which includes the requirement for EVMS reporting, and Cost and Software Data Reporting (CSDR). The government can ensure that these deliverables are received by including the necessary Contract Data Requirements List (CDRL) element in the SOW.

In determining what CDRLs should be included and how the deliverables are formatted, the government needs to consider the level of actuals that will be useful in projecting future costs, the limitations of contractual deliverables depending on the phase of the program, and how to record actual costs and correlate them to the cost estimate.

Guidance on CDRLs can be found in the DoD Handbook: Preparation of the Statement of Work (MIL-HDBK-245D) and the DoD Standard Practice: Data Item Descriptions (DIDs) (MIL-STD0963C).

There will be instances when a deliverable for an added report or event, ex: Integrated Baseline Review, may not have a specific DID reference. The overarching goal is that all requirements are identified in the SOW so that the contractor can develop a comprehensive proposal and associated cost for the required effort.

Additional guidance on reporting thresholds can be found in the DoDI 5000.02 (IPMR/CSDR), OSD CAPE 4 January 2019 Memo: Updated Implementation of Cost Data Reporting Requirements in

Accordance with Section 2334(g), and the 14 September 2018 Memo: ASA(ALT) Earned Value Management Applicability Determination and Waiver Implementation Guidance.

The list of management (MGMT) and financial (FNCL) DIDs follows.

Title	DID Reference	DD Form Reference
Cost and Software Data Reporting DIDs		
Cost and Software Data Reporting Plan		DD Form 2794
Contract Work Breakdown Structure (CSDR and EVMS)	DI-MGMT-81334D	Based on structure in DD Form 2794
Cost Data Summary Report	DI-FNCL-81565C	DD Form 1921
Functional Cost Hour Report	DI-FNCL-81566C	DD Form 1921-1
Progress Curve Report	DI-FNCL-81567C	DD Form 1921-2
Contractor Business Data Report	DI-FNCL-81765B	DD Form 1921-3
Sustainment Functional Cost-Hour Report	DI-FNCL-81992	DD Form 1921-5
Software Development Report	DI–MGMT-82035A	DD Form 3026-1
Software Maintenance Report	DI–MGMT-82035A	DD Form 3026-2
Enterprise Resource Planning (ERP) Software Development Report	DI–MGMT-82035A	DD Form 3026-3
Cost and Hour Report (FlexFile)	DI-FNCL-82162	FlexFile Submission. Uses DD Form 2794
Quantity Data Report	DI-MGMT-82164	FlexFile Submission. Uses DD Form 2794
Maintenance and Repair Parts Data Report	DI-MGMT-82163	FlexFile Submission. Uses DD Form 2794
Technical Data Report	DI-MGMT-82165	FlexFile Submission. Uses DD Form 2794
Other Cost & Management Associated DIDs		
Contract Funds Status Report (CFSR)	DI-MGMT-81468	DD Form 1586
Integrated Program Management Report (IPMR), including EVM reporting and the Integrated Master Schedule	DI-MGMT-81861A	DD Form 2734/1 DD Form 2734/2 DD Form 2734/3 Format 5, Explanations & Problem Analysis (no DD Form) Format 6, IMS (no DD Form) Format 7, Electronic History and Forecast File (no DD Form)

[10]

[10] *https://cade.osd.mil/policy/dids and https://www.acq.osd.mil/evm/#/policy-guidance/dids-cdrls-standards*

2. Data Normalization

Cost information is not the same across data sources or even among different reports from the same data source. Before data can be used in cost estimation, it must be normalized to ensure that the analyst is comparing apples to apples. One of the primary components of normalization is adjustments for inflation. Inflation considerations are discussed in Chapter 5: Inflation.

4. Develop the Point Estimate

Once an analyst has compiled a data set, the analyst is ready to develop the cost estimate. An analyst develops the cost estimate at the lowest level possible by relating the data to cost elements. An analyst may use more than one cost estimating methodology throughout the estimate. Chapter 4 provides details on the various cost estimating methodologies.

After estimating all the components of the program, an analyst has a point estimate, or a single value that is the summation of all the methodologies' results at the lowest CES level. The point estimate's cost and schedule must be based upon a realistic, documented definition of the program, as provided by the CARD or CARD-like document.[11]

5. Conduct Sensitivity Analysis

Once the point estimate is calculated, an analyst should include sensitivity analysis. Sensitivity analysis allows an analyst to assess the extent to which costs and benefits are sensitive to changes. While conducting sensitivity analysis, the analyst determines the impact of cost estimating methodologies used and key GR&As. If changing inputs results in a relatively large change in cost, then the estimate is said to be sensitive to that input. Sensitivity analysis does not have to be applied to every portion of the estimate, but an analyst should conduct sensitivity analysis on cost drivers, as well as areas of the estimate that have been identified as subject to change.

Some factors that may warrant sensitivity analyses are:

- The effects of a shorter or longer economic useful life (EUL).
- The effects of variation in the estimated volume, mix, or pattern of workload; for example, the production rate or learning curve.
- The effects of potential changes in requirements resulting from either congressional mandate or changes in functional responsibilities.
- The effects of potential changes in requirements resulting from changes in organizational responsibility at the site, installation, base, or Major Army Command (MACOM) level.
- The effects of changes in configuration of hardware, software, data communications, prime support equipment, and other facilities.
- The effects of alternative assumptions on areas such as the project operations, inflation rate, residual value of equipment, and length of development.
- The effects of changing the fielding strategy.
- The effects of costing to different quantity sets such as the Army Acquisition Objective (AAO), the Army Procurement Objective (APO), or the Basis of Issue Plan (BOIP).

[11] Joint Agency Cost Schedule Risk and Uncertainty Handbook

6. Risk and Uncertainty Analysis

Risk and Uncertainty should be applied to estimates in accordance with the Joint Agency Cost Schedule Risk and Uncertainty Handbook dated 12 March 2014. Uncertainty should only be applied when you have the information to justify it.

7. Presentation

After completing the estimate and conducting sensitivity, risk, and uncertainty analyses, the analyst is ready to present findings to decision makers. These presentations typically take the form of briefings. Briefings should be clear and complete, making it easy for those unfamiliar with the estimate to comprehend it. A best practice is to present the briefing in a consistent format to facilitate understanding the completeness of the cost estimate, as well as its quality. Moreover, decision makers who are familiar with a standard briefing format will be able to concentrate on the briefing's contents and on the cost estimate, rather than focusing on the format itself.

The cost estimate briefing should illustrate key points that center on the main cost drivers and the final cost estimate's outcome. Communicating results simply and clearly engenders management's confidence in the process that was followed to develop the estimate, including the GR&As, methods, and results. The presentation should include program and technical information specific to the program, along with displays of budget implications, contractor staffing levels, and industrial base considerations.[12]

8. Updating

Once an estimate is approved, the analyst's work is not done. Best practice is for the analyst to update the estimate and corresponding documentation at least annually. When updating the estimate, the analyst should account for actual costs incurred and update the model to reflect any new information. For example, the analyst can update the model to portray actual expenditures, reflect changes to GR&As, and consider changes to the planned EUL. By updating the estimate so that it reflects the current planned program, the analyst ensures that the cost product remains relevant. An updated estimate allows an analyst to respond to "what if" drills and "fact of life" changes to the program. An updated Life Cycle Cost Estimate (LCCE) enables the program office to engage in cost management throughout acquisition and O&M.

9. Documentation

At every step of the cost estimating process, the analyst should ensure that there is proper documentation. Documentation should be complete, clear, concise, and display consistency. The goal of the documentation is to provide reports that are readable, auditable, and useful. The analyst should index the documentation for easy and rapid access. Documentation should record:

1. All GR&As used in developing the estimate.
2. The data used in the estimate and the data sources.
3. The analyst's treatment of the data (e.g., costs found in the CSDRs have been normalized for inflation).
4. The methodologies used in the estimate, the sources of those methodologies, and any known limitations with the methodologies (e.g., cost was calculated from a CER obtained from a commodity bluebook with an applicable data range of ABC to XYZ).

There should be enough documentation to enable a person unfamiliar with the estimate to reconstruct the estimate and obtain the same results. Just as an analyst should update the estimate to reflect the current

[12] GAO Cost Estimating and Assessment Guide Best Practices for Developing and Managing Capital Program Costs March 2009

program description, the analyst should update the documentation to ensure that the documentation continues to reflect the current estimate.

At a minimum, cost documentation must include the following sections:

1. Header: This section identifies the system, cost element or prime mission equipment sub-element title and number, and date of the documentation.
2. Assumptions: This section includes all assumptions for this element. The assumptions are for the given element, not a restatement of the overall ground rules and assumptions.
3. Inclusion/Exclusion Criteria: This section should include a listing of the inclusion/exclusion criteria to provide an explanation of the element being costed.
4. Data Source and Data Adjustments: This section includes all data sources and any adjustments made, such as those based on complexity factors.
5. Cost Expression: This section should provide the basic equation used to calculate the results and a listing of all variables unique to this element. Recurring variables should be documented.
6. Methodology/Calculations: This section should include a summary of the methodology, techniques, and calculations used to compute the estimate.
7. Limitations of Estimate: In this section, the analyst should present the limitations and constraints of the estimate, providing insight into the strengths or weaknesses of the estimate.

In documenting all recurring variables, the analyst should include the following information:

1. Header: The analyst should identify the system, variable title and number, and date of documentation.
2. Current Value Being Used: The analyst should provide the variable's numerical value used in the estimate.
3. Data Source and Adjustments: This section includes all data sources and any adjustments made, such as those based on complexity factors.
4. Description of How the Value Was Derived: The analyst should include a basic summary of the methodology, techniques, and calculations used to determine the value of the variable.

Appendix 7 provides an example of documentation.

10. Rough Order of Magnitude (ROM) Estimates

As briefly mentioned during the "Define the Estimate's Purpose" portion of this chapter, there is a specific type of estimate known as a ROM. In developing a ROM, an analyst will still follow the steps of the cost estimating process detailed in this Chapter to the extent that they are able, though there is an understanding that the completed product will be less robust due to the paucity of available information. ROMs are typically based on analogies to historical programs and often use subject matter expert (SME) opinion due to the lack of specific information about the desired system and its requirements. However, even though a ROM is less robust than a traditional cost product, guidelines must be followed. These guidelines include:

1. Document all GR&As.
2. Document the types of dollars the results are in.
3. Decompose the estimate to the product- or process-oriented WBS that reflects the lowest level of available, relevant data.
4. If the effort spans multiple years, the estimate shall be time phased and the rationale for the phasing shall be documented.
5. SME inputs should be specified at the lowest level possible.

6. The estimate shall include documentation of the application of SME inputs, including a summary of how the SME determined the input..
7. Where analogous programs are used, they should be identified and source data shall be included in the documentation.
8. Documentation for SME input should include name, organization, job title, email, and telephone number.
9. Estimate shall be in ACEIT or MS Excel with formulas where applicable and inputs, calculations, and estimating methods must be available for review.
10. If there is a high level of uncertainty, the estimate may be presented as a range. The Joint Agency Cost Schedule Risk and Uncertainty Handbook dated 12 March 2014 should be referenced as needed.

Chapter 4 Cost Estimating Methodologies

As mentioned in Chapter 3, an analyst may use more than one cost estimating methodology when developing a cost estimate, depending on what approach is most appropriate for each cost element costed. Five common cost estimating methodologies are:

1. Extrapolation from Actuals
2. Parametric Cost Estimating
3. Analogy
4. Engineering (Bottoms Up)
5. Expert Opinion

1. Extrapolation from Actuals

The "Extrapolation from Actuals" technique should be used in cases where there is ample cost data on the specific program being estimated. It is appropriate for systems that have been in production for several years. It is performed by taking the existing historical cost data and using it to estimate the cost of continued production.

2. Parametric Cost Estimating

In the "Parametric" technique, the analyst relates historical costs from multiple programs to physical attributes, performance characteristics, or capabilities. Some common attributes include weight, horsepower, and fuel consumption. During the parametric cost estimation process, the analyst develops a cost-estimating relationship (CER). A CER is a mathematical equation that is based on historical data and relates the dependent variable (cost) to independent variable(s) which are the system attributes. Once developed, the CER is applied to the current program's attributes and used to predict cost. The validity of a CER depends on the significance of the relationship between cost and attribute, as well as the robustness of the historical data set.

3. Analogy

The "Analogy" technique involves the analyst creating an estimate based on scaling a historical data point. Analogy and parametric estimating require the same type of data, namely historical costs, but analogies require only one historical data point, whereas parametric cost estimating requires many data points. Analogies are often appropriate during early milestone estimates and in cases where programs are ill-defined. Analogies can also be used as a check on estimates used by other methods.

When using the "Analogy" technique, the analyst breaks down the system being costed into components, via a WBS or CES. For each component, the analyst compares the historic system to the new system and makes adjustments. Some common reasons for adjustment include changes in:

- Capabilities
- Size
- Weight
- Reliability
- Material composition, and/or
- Complexity

An example of an analogy is as follows: Cost (New) = Cost (Old) x (Complexity Factor) x (Weight Factor).

4. Engineering (Bottoms Up)

The "Engineering" technique is used when there is a great deal of available information on the new system, including knowledge of the specific resources and processes used in performing the work. When using the "Engineering" technique, an analyst examines work segments in detail and then sums the estimates for each section into a total cost. When using the "Engineering" technique, many small errors can combine to produce a large error in the overall cost estimate. The "Engineering" technique requires detailed knowledge to complete and is very time consuming as much effort is required to produce and document the estimate.

5. Expert Opinion

The "Expert Opinion" technique requires the analyst to consult with experts, who use their experience and understanding of the system to help determine a cost. The "Expert Opinion" technique is generally used when more objective techniques are not applicable. Additionally, it can be used to corroborate or adjust objective data, and cross check historical-based estimates. One specific example of the "Expert Opinion" technique is the Delphi technique which requires the analyst to query a group of experts independently about their opinions through an iterative process that continues until the experts reach a consensus, or near consensus. Some areas to consider "Expert Opinion" include:

- Cost Drivers: Identify which parameters are likely to drive program costs. Not necessarily interested in "how much" each driver costs, but interested in the "influence" of a variable.
- Analogous System and Related Factors: Identify the closest system or subsystem to the program being costed and quantify those relationships with a factor.
- Inputs to CERs and Cost Models: What are the technical parameters, such as weight or power, which have key relationships to cost?
- Percent Complete: How complete is an in-process contract? This will allow allocation of sunk costs to the percent complete and extrapolation for the remaining effort.
- Inputs to Risk and Sensitivity Analysis: Is there a suggested range or "bounds" of uncertainty/risk associated with the data, or for the overall program?
- Inputs to Time-Phasing Methodologies: Identify key milestones and the percentage of effort associated with each one, impacting the planned outlay profile.

Given the subjective nature of "Expert Opinion," it is important to show the credibility of the experts in the documentation, as well as the experts' names and basis for opinion.

Chapter 5 Inflation

After an analyst collects historical data, the analyst needs to determine if any adjustments should be made prior to estimation. The most common adjustments an analyst makes are those based on inflation. Constant year/Constant price values do not show the changing spending power of the dollar over time

whereas current year/then year values reflect the effect of inflation. In order to use a varied data set, an analyst must ensure that a consistent base year is used in order to determine the true cost impacts of inputs.

Inflation is relevant because the buying power of the United States (US) Dollar changes over time. For example, one gallon of milk purchased in the US in 1950 would cost approximately $0.82.[13] The same end item – one gallon of milk – purchased in the US in 1996 would cost approximately $3.12.[14] The end item, one gallon of milk, is the same and the unit of measure, the US Dollar, is the same however, the cost is different. In this example we are assuming that there is no change in the quality or relative value of milk to other goods, the real value. The value of the US Dollar changed from 1950 to 1996 such that more dollars are needed to acquire the same end item at the later point in time. The devaluation of currency over time (or, inversely, the increasing cost of goods and services over time) is referred to as "inflation," and it needs to be considered in the cost estimating process.

If 0.82 USD1950 = 1 gallon milk,
and 3.12 USD1996 = 1 gallon milk,
then, by the transitive property, 0.82 USD1950 = 3.12 USD1996
and [0.82 USD1950 / 3.12 USD1996] = 1 = [3.12 USD1996 / 0.82 USD1950]
One can now convert between USD1996 and USD1950 using the above ratios.

Figure 3: Example of Inflation

As stated in Chapter 3, the Base Year (BY) of the estimate is an important GR&A. When developing a cost estimate, an analyst must establish a constant base year to establish Constant Price (CP) and Constant Year (CY) values of the dollar. The chosen BY is typically the current Fiscal Year (FY) occurring while the analysis is conducted. No matter how many years into the future a program estimates, the costs can be normalized to this constant CY, providing a consistent measure of the size and scale of the program relative to a fixed dollar value. When comparing multiple programs, ensuring that each program displays costs in the same CY allows for a like to like comparison by removing the effects of inflation. The Office of Management and Budget (OMB) publishes guidance annually with historic and projected future rates of inflation based on year-to-year changes in US Gross Domestic Product (GDP), or the average cost of goods and services produced domestically within the US each year, which can be used to convert from one CY to another.

[13] 100 Years of U.S. Consumer Spending, U.S. Department of Labor, U.S. Bureau of Labor Statistics, May 2006, Report 991
[14] 100 Years of U.S. Consumer Spending, U.S. Department of Labor, U.S. Bureau of Labor Statistics, May 2006, Report 991

Program A is an older program, where each end item had a unit cost of $12M USD1975.
Program B is a newer program, where each end item had a unit cost of $12M USD2000.
To say the programs were of "equal size" because they both resulted in items valued at "$12M" apiece ignores the fact that the word "Dollars" has two different values given the time context.
Using OMB published factors, the value from 1975 can be converted to USD2000:
$12M USD1975 * [2.82 USD2000 / 1.00 USD1975] = $33.84M USD2000
Similarly, the 2000 value can be converted using the inverse factor:
$12M USD2000 * [1.00 USD1975 / 2.82 USD2000] = $4.26M USD1975.
So, two programs with a measured per unit cost of $12M in their respective time periods actually differ in scale by a factor of 2.8:
Program A = $12M USD1975 and Program B = $4.25M USD1975,
AND Program A = $33.87M USD2000 and Program B = $12M USD2000.

Figure 4: Base-Year Comparison Inflation Example

The effects of inflation are especially important when a cost estimate is used for budgeting purposes. When considering a purchase planned for ten years in the future, it is not enough to know the estimated cost in terms of the buying power of today's dollar. To budget the correct amount of funds for a future purchase, the estimate must convey the projected future value of the US Dollar that will be used to make that purchase. Additionally, based on appropriation, programs have differing lengths of time in which to spend allocated funds. This means that funds sit in the US Treasury for some time before being spent or outlaid on intended purchases. Inflation continues to occur while the funds are waiting to be spent, and this budgeting needs to consider this continued devaluation.

In addition to the annually published rates of inflation, OMB publishes a table of appropriation-specific Outlay Rates. Outlay Rates attempt to account for the continued inflation that occur between funds being allocated and funds being spent. Practically, defense contractors understand that they will be paid with a delay and if they are setting prices for obligations made in FY26 with the understanding that payment will not come until FY28 they will set a price that accounts for the delay. Outlay Rates are published as percentages by year and indicate, historically, how long funds remain in the Treasury after being allocated before being spent. These Outlay Rates are combined with Inflation Factors to determine a Then Year (TY) conversion factor: a scalar multiplier for converting an estimate from a fixed CY value to a budget-representative value that will sufficiently fund the specified amount of goods and/or services given the time it historically takes to spend the specified funding. This ensures that enough money is set aside in the current year to afford purchases spread over time with a constantly deflating valuation of dollars.

	FY2012	FY2013	FY2014	FY2015	Total
CY2012$	$15.00M	$15.00M	$15.00M	$14.50M	**$59.50M**
CY12 to TY$OPA	1.0199	1.0406	1.0582	1.073	
TY$OPA	$15.30M	$15.61M	$15.87M	$15.56M	**$62.34M**

Third row shows TY12$ in FY12, TY13$ in FY13, etc.

Figure 5: Outlay Inflation Example

Not all goods and services increase at the same rate. OMB rates are based on overall US GDP from year to year, which averages out higher rates of growth for some commodities than others. The change in price for a specific commodity above or below the overall rate of inflation is referred to as the Real Price Change (RPC) for the commodity. The compounded factor of RPC with inflation is called Escalation. Detailed procedures for converting between base years and calculating Constant Price, Constant Year, and other dollar types using inflation and escalation indices can be found in the OSD Inflation and Escalation Best Practices for Cost Analysis guidebook located at https://cade.osd.mil/costestimatingguidance/inflationandescalation.html.

The US Navy and US Air Force attempt to account for RPC in their estimates, if prior observations of accelerated growth for a given commodity will continue into the future. These accelerated rates of growth should be offset in other areas of Navy and Air Force estimates by decelerated rates of growth: commodities for which the average rate of inflation is greater than the actual rate of change in price for the good or service for the given period of time. Unless an estimate shows an unusually high investment into a single commodity or group of commodities with similar RPC factors, all estimates should show a relatively similar rate of overall escalation at a top level from year to year. A caution with RPC is that a period of accelerated growth is typically not sustainable, so projecting a commodity to continue to outpace the average rate of inflation because it has shown accelerated growth in the past may or may not be justifiable. Rather than scale individual elements up or down relative to the average rate of inflation, the US Army accepts OMB published rates (which are, in fact, labeled "Escalation Rates") as given for each appropriation, allowing peaks and valleys for individual commodities to be smoothed over by the average.

Let π be the percentage Rate of Inflation from one specified time period to the next.
Let r be the RPC percent for a given commodity from the same specified time period to the next.
Given a Unit Cost (UC$) in the first specified time period of UC$,
the inflated Unit Cost to the next time period is $UC\$*(1 + \pi)$
and the Escalated Unit Cost in the next time period is $UC\$*(1 + \pi)*(1 + r)$
$UC\$*(1 + \pi)*(1 + r) = UC\$*(1 + r + \pi + \pi*r) \Rightarrow UC\$*(1 + e)$ where $e = \pi + r + \pi*r$

Figure 6 Escalation Compounds Inflation with Real Price Change Example

Because of the impact of inflation, it is important to specify the specific dollar type being used in any table, graph, or estimate. If an analyst does not know whether an estimate is being presented in TY or CY dollars, an analyst can look for patterns from year to year to infer if inflation is or is not included. Costs that are identical from one year to the next imply that inflation is not included. Costs that scale by approximately 2 to 3 percent from one year to the subsequent year likely include inflation, especially if the percentage is consistent from year to year to year. Dollars given to an analyst from contracts or other actual expense sources are likely TY dollars, as the contract was likely based on budgeted TY dollars. Subject Matter Experts (SMEs) typically give estimates in current CY dollars, as they tend to estimate costs based on doing the work or making the purchase today. These inferences are not rules, and it is the responsibility of the analyst to ensure that any costs used in their estimate or an estimate under review are properly sourced, but they are a good starting point for dealing with costs without a specified dollar type.

Chapter 6 Acquisition Costing

1. Introduction

As of 2019, there are six different acquisition pathways for the Department of Defense (DoD). They are:

1. Urgent Operational Need (UON)/Joint Urgent Operational Need (JUON)
2. Middle-Tier Acquisition (MTA)
3. Traditional Major Defense Acquisition Program (MDAP)
4. Defense Business Systems (DBS)
5. Services
6. Software Pathway

The applicable acquisition pathway determines the timing and nature of required cost analysis products. However, regardless of the specific requirements, cost analysis provides a rigorous and systematic approach to evaluating the likely cost of specific items in defined scenarios, allowing decision makers to evaluate the impact of chosen alternatives.

One of the common cost estimates an Army analyst develops is a life cycle cost estimate (LCCE). LCCEs represent the total cost of a program from cradle to grave. The costs may also be referred to as the life cycle costs (LCCs).

There is a need to differentiate between phases of the LCCE and the appropriations used to fund the efforts in those phases. For example, core program office staff will be funded using the Operations & Maintenance, Army (OMA) appropriation even during the Research and Development phase.

2. Milestones

As per the DoD 5000.73, the phases of a cost estimate include Research and Development, Investment, Operating and Support, and Disposal. During the acquisition process, a program encounters major decision points, known as milestones, which help ensure that the program is ready to go onto the next phase or effort. These milestones are as follows.

i. Milestone A

During Milestone A, the decision makers decide to pursue a specific product or design concept. There is an analysis of alternatives (AoA) that considers potential solutions, reviewing cost, schedule, and performance parameters to determine what solution should be selected for further exploration. During Milestone A, initial affordability goals are set. Following Milestone A, the program is in the Technology Maturation and Risk Reduction (TMRR) phase. The purpose of the TMRR phase is to reduce technology risks and to determine and mature the appropriate set of technologies to be integrated into a full system.

ii. Development Request for Proposal Release Decision Point

The Development Request for Proposal (RFP) Release Decision Point occurs between Milestones A and B. The purpose of the decision point is to approve the release of the RFP for the Engineering and Manufacturing Development (EMD) phase.

iii. Milestone B

The primary focus of Milestone B is to decide on the most appropriate materiel solution, establish the EMD phase acquisition strategy, and set the initial acquisition program baseline (APB). The purpose of the EMD phase is to develop a system or an increment of capability; complete full system integration; develop an affordable and executable manufacturing process; ensure operational supportability with particular attention to minimizing the logistics footprint; design for reducibility; ensure affordability; and demonstrate system integration, interoperability, safety, and utility. Following Milestone B, the program is in the EMD phase.

iv. Low Rate Initial Production (LRIP) and Milestone C

At LRIP, the MDA decides to build the first production units for use in operational tests. LRIP typically occurs at Milestone C, which precedes the Production and Deployment Phase. The purpose of the Production and Deployment Phase is to achieve an operational capability that satisfies mission needs. During the Production and Deployment Phase, operational test and evaluation activities determine the effectiveness and suitability of the system.

v. Full-Rate Production (FRP)

The primary purpose of the FRP decision is to determine whether the program is ready to begin production at the desired rates. This entails assessing the manufacturing infrastructure at the contractor site(s) to ensure they have the required capacity.

vi. Post-Initial Operational Capability (IOC)

After IOC, DoD Components must continue to track O&S costs and update O&S cost estimates annually throughout the program's life cycle to determine whether preliminary information and assumptions remain relevant and accurate and to identify and record reasons for variances.

3. Appropriations

In the Army, LCCEs are broken into five major appropriations categories:

1. Research, Development, Test, and Evaluation (RDT&E)
2. Procurement (Proc)
3. Military Construction (MILCON)
4. Military Personnel (MP)
5. Operations and Maintenance (O&M)

i. RDT&E

RDT&E costs are costs for system-specific efforts during program definition and risk reduction and the engineering and manufacturing development phases from Milestone A through Milestone C. RDT&E costs include government costs, contractor and in-house costs, and products and services necessary to bring a system from concept to production. They also include all costs to the government for developing the specific capability, without regard to the funding source for such costs.

Estimates of RDT&E costs include nonrecurring and recurring costs for prototypes, engineering development equipment and test hardware. Analysts must identify and estimate contractor system test and

evaluation, along with government support to the test program. In addition, analysts should consider such items as support equipment, training, data and military construction.

ii. Procurement

Procurement costs are costs of buying the prime mission equipment (PME) and its support. Procurement costs cover production through introduction (or fielding) of the materiel system into the Army's operational inventory. Examples of cost elements associated with the support portion of the system are support equipment, training, data, and initial spares.

Procurement costs include government costs—both contractor and in-house costs—of products and services necessary to produce and field an operational system. This includes the hardware, training, and support activities necessary to begin operations. It also includes costs of both a nonrecurring (setting up a production capability) and recurring nature (repeated production).

Finally, procurement costs include costs resulting from fielding the system. Fielding is the iterative process of introducing a system to a final user with enough resources (people, materiel, and facilities) to achieve a mission. This requires the integrated efforts of the Army staff policy makers (ARSTAF), project manager and program executive officers (PEO), Army Commands (ACOMs) as functional intermediaries, and Table of Organization and Equipment (TOE) or Table of Distribution and Allowances (TDA) units – the final users. The fielding limits (beginning and ending) are a function of the number of fielding iterations for which each group is responsible. An iteration begins when the manufacturer passes ownership of the system to the government. An iteration ends when the TOE or TDA unit accepts the system and begins operations with it. The range of fielding limits thus extends from a single iteration for a unit to the ARSTAF that is responsible for all iterations.

iii. Military Construction (MILCON)

MILCON costs are costs of system-specific construction. Only projects that are required for the materiel system, and will be canceled upon termination of the materiel system, are system-specific construction. Examples of system-specific construction projects are: simulator buildings, missile bunkers, and billets associated with the fielding of new organizations for the new system.

iv. Military Personnel (MP)

MP costs are the costs associated with the development, production, fielding, operation, and support of the materiel system that are not reimbursed by any other appropriation. AMCOS is the preferred tool for estimating MP costs and is elaborated on in Chapter 12.

v. O&M

O&M costs include direct and indirect elements of a fielded weapon system. Major cost elements include personnel, unit-level consumption, depot maintenance, sustaining investment, inventory management control, and indirect O&M costs. In general terms, O&M costs include the continuing annual recurring costs of operating and maintaining force structure and materiel systems to perform assigned missions. The level of sustainment is a function of force allocation, training goals, and the OPTEMPO assigned to individual materiel systems. O&M costs begin with materiel system fielding and end when the materiel system leaves the Army inventory. The length of time associated with steady-state operations also drives the O&M costs.

In addition, O&M costs include costs of the program, regardless of fund source or management control. They also include measures of the opportunity cost of existing assets or assets available from another source. O&M costs include demilitarization, detoxification, or long-term waste storage.

4. Unit Costs

When discussing LCCEs, analysts will often be interested in unit costs. When discussing unit costs, one must be careful to be clear about what unit costs are being discussed. Common unit costs include average procurement unit cost (APUC), program acquisition unit cost (PAUC), and average manufacturing unit costs (AMUC). When considering unit costs, it is important to note that only the PAUC is statutorily defined. This manual provides definitions for APUC and AMUC based on current recommendations, but it is still important for analysts to clarify what is included and what is excluded in calculating figures so that a common understanding is reached and apples to apples comparisons may be made.

i. Average Procurement Unit Cost (APUC)

The APUC is the program procurement cost divided by the procurement quantity.

ii. Program Acquisition Unit Cost (PAUC)

The PAUC is statutorily defined as the amount equal to (A) the total cost for development and procurement of, and system-specific military construction for, the acquisition program, divided by (B) the number of fully-configured end items to be produced for the acquisition program.[15] Acquisition O&M may be included in the "(A)" portion of the calculation.

iii. Average Manufacturing Unit Cost (AMUC)

The AMUC is the program's recurring production costs plus the contractor systems engineering program management (SEPM) divided by the number of production units. Contractor SEPM is included for AMUC. When determining AMUC, analysts often look to Contract Line Item Number (CLIN) pricing, and contractor SEPM is almost always rolled into the CLIN total price.

Chapter 7 Software Cost Estimating

1. Introduction

Software plays a critical factor in the functionality of modern Army systems, encompassing custom developed software, commercial off-the-shelf (COTS) software, databases, and enterprise resource planning (ERP) tools. As the Army seeks to maintain a competitive advantage in the capabilities delivered to the soldiers, the role of software has only grown in importance. This has resulted in an expansion of development approaches and acquisition frameworks to allow flexibility in delivering software products to the warfighter. Due to differences in the way software is developed and acquired, consideration must be placed on the metrics collected, analysis performed, and method used for estimating software costs. Factors including size, complexity, capability, application, and point in the system lifecycle are considered as the scope and phasing of software development evolves.

A common thread that can be found among cost analysis manuals and guidebooks is that data is the cornerstone of building cost estimates, to that end data collection (Chapter 3 Section 3 Data Collection) on software projection must be a focus to support estimating software efforts. CSDR data collection requirement in accordance with Section 3227(a) of Title 10, U.S.C outlined in DoDI 5000.73 is a starting point (primarily CCDRs and SRDRs) for collecting historical data to develop repositories of metrics to support different methods of software estimating. This statutory required data is the primary data source utilized when completing cost estimates and now needs to be supplemented with Agile Metrics from the ASA(ALT) Agile Metrics Playbook. Coordination between the Program Office and ASA FM&C DASA-CE and ASA ALT DASA (DES) is also necessary for data collection.

2. Software Development Techniques

The U.S. Government Accountability Office (GAO) published a report in 2021 that identified seven software development models employed by Department of Defense acquisition programs[1]: waterfall, incremental, spiral, agile, DevOps, DevSecOps, and hybrid/mixed. Descriptions for each approach are included in Table 1 and range

[15] 10 U.S. Code § 2432.

from a structured, sequential development (waterfall) to an approach that favors flexible, iterative-development cycles (agile).

Table 1: DoD software development models

Software development model	Description
Waterfall	This model relies on strict phases, and each phase needs to be completed before going to the next phase. The phases include requirements definition, design, execution, testing, and release. Each phase relies on information from the previous phase. This model is a linear sequential flow in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of software implementation.
Incremental	This model sets high-level requirements early in the effort, and functionality is delivered in stages. Multiple increments deliver parts of the overall required program capability. Several builds and deployments are typically necessary to satisfy approved requirements.
Spiral	This model takes ideas from the incremental model and its repetition while also combining the structured and systematic development of the waterfall model with a heavy emphasis on risk analysis. The project passes through four phases (identification, design, build and evaluation, and risk analysis) repeatedly in a "spiral" until completed, allowing for multiple rounds of refinement.
Agile	An umbrella term for a variety of software practices, Agile calls for the delivery of software requirements in small and manageable predetermined increments. This model is based on an "inspect and adapt" approach where requirements change frequently and software is released in increments. Agile frameworks produce ongoing releases, each time adding small changes to the previous release. During each iteration, as the product is being built, it is also tested to ensure that at the end of the iteration the product can be delivered to the user. Agile emphasizes collaboration, as the customers, developers, and testers work together throughout the project.
DevOps	DevOps combines "development" and "operations," emphasizing communication, collaboration, and continuous integration between software developers and users.
DevSecOps	DevSecOps is an iterative software development methodology that combines development, security, and operations as key elements in delivering useful capability to the user of the software.
Hybrid/Mixed	This approach is a combination of two or more different methodologies or systems to create a new model.

Source: GAO-20-590G and GAO analysis of Department of Defense and software industry documentation. | GAO-21-105298

While each model is distinct, overlap and collaboration exist between the software development approaches, and likewise, similarities exist from a cost estimating standpoint. Therefore, with waterfall and agile representing the sharpest paradigm shift in approach, these two models will be the focus of the ensuing sections. Approaches that mix aspects of these two models can be understood through the differences in the waterfall and agile paradigms. Section 5 Training & Resources presents resource options for additional information on other software development models.

i. Waterfall Model Overview

The waterfall approach is typical for software development with a fixed scope and well-defined requirements that are assumed stable prior to the start of the development. The process is characterized by extensive planning made up-front with ensuing development following a linear, sequential process, which results in the software becoming an available product once the effort has reached completion. Traditionally, these developments have planned and estimated software in terms of Computer Software Configuration Items (CSCIs), as defined in MIL-STD-498, and include estimates of effort for the totality of the software development. Figure 1 below illustrates the workflow of a waterfall approach.

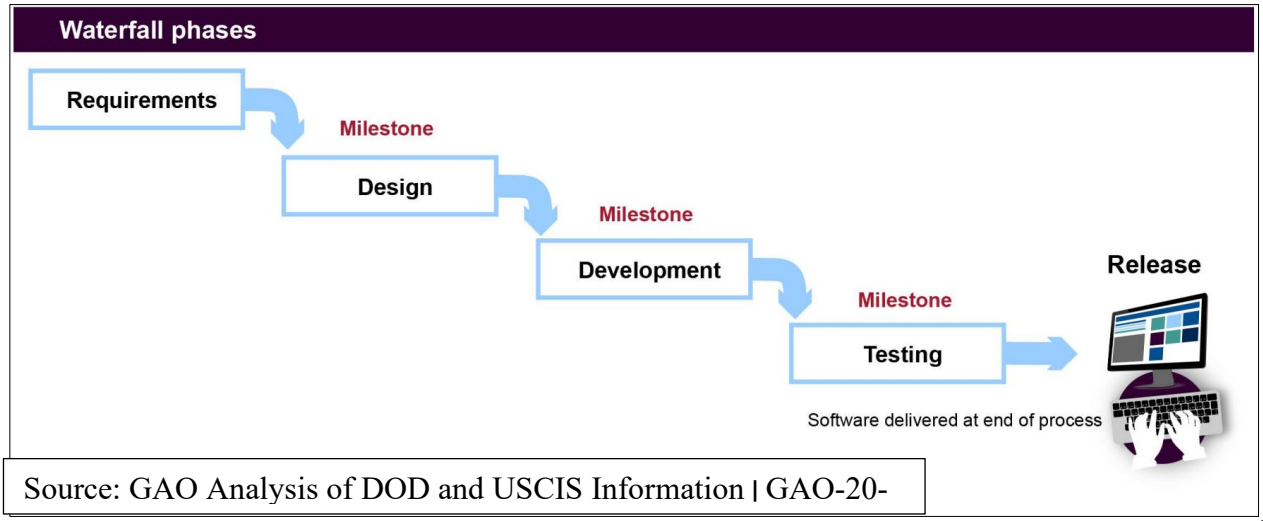

Figure 1: Waterfall software development model workflow

Common forms for estimating effort in a waterfall model revolve around the use of Software Lines of Code (SLOC) and the composition of new and reusable code metrics for the executed and planned software. Considerations of historical hours linked to analogous executed software development are influential datapoints in an assessment of plausible productivity ranges. These metrics for a waterfall model are key drivers of cost and are discussed in additional detail in Section 3 Cost Drivers and Methods. Due to the fixed scope, risk is inherent to the schedule and cost for a software development that follows a waterfall approach. This can be the result of failure to account for full scope of requirements or inaccurate assessments of workforce productivity.

ii. Agile Model Overview

As a counter to the waterfall development model, agile development is an available approach that iteratively and incrementally develops software to meet the evolving requirements of a program. It is characteristic of an effort with scope flexibility where cost and schedule are fixed. This model provides increased engagement from the customer with feedback provided throughout the process. Agile works well with smaller development teams and highly engaged customers and has become an increasingly popular practice to reduce cost growth and deliver better results to customer[2]. The recurring, iterative cycle of an agile model is depicted in Figure 2. During each iteration, software is designed, developed, tested, and integrated in small portions of the larger software as a whole. This enables the opportunity for user feedback to be provided during each cycle.

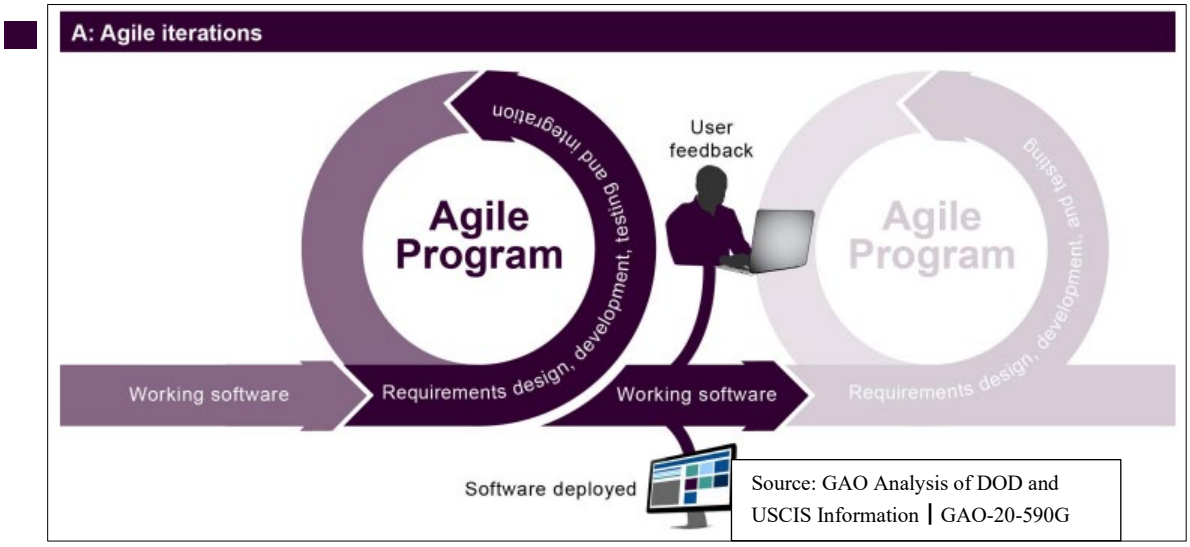

Figure 2: Agile software development model workflow

Although potentially varying from project to project, the iterative process of an agile model typically decomposes into the following scope and duration-based terminology:

Scope-based terminology:

- **Initiatives** – high level goals or themes for software system that are delivered through a collection of Epics. Complete delivery of an initiative, goal, or theme may not occur until delivery of the final software product.
- **Epic –** large, typically cutting across system functionality, customer-facing software that includes new development necessary to realize certain business benefits. Epics include multiple capabilities, features, and stories and an epic may span multiple program increments.
- **Capability –** are similar to features, but they describe higher-level solution behaviors than the features do so multiple features can be assigned to a capability. Capabilities fit within a single program increment to assure that incremental and measurable value is continuously delivered.
- **Features –** result of splitting work found in Epics or Capabilities. Features are a group user stories that can be completed in a single program increment that represent functionality customers will use.
- **User Stories or Stories** – are short incremental requirements or requests written from the perspective of an end user that capture software functionality. It is typically the smallest unit of work estimated in an agile framework, focusing on the user end goal. Stories should not span more than one sprint.
- **Scope Limit** – the relative amount of work effort or number of user stories that can be completed during a sprint. The Scope Limit is based on team availability and the amount of work a team can complete over a given period, known as Velocity.
- **Scrum –** organizational technique to align developers on path forward, tasking objectives and status, and to establish framework for collaboration in an agile environment.
- **Release –** an apportioned bundle of working software from Program Increments (PI) anticipated to be deployable to users on a future, scheduled date. May include concept of a Minimum Viable Product (MVP), representing the minimum functionality and capability to be deployed to users.

Duration-based terminology:

- **Program Increment (PI) –** time-box, such as 3 months, subdivided evenly into sprints.
- **Sprint –** represents a fixed time-box iteration in a Scrum or Program Increment and ranges from 1-4 weeks (most typically 2 or 3 weeks). Sprints contain planned work for the agile development team based on the Scope Limit.

Other Agile terminology:

Agile projects may use other terms relating to work scope or duration such as Bugs, Tasks, Sub-Tasks, Issues, and more. Reference these sources to assist in understanding agile activities.

- GAO Agile Assessment Guide (GAO-20-590G)
    - Appendix II: Key Terms
    - Appendix III: Related Terms.
- Atlassian/JIRA glossaries.

Figure 3 depicts the decomposition process for each software release made in an agile-based model.

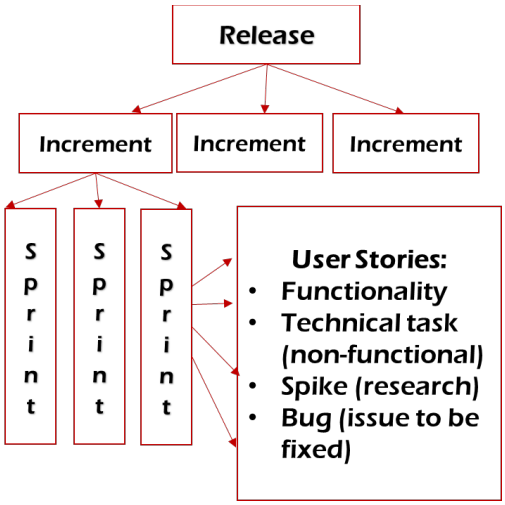

Figure 3: Agile software development hierarchy

Due to the constraint of cost and schedule, the risk assumed by employing an agile model is thereby associated with the product output delivered. Impacts to the product output can be driven by software growth as a result of requirements creep. A comparison of risk variables in an agile and traditional software model environment are shown in Figure 4.

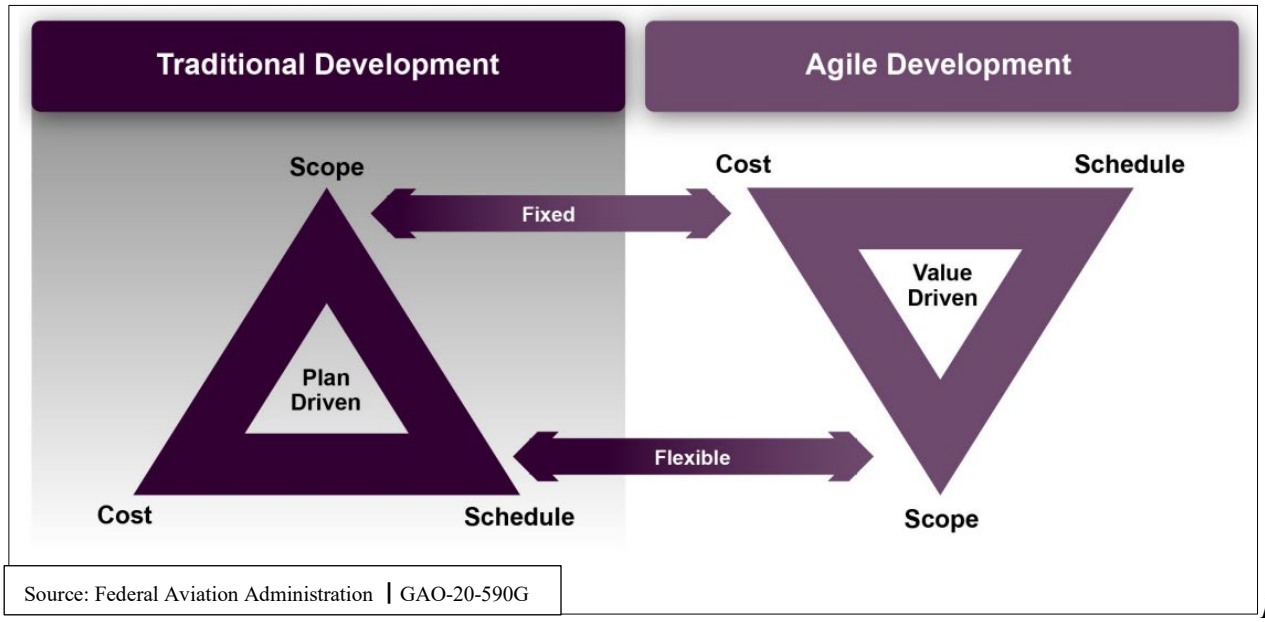

Figure 4: Software development risk variable impact for an agile and traditional model

Common supporting agents to the agile model are Continuous Integration (CI)/Continuous Delivery (CD), Development and Operations (DevOps), and Development, Security and Operations (DevSecOps) concepts. Each are a set of practices that function to deliver secure, reliable software products in the most efficient manner.

- **CI/CD** – development process for quickly building and testing code changes that helps organizations maintain a consistent code base for their applications while dynamically integrating code changes[3]. CI/CD commonly employs a pipeline toolchain to automate the integration and deployment of applications in a quick and efficient process.
- **DevOps** – a practice of removing the separation of engineering and IT operations by emphasizing communication and collaboration between both groups. DevOps can be considered its own software

development framework and used in collaboration with other approaches such as iterative and spiral, however, DevOps most frequently paired with agile.

- **DevSecOps** – a practice of incorporating security into all aspects of the software development, integration, and deployment process. Security implications are considered during early stages of development. DevSecOps, like DevOps, can be considered its own software development framework and used in collaboration with other approaches such as iterative and spiral, however, DevSecOps is most frequently paired with agile.

3. Cost Drivers and Methods

Software development is primarily a labor activity with cost driven by the total amount of effort linked to the development. The effort required to produce developed software will depend on the amount of software, complexity of the software, the capability of the development team, and the schedule constraining the development. The amount of software developed is commonly referred to as software "size". The ability to produce software is referred to as "productivity" and is influenced by things such as the complexity and type of software, as well as the capability of developers. Cost estimation of software, therefore, can be decomposed into two major concepts: measurement and estimation of *size*, and measurement and estimation of *productivity*.

The following sections each go into more depth on the concepts of size and productivity. The remaining sections under this topic address the cost implications of development methodology and describes the metrics and estimating methods used for an agile development methodology.

i. Software Size

Software size refers to amount of software that developers will produce. Software size does not have a universally accepted approach for measuring that is common with methods of measuring tangible objects such as length, volume, or weight. Rather, it is an abstract measure of software development aspects that consume work effort. A positive correlation between size and effort exists (i.e., larger projects require more effort), however, the exact nature of that relationship—the slope of the line and whether it is linear or non-linear, is not widely known, especially for projects that are planned but not yet complete.

It is important to understand that there are various ways of measuring size. Each method takes a different perspective on evaluating software size and are used successfully in software estimating (reference Chapter 3 Section 2i for Budget Formulation Estimates and Comparative Studies). None are perfect, however, different measures hold value in different situations, and often the choice of sizing method depends on timing and the type of estimate. These methods can be broadly grouped into the following categories:

- **Physical Size** - this category of size refers to things that can be measured physically, such as source lines of code (SLOC).
- **Functional Size –** this metric is based on the functionality that the software delivers.
- **RICE-FW** – a sizing method, used to estimate the effort to implement Enterprise Resource Planning (ERP) applications, counts the number of Reports, Interfaces, Conversions, Extensions, Forms, and Workflows. These counts are then entered into a cost estimating equation that relates RICE-FW counts to cost and effort.
- **Agile Size / Relative Size –** Agile sizing metrics are relative size metrics measuring software in a way that are intended to be comparable only to software previously developed by a given person or a team, and not across other teams, projects, or vendors.

The selection of a sizing metric will often depend on the data available. For example, a physical measure of SLOC is most useful when there is delivered code that can be counted via a code counter. In cases where development has not yet started, but functional requirements are documented, a function point count might be a good method. In situations where software development can be compared against an analogous effort with known effort, then relative sizing might be a viable choice.

No matter the size method used, software size growth, whether due to underestimation of initial requirements or requirements creep, may result in differences between initial estimates of software size and actual final software size.

The following sections describe each sizing method in more detail.

1. Physical Sizing Methods

The most common way of measuring physical size is by counting source lines of code (SLOC). SLOC considers the volume of code required to develop the software and many automated tools exist for counting SLOC. A SLOC count includes any software statement that must be designed, documented, and tested. Countable SLOC are software statements that are categorized as either Executable, Data declarations, Compiler directives, or Format statements. It is important to note that coding language is a factor that impacts SLOC counts. SLOC is usually reported in either physical SLOC or logical SLOC:

- **Physical SLOC** – the most basic form of SLOC which counts all lines of code.
- **Logical SLOC–** the portion of physical SLOC that excludes software statements that are comments, blanks, and debugging lines. Logical SLOC directly impact the execution of the code.

A common variation on a SLOC sizing metric is to account for reduction in effort required for modified, reused, or auto-generated code. By applying an adjustment factor to each of these categories, the analyst can calculate equivalent or effective source lines of code (ESLOC). The interpretation of an ESLOC number is that it represents the theoretical new SLOC that would take the same amount of effort as the sum of all new, modified, reused, and auto-generated code. The definitions of each of these categories are as follows:

- **New** – lines of code that are newly-developed or newly coded.
- **Modified** (also known as Adapted) – pre-existing code that must be adapted to function in the proposed system that requires a redesign, recoding, and retesting effort.
- **Reused** (can also be considered Adapted with no redesign or recoding required) – code that should require no changes to the preexisting source. However, analysts must include, at a minimum, integration and testing of reused code. Analysts should ask if the reused will be "touched." If so, additional effort must be added to reuse this software.
- **Carry-Over and Auto-Generated** – code generated from an automated software tool. Can reflect new code development or migration of existing source code from one language to another.

In addition to the way that software language impacts SLOC count, different organizations may use different adjustment factors to convert SLOC counts into ESLOC for use in various CERs. For example, the specific weighting factors for calculating ESLOC to use in the well-known COCOMO cost estimating model can be found in this 2016 study https://www.iceaaonline.com/wp-content/uploads/2016/10/TRN08-SW-Cost-Est.pdf, slides 21-23.

2. Functional Sizing Methods

Functional size metrics consider how many functions a program does rather than how many instructions it contains making it independent of programming languages, the development platform, and experience of the developers. Functional sizing measures user requirements specifying what the software shall do in terms of discrete tasks and services. These typically include user inputs (add, change, delete), outputs (reports), internal data files to be updated by the application, external interfaces with other applications, and inquiries (searches or retrievals).

There are many types of function points with the two main categories being Full Function Points (FFPs) and Simplified Function Points (SFPs). FFPs require a Certified Function Point Specialist or above within the certifications by the International Function Point Users Group (IFPUG). The functions that are counted in a FFP measure include:

- **External Inputs (EI)** – functions, for which the primary purpose is to take in data from outside the boundary to update one or more internal logical files (entities) or control the behavior of the system (such as alarm conditions that trigger a function to be invoked in the software).

- **External Outputs (EO)** – functions, for which the primary purpose is to send data out to a user and the process must contain one or more calculations, derive data, update an ILF as part of the process or change the behavior of the system. At least one of these four conditions must be true for an elementary process to qualify as an EO.
- **External Queries (EQ)** – functions, for which the primary purpose is to send data retrieved from a counted data function (an ILF or EIF) to a user, but the process cannot contain any of the four conditions that are described for an EO.
- **Internal Logical Files (ILF)** – a persistent logical entity that maintains data by the functionality of the software.
- **External Interface Files (ELF)** – a persistent logical entity that is referenced only by this software and maintained by another (external) piece of software.

Additionally, a FFP requires that the analyst applies a complexity factor to each function, where complexity is measured as high, medium, or low based on other countable characteristics.

A simple function point (SFP) is a simplified version of a function point count, that is also published by IFPUG. SFP collapses the first three categories and the last two categories from FFP into two categories:

- **Transaction functions** – this is the sum of all transaction functions (EI+EO+EQ).
- **Data Groups** – this is the sum of all data functions (ILF+ELF).

Additionally, a SFP eliminates the need for a complexity designation and instead assumes an average complexity for all functions.

Other methods of function point sizing include COSMIC function points, use case points, and requirements count:

- **COSMIC Function Points** – Common Software Measurement International Consortium (COSMIC) function points, Netherlands Software Metrics User Association (NESMA) function points. Each of these offer alternative ways of counting function points.
- **Use case points** – this is a metric that can be used when software requirements are written as user-oriented use cases.
- **Requirements count** – the count of requirements categorized as new, modified, safety, security, internal or external. Also includes count of reused or adapted requirements for preexisting software.

It is worth noting that function point sizing, by design, only captures the functional requirements of the system. Functional requirements can be thought of as user-facing features and capabilities. Non-functional requirements can be thought of as the infrastructure needed to ensure performance, security, usability, reliability, and scalability. In order to capture the effort and cost associated with non-functional requirements, it is necessary to apply a value adjustment factor (VAF) to function point sizing. IFPUG offers a process for calculation of the VAF, which is called the Software Non-functional Assessment Process (SNAP)

3. RICE-FW Sizing

RICE-FW is a sizing metric that is often used to estimate the size of Enterprise Resource Planning (ERP) applications. ERPs are a special category of software that automate a business function such as human resources, financial management, or inventory management. The key characteristics of an ERP that makes in unique are that they typically serve a broad community of users, contain a single centralized database, and integrate business processes with data and applications. ERPs tend to be larger and hence more costly than most other types of software. They also usually involve use of commercial software, with a significant amount of configuration and customization necessary to meet all the needs of the community of users. Because the effort and cost are related more to the amount of configuration and customization and less about the amount of code that needs to be written, sizing measures such as SLOC or Function Points are less often used for an ERP. Instead, estimators will normally use a sizing measure known as a RICE-FW object count. RICE-FW counts reports, interfaces, conversions, extensions, forms, and workflows. Sometimes the FW objects are omitted, and a RICE object count is used. Each of these objects are defined as follows:

- **Reports** are executable programs that read data from the database and generate output based on the filter criteria selected by the end user.
- **Interfaces** include all development and configuration objects that allow internal as well as external SAP and non-SAP systems to communicate with each other.
- **Conversions** refer to data that is converted from one format to another format and from one system to another. This includes converting legacy data to a loadable format into the system's database.
- **Enhancements/Extensions** add/modify existing functionality to SAP/Oracle's standard business applications.
- **Forms** are printouts taken from the database. Form development includes fetching necessary data from the system and presenting it as output which is standardized by the business or external regulatory entities.
- **Workflows** are a sequence of connected activities resulting in exchange of information. Workflows can be from person to person, system to system, or triggered by custom activities within the application.

With RICE-FW sizing, cost estimators can input RICE object counts into a published CER (for example, https://www.psmsc.com/UG2010/Presentations/p11-Packard-Improving%20ERP%20Estimation%20in%20the%20DOD%20(FINAL).pdf) to calculate estimated effort. Alternatively, estimators might use RICE-FW in a scaled analogy or in a custom-developed CER, if the analogous data are available.

4. Agile Size / Relative Size

The most common method of measuring relative size in agile developments is with story points. Story points are a unit of measure to quantify an estimate of the relative overall work effort required to fully implement a product backlog item, e.g., user story.

Software developed using the agile software development paradigm starts out with a high-level, preliminary set of software requirements that form the initial product backlog. During development, higher level requirements are decomposed into lower level agile objects and the product backlog is continuously monitored and adjusted by the customer, called the product owner, who places the highest value / priority items at the top of the backlog to be developed in order of priority.

Development teams allocate work to be done by assigning user stories to iterations, called sprints. To figure out how much work can fit into a sprint, the team estimates the relative effort that each assigned user story might take based on how much work it took to do a relatively easier or harder user stories from prior experience. Estimating is the most difficult during the first sprint when the team must estimate without reference to experience on the current system. The size of the user stories is subjective and becomes the relative effort estimate.

Teams that use story point sizing estimate through a variety of approaches some of which are described below:

- **Time Buckets –** this method relies on consensus method by the development team creating time buckets (1 day or less for example) then filling the buckets with development items.
- **T-shirt sizing –** this method assigns a relative size to software development based on general categories: small, medium, large, extra-large.
- **Planning poker –** this method is similar to the other relative sizing metrics, but instead assigns a number size based on the consensus of a group. Relative size is usually assigned a number from the Fibonacci scale: 1,2,3,5,8,13,21, etc.

5. Strengths and Weaknesses of Each Sizing Method

The selection of a sizing metric is often based on the data available. However, estimators should also be aware of the strengths and weaknesses of each metric. Table 2 summarizes this information:

Table 2: Software sizing methods

Method	Strengths	Weaknesses

SLOC / ESLOC	• Accurate and objective for delivered code. • ESLOC allows for adjustment for use of modified code, reused code, or auto-generated code	• No objective way to estimate SLOC for planned work.
Function Points	• Can be counted early in the development effort. • Are language/technology independent. • Can be weighted for complexity.	• Subjectivity in counting. • Requires certified function point counter for FFPs. • Difficult to adjust for reuse. • Does not capture non-functional requirements or technical and design constraints.
RICE-FW	• Captures effort associated with configuration and customization, especially for ERP software.	• Less applicable for non-ERP software.
Story Points	• Often used by agile teams and captured in project tracking tools such as JIRA.	• Greater subjectivity than FPs. • Non-standardized tracking unique to a team. • Only provides a measure of relative size.

ii. Productivity

Along with size, the second major component to a software estimate is productivity. A general definition of productivity is the amount of output divided by the amount of input. In software development, this equates to the amount of delivered software divided by the development effort. The unit of measure for productivity will depend on the sizing metric and how effort is measured. For example, if a project uses function point sizing and measures effort in person-hours, then productivity can be expressed as function points per person-hour (FP/PH).

There are a number of factors that will influence software development productivity. These can be divided into three groups: complexity, capability, and schedule. Complexity refers to the nature of the software and its requirements. Examples of factors that influence complexity include function/domain, operating environment, coding language, number of interfaces, and cybersecurity requirements. Capability is based on the ability of the software development team and is influenced by things such as developer skill, availability of tools, and co-location of teams. Finally, productivity is impacted by the schedule imposed upon the software development effort. Compressing or constraining a software development effort can cause a program to increase developers beyond optimal levels, and cause cutbacks in other areas such as requirements analysis, design, testing and documentation which can cause expensive rework efforts.

As with size, there are several ways that productivity might be estimated:

- **Published factor –** for example, a study[4] published in 2013 analyzed over 2,000 software projects completed between 2000 and 2012. Table 3 show some of the results of that study with productivity factors measured in FP/PM, based on the size (FP) of the project.

Table 3: Productivity profile example based on function point sizing[4]

Productivity by Size Category		
Size (FP)	Count	FP/PM (Median)
<=50	269	3.49
51-100	492	5.13
101-150	304	6.54
151-200	216	6.67
201-250	160	7.65
251-300	159	8.49
301-400	171	9.55
401-500	102	9.72
501-1000	204	13.43
1001-2000	97	16.29
>2000	57	23.10

- **Analogy –** if the estimator has access to an analogous software development project, with known size and effort, then productivity can be calculated and applied to a new project.
- **Database average –** if the estimator has access to multiple projects, with known size and productivity, then average productivity can be calculated.
- **Custom CER –** this is a more sophisticated variation on the database average method. It uses statistical regression to calculate the relationship between size and effort. The result of this analysis is an equation that can be used to estimate future project effort based on a size input.
- **Published CER –** this method uses a CER that has been made available for general use. Examples include the COCOMO model[5] or the RICE-FW model[6].
- **Software estimating tool –** commercial tools are available that allow the user to input a size metric, along with complexity and capability factors to generate an estimate of effort.

iii. Cost Implications of Software Methodology

As noted in the previous section, agile methodologies can specify and constrain time and cost, and let scope be uncertain and variable. This contrasts with a waterfall methodology, which will constrain scope and recognize that cost and schedule are unknown. The cost implication of this distinction is that in an agile environment, the estimator may need to estimate completed scope. In other words, if cost and time are strictly constrained, then the relevant question for the estimator is *how much software development can be accomplished and delivered withing the time and cost constraint?* Additionally, the risk and uncertainty analysis in a strict agile environment needs to quantify and show scope risk, in the format of how much development can be accomplished. In contrast the approach under a non-agile methodology would be to assume a constrained scope based on documented requirements. It is still necessary for the estimator to account for scope growth but the approach will be to estimate cost based on a given scope. Risk and uncertainty analysis in this case focuses on the risk associated with a cost or schedule over-run.

The ASA(ALT) Agile Metrics Playbook[7] contains required and optional reporting of agile program management metrics, some of which may have usefulness for software cost estimation.

- **Cost Per Release -** may have usefulness for estimating effort or direct costs on an agile project when there are comparable releases being delivered.
- **Cost Per Agile Team -** may have usefulness for estimating direct costs when there is comparable complexity of the software, capability of the agile team, and labor rates of the agile team.
- **Recidivism Rate -** may have contextual usefulness for estimating effort to remediate rejected stories on an agile project.

iv. Other Software Cost Driver Considerations

In addition to size, productivity, and development methodology, there are several other factors that the cost estimator should consider. Each of these are addressed in the following sections.

1. Program Management

Software development involves activities that go beyond the process of writing code. Program Management is an example of a task that may or may not be included in the effort hours reported for software development. For example, a contracted effort under a firm fixed price contract will likely include program management in the cost and effort. Time and materials contracts, as well as government efforts, may or may not separate program management. For the cost estimator, the key principle is that for any metric that includes effort hours, the activities included must be fully understood. This concept applies for all potential activities included in software development such as requirements analysis, design, testing, and integration.

An example can help illustrate this concept. Assume that the estimator is told that historical software development productivity for a given organization is 0.2 function points per person-hour. If the estimator also is given a function point size estimate of 2,000 function points, then effort can be calculated as size divided by productivity, resulting in 10,000 person-hours. But does this effort include program management, or any other activities associated with development? The answer depends on the context and derivation of the productivity factor. If the productivity factor was calculated using data on only software development and no other activities, then the estimator will need to determine which other activities, such as program management, are required. The estimator would then find a way of estimating other activities and add then to the 10,000 hours of development. On the other hand, if the productivity factor includes the full end-to-end development process, then the estimated 10,000 hours has a different meaning. In either case, the estimator would apply cost associated with 10,000 hours into a larger cost estimating structure at the appropriate level.

2. COTS Estimation

In the world of software and IT estimating, developed software is only one possible category. Purchase of Commercial Off-the-Shelf (COTS) software is another category that often accompanies software development. The estimating tools for COTS software differ from those used for developed software. Size and productivity are not relevant for COTS. Instead, estimators will need data on number of licenses, license structure (per user, per location, etc.), and cost per license. Commercial pricing, as reported on public websites such as https://www.gsaadvantage.gov/, can be a good data source. Other possible sources include requests for vendor quotes, or historical costs for software licenses.

3. Cyber Security

As with Program Management, cyber security is another activity that is closely tied to software development. As discussed in the previous section, the estimator needs full visibility into whether source data includes costs for cyber security, or whether these costs need to be added to the estimate.

Because cyber security is an ongoing and never-ending issue, costs for this activity are often part of software sustainment. Cost estimating methods of software maintenance are summarized in section 4.ii.

4. Cloud Infrastructure and Services

Costs for cloud storage and compute are an increasing part of a software / IT estimates. Programs often have the choice of conducting development activities on dedicated on-site infrastructure, remotely hosted services, or a combination of both. Cloud costs may be incurred as a service from a commercial provider, as a service from a government provider, or as a cost to buy and host on-premises hardware. The engineering build-up/bottoms-up cost estimation method has proven useful for estimating cloud costs.

Within the category of cloud costs, the estimator will want to consider the costs for storage, computer, and network. Storage refers to the costs to store data, often in high volume. Cost drivers for cloud storage include the amount of data, how frequently data needs to be accessed, and retention policy. Cloud compute refers to the cost to run virtual servers in a cloud environment. Cloud compute costs drivers include number of virtual servers, and the technical configuration of each server. Cloud network cost refers to the applications necessary to interconnect cloud resources and make them securely available to users. Cost drivers for cloud networking include the security and backup requirements for cloud data, as well as the location and access requirements of users. Different cloud services can be

selected from Cloud Service Providers (CSPs), these services can range from a basic computing infrastructure on which government agencies run their own software, to a full computing infrastructure that includes software applications. In defining cloud service models, NIST identifies three primary service models:

- **Infrastructure as a Service (IaaS)** - The CSP delivers and manages the basic computing infrastructure of servers, software, storage, and network equipment. The customer provides the operating system, programming tools and services, and applications.
- **Platform as a Service (PaaS)** - The CSP delivers and manages the infrastructure, operating system, and programming tools and services, which the customer can use to create applications.
- **Software as a Service (SaaS) -** The CSP delivers one or more applications and all the resources operating system and programming tools and underlying infrastructure, which the customer can use on demand. Refer to Figure 5 for a detailed break out of responsibilities.

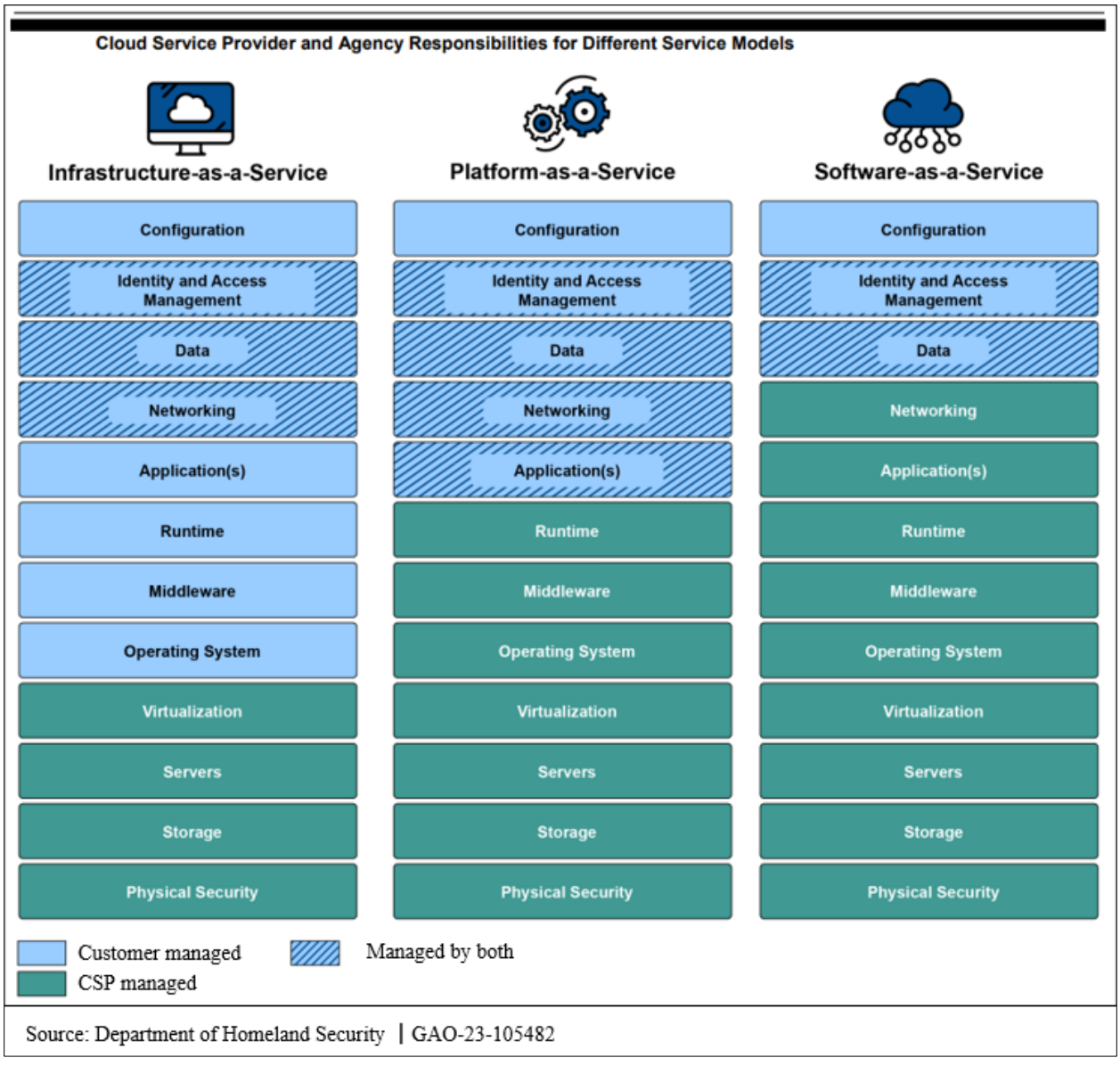

Figure 5: Cloud service provider and agency responsibilities for different service models

5. Facilities

In situations where the IT program requires dedicated facilities, then this cost must also be considered. Facilities costs are often seen on programs that use on-premises hosting, have elevated security considerations, or require operational hardware or integration and testing. Cost drivers for this element include the size of facility required, and the security requirements / classification level required. Consideration must be made if the use of development, integration, or test/tactical laboratories is required and if there is a cost associated with their services.

v. Software Product CES

Reporting cost for the procurement of a software product follows a similar categorization process as a hardware system, in which costs for software development and its other supporting cost drivers, such as program management and testing, should be reported to the Army Cost Estimating Structure (ACES) most related to the effort.

See Appendix 4 for full list of ACES for DBS (Defense Business Systems) and non-DBS systems.

4. Software Maintenance

Modifications to software to address faults, performance, and changes to the operating environment are considered software maintenance. Software maintenance differs from software development in that it is focused on modifying an already existing capability. Because of this, maintenance takes place as soon as a release of software is deployed which often occurs along with or prior to the first unit of hardware production. Software maintenance can be categorized as adaptive, corrective, perfective, or preventative[8].

- **Adaptive** – modification to maintain usability in a changed environment.
- **Corrective** – reactive modification to correct discovered problems.
- **Perfective** – provide functional enhancement to users.
- **Preventative** – enhance maintainability.

Each form of maintenance can be decomposed into Software Change Product, Sustaining Engineering, Licenses, Cybersecurity, Project Management, System Facilities, Field Software Engineering, and Follow-On User Training.

i. Software Maintenance CES

Given that software maintenance modifies an existing capability, costs for software maintenance are captured under an individual CES element, see Appendix 4 for the software maintenance CES element for production and sustainment. The Software maintenance CES is broken into the follow subcategories provided in Figure 6.

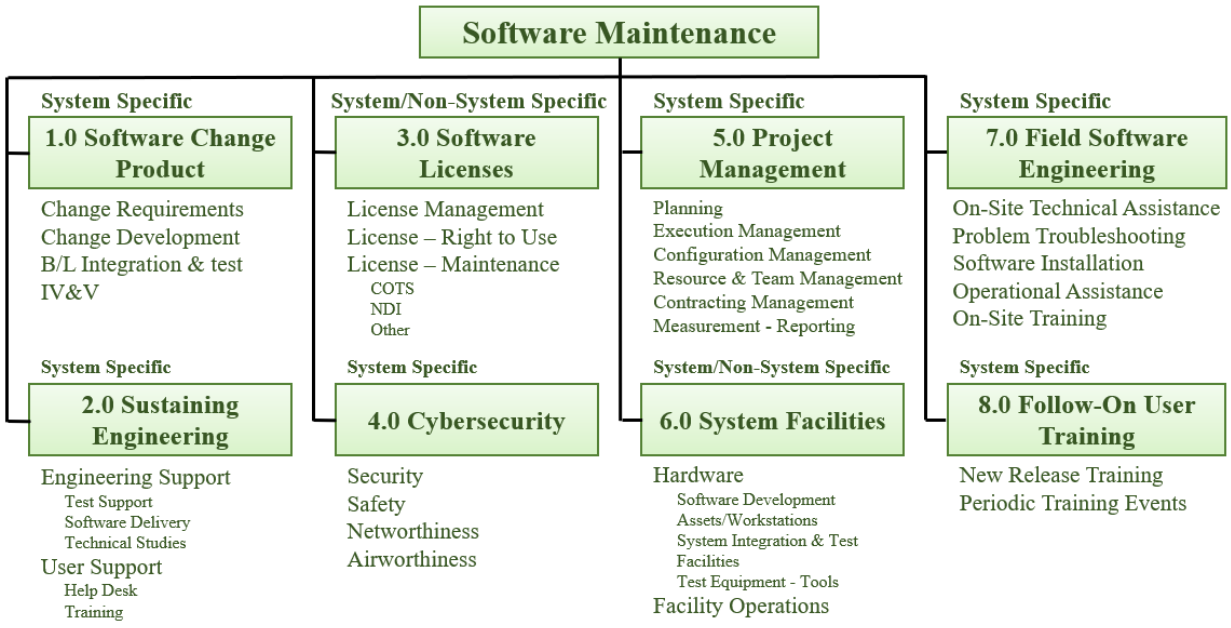

Figure 6: Software maintenance CES

1.0 Software Change Product – products and activities associated with defining, allocating, generating, integrating, and testing software changes for an operational software product or system.

2.0 Sustaining Engineering – products and activities associated with system specific test, delivery, and training support.

3.0 Software Licenses – products and activities associated with the procurement and renewal of software licenses for operational software.

4.0 Cybersecurity – products and activities associated with verifying a software system against externally defined domain performance criteria.

5.0 System Project & Technical Management – products and activities associated with system specific software maintenance project and technical management.

6.0 System Facilities – products and activities associated with establishing and operating software maintenance related development, integration, and test facilities, and support equipment and tools.

7.0 Field Software Engineering – products and activities associated with the on-site support of a deployed software product or system in its operational environment.

8.0 Follow-On User Training – products and activities associated with new release training/periodic training events driven by a software change.

ii. Software Maintenance Estimating Methods

The primary methods for estimating software maintenance are summarized in Table 4:

Table 4: Software maintenance estimating methods

Estimating Method	Definition	Example
Cost Factor-based	Approaches that estimate software sustainment cost as a percentage, or factor, of some other (estimated) cost.	Cost = 15% of Total Development
Size-based Productivity, and Annual Change Traffic (ACT)-based	Approaches that estimate software product changes costs based on delivered software size and productivity or on the annual amount of code touched or changed.	Productivity = 1,500 FP per FTE Effort = SLOC / Productivity
Parametric CER	Approaches that allow the software cost estimator to create their own CER based on Total Software Changes (TSC) or other measures.	Effort = A + B*SLOC
Commercial Estimating Models	Commercial Estimating Models give estimated hours associated with each type of software maintenance based on key cost driver inputs[1] (e.g., size, complexity, capability).	

Historical Execution Extrapolation	Approaches that rely on FTE historical budget data to estimate software sustainment as steady state level-of-effort (LOE) task.	Cost = previous years funding ^ growth rate

iii. Software Maintenance for Continuous Integration/Continuous Delivery (CI/CD)

Software estimate should be iteratively refined over time as project-specific data becomes available. Once an element of the software project is deployed, it may be advantageous to estimate that element via methods traditionally used for maintenance activities such as extrapolation from actuals (see Chapter 4). Software project elements that are still in development may require engineering, analogy, or parametric estimating methods. However, splitting granular costs into development or maintenance may not be resourceful for cost estimation.

5. Training and Resources

Training and resources are available to support Army cost analysts in software estimating, with an option for certification in some instances. These include, but are not limited to:

- **Defense Acquisition University (DAU)** – an educational-based organization dedicated to provided resources and trainings to the defense community, including software topics. The organization offers the *CBCE 001 Software Cost Estimation Credential* found at https://www.dau.edu/credentials/cbce-001 to provide software knowledge for producing a software cost estimate following the newest acquisitions and technological changes.
- **Udemy** – an educational-based organization with coursework offered on the topic of agile software development.
- **International Cost Estimating & Analysis Association (ICEAA)** – a cost estimating organization promoting shared knowledge amongst members of the cost community. The organization offers publicly accessible resources that include a library of past ICEAA papers found at https://www.iceaaonline.com/archives/ and additional software-centric coursework in *CEBoK-S* for members with the option to obtain a certification upon passing the *Software Cost Estimating Certification Exam (SCEC)* found at https://www.iceaaonline.com/certification/.
- **Cost Assessment Data Enterprise (CADE)** – the authoritative source for defense contractor cost data reporting. CADE offers reference material for Software Resources Data Reporting (SRDR), a mechanism used by the DoD cost and acquisition communities to collect cost and technical data on government and contractor software development, software maintenance, and Enterprise Resource Planning (ERP) development efforts. More information on CADE's SRDR reporting guidance can be found at https://cade.osd.mil/policy/srdr.
- **International Function Points Users Group (IFPUG)** – a community-led organization dedicated to growing public understanding and application of Function Point software sizing. The organization offers an *IFPUG Learning Center* for all levels of professionals along with various certifications and accreditations in function point counting and simplified function point counting, including *Certified Function Point Specialist (CFPS)*, *Certified Function Point Practitioner (CFPP)*, and *AD/M Benchmarking Certification*.

6. Off-the-Shelf Estimating Tools

Off-the-Shelf (OTS) estimating tools or commercial/publicly available parametric models are used by the costing community to automate estimation of cost and schedule of developed software. These models allow users to generate estimates using commonly known inputs to generate cost and schedule estimates. However, these models are limited by a lack of full transparency and the differences in terminology and definitions across models. Some examples of OTS models used include QSM-SLIM, SEER, True Planning (PRICE), COCOMO, COSYSMO, Putnam model, AFCAA REVIC model.

In order to combat the issues with the OTS models, it is important that software estimates be conducted using parametric tools that can be traced to historical data and are calibrated using this data. Model calibration applies trends in actual historical data from specific programs or organizations to adjust the algorithms of the out-of-the-box

models. Each of the common OTS models has a set of standard software development activities. These activities need to be mapped to the activities in the historical data.

7. References

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Chapter 8 Military Construction Costing

1. Introduction

The purpose of this chapter on Military Construction Costing is to provide a general understanding of the components used to generate ROM installation costs for military construction projects (MILCON), including sustainment, restoration and modernization (SRM). This Chapter identifies information which should be included in the supporting cost documentation, and provides some references and sources of installation cost data and guidance, including the Facilities Costing Template. The Facilities Costing Template is available from the Cost and Performance Portal located at https://cpp.army.mil/.

A MILCON project consists of all work necessary to produce a complete and usable facility, or a complete and usable improvement (renovation) to an existing facility. A MILCON project includes all construction work, land acquisition, supervision, inspection, and overhead costs. It also includes procurement and installation of specific types of built-in (installed) equipment necessary to make a facility complete and usable.[16]

MILCON and Army Family Housing – Construction (AFH-C) costs are generally associated with major construction projects. Per the Army Military Construction and Non-appropriated Funded Construction Program Development and Execution Pamphlet (DA PAM 420-1-2, Section B-5), major construction projects are those that have a funded cost in excess of the statutory limitations on minor construction projects ($750K).
MILCON cost estimates are typically generated to reflect how much it will cost to construct new facilities within a POM Cycle. In some cases, the MILCON project(s) may be programmed in one or more fiscal years. As a result, the costs need to be outlined in detail, for each fiscal year. Most MILCON estimates in the C-BA packages are in summary format without any detailed cost documentation (in spreadsheet format) that can be traced to it.
There is specific information required in order to develop a MILCON estimate. For instance, if there is a requirement to construct a new building or facility at a particular location, an analyst must first identify the type of building or facility and the location. If construction of military

[16] DA PAM 420-1-2 page 135.

housing is required, the requestor should specify whether or not it is enlisted, unaccompanied, personnel housing, enlisted barracks or transient training. Additionally, the following details should be considered in developing a MILCON estimate:

- *Facility type(s)* - e.g. enlisted unaccompanied personnel housing;
- *Real property (facility) codes* – e.g. 72111;
- *Unit cost per quantity* - e.g. $186.23 per sq. ft.;
- *Quantity required* – e.g. 99,500 sq. ft. (Source: program requirement information);
- *Adjustment factors pertinent to the project's features, technical requirements and location* - e.g. area cost factor
- *Inflation factors* - e.g. 1.0727.

After you have determined all the appropriate details, components and factors, the estimate should be computed as follows:

- Unit Cost Per Quantity * Area Cost Factor x Project Cost/Size Adjustment Factor x Technology Complexity Factor = Adjusted Unit Cost.
- Total Cost Before Inflation * FYXX MILCON Inflation Rate (Weighted Composite Rate) = Total Project Cost After Inflation.

There are other factors/adjustments and supporting facility costs that are built in to the true cost of MILCON projects that are programmed in the DD Form 1391 Processor and validated by the United States Army Corps of Engineers (USACE). If there is a DD Form 1391 Processor for the MILCON project, you should include the project numbers or the actual DD Form 1391s and the USACE point of contact information in the documentation.

2. Sustainment Restoration and Modernization (SRM) Cost Components

An SRM cost estimate reflects the annual operating costs that will be required for sustainment, restoration and modernization of the facilities over the program years and life cycle. The following is a list of relevant components:

- *Facility type(s)* - e.g. enlisted unaccompanied personnel housing;
- *Real property (facility) codes* – e.g. 7210;
- *Unit cost per quantity* - e.g. $3.45 per sq. ft.;
- *Quantity required* – e.g. 99,500 sq. ft. (program requirement information – you provide);
- *Area cost factor* - e.g. – Fort Hood - .89 and;
- *Inflation factors* - e.g. 1.0732 for FY14 OMA APPN.

After you have determined all the appropriate details, components and factors, the estimate should be computed as follows:

- Adjusted Unit Cost * Quantity Required = Total Annual Cost Before Inflation.
- Total Annual Cost Before Inflation * FYXX OMA Inflation Rate (Weighted Composite Rate) = Total Annual Project Cost After Inflation.

3. Base Operations Support/Maintenance (BOS) Cost Components

A BOS cost estimate reflects the annual operating costs that will be required for facility maintenance over the program years and life cycle. Generally, these costs consist of water, wastewater, real property management, custodial, refuse collection, grounds maintenance, pavement clearance, and pest control services. However, all facility types may not require these services for annual operations; it depends on the facility type.

The following is a list of the components:

- *Facility type(s)* - e.g. enlisted unaccompanied personnel housing;
- *Real property (facility) codes* – e.g. 7210;
- *Unit cost per quantity* - e.g. $0.18 per sq. ft.;
- *Quantity required* – e.g. 99,500 sq. ft. (program requirement information – you provide);
- *Area cost factor* - e.g. – Fort Hood - .89 and;
- *Inflation factors* - e.g. 1.0732 for FY14 OMA APPN.

After you have determined all the appropriate details, components and factors, the estimate should be computed as follows:

- Adjusted Unit Cost * Quantity Required = Total Annual Cost Before Inflation.
- Total Annual Cost Before Inflation * FYXX OMA Inflation Rate (Weighted Composite Rate) = Total Annual Project Cost After Inflation.

4. Guidance/Source References for Generating MILCON, SRM, and Maintenance Estimates

The following references are available to assist in identifying and gathering the information necessary to generate a ROM facilities cost estimate for MILCON, SRM and Maintenance.

- **DA-PAM 415-28** - *Guide to Army Real Property Category Codes*. This pamphlet can assist the user in identifying real property codes and facility types, as well as provide a brief description of the facilities.
- **PAX Newsletter 3.2.2** – For MILCON (new construction) unit costs with the desired facility types.
- **DoD Facilities Pricing Guide** – For SRM (sustainment, restoration and modernization) unit costs and BOS (base operations - maintenance services).
- **DoD Facilities Pricing Guide or PAX Newsletter 3.2.1**. - Area cost factors for the desired facility types
- **OSD Joint Inflation Tool** – For the inflation factors.

In addition to the references notes above, the DASA-CE managed Facilities Costing Tool/Template can assist the user in developing generic or rough order of magnitude (ROM) estimates. It is available from the Cost and Performance Portal located at https://cpp.army.mil/.

Chapter 9 Demilitarization and Disposal (D&D) Costing

1. Background

Demilitarization and Disposal (D&D) costs are another special topic to consider. D&D removes equipment and facilities from the inventory. D&D includes transfer, donation, selling, redistribution, and disposal. D&D is a joint function of the Army Materiel Command (AMC) and the Defense Logistics Agency (DLA). In determining D&D costs, the system product manager (PM) must consider Department of the Army (DA) turn-in directives, parts reclamation for legacy systems, current fielding plans, support contracts, and setting up inventory trades that can impact costs.

Demilitarization (DEMIL) renders a system (or its sub-component item) inoperable by destroying the inherent military advantage, whether offensive or defensive. The procedures are tailored and specific to the system detailed in the D&D Plan. Distribution of inert materials and support equipment, hazardous waste disposal, transportation and recycling contribute to the D&D cost component.

2. Resources

The following documents provide guidance for D&D activities.

- **DoD 4160.21-M**, *Defense Materiel Disposition Manual*: addresses policies/procedures to

dispose of items, including sales and donations.

- **DoD 4160.21-M-1,** *Defense Demilitarization Manual:* focuses on the demilitarization procedures required before items can be disposed. This manual also addresses demilitarization coding.
- **DoD 4160.28 vol. 1-3**, *Defense Demilitarization*: focuses on demilitarization requirements and performing physical DEMIL of DoD personal property and DEMIL coding of systems and sub-systems
- **DoD 2030.8,** Trade Security Control on DoD Excess and Surplus Personal Property: Addresses Trade Security Controls which prevent military-sensitive material from being released to the public or foreign governments by ensuring proper licenses are in place.
- **AR 700-144,** Demilitarization and Trade Security Controls, is a key document for Army demilitarization managers. This regulation addresses Army policies to comply with DoD 4160.21-M-1, with a major focus on demilitarization.
- **DA PAM 70-3,** Army Acquisition Procedures, provides points of contact for Army demilitarization operations (i.e., Office of the Deputy Chief of Staff for Logistics [Pentagon]). Appendix X and XI to PAM 70-3 provide guidance on the disestablishment plans the PM must develop, i.e., when an entire program and program office are terminated (as opposed to demilitarization of aircraft).
- **DoDD 5530.3,** International Agreements. For Foreign Military Sales (FMS) cases, the PM should contact the Deputy Under Secretary of the Army for International Affairs (DUSA (IA)) office for further guidance. The US Army Security Assistance Command is the focal point for Army FMS, with DoD activities managed by the Defense Security Cooperation Agency. Relevant guidance for FMS includes the Defense Logistics Agency (DLA) Foreign Military Sales Handbook.

3. Methodology

Depending on the acquisition status, the analyst for the D&D activities may refer to the D&D Plan developed by the project management office (PMO) following DI-MISC-80508A specific to a weapon system. For programs that are in the early phases of acquisition (TMRR, Pre-MS-A, or MS-A), system configuration is less well-defined so the D&D estimate will be developed using the analogy technique based on historical data from a comparable system.

The D&D Plan is an integrated plan describing the system, its function, materials of construction and components, how to disassemble to facilitate demilitarization of components, safety requirements related to the demilitarization processes and the environmental considerations and/or liabilities associated with the disassembly, demilitarization and disposal processes.

The US Army Environmental Command (USAEC) uses MS Excel as a tool for developing D&D cost analysis for weapon systems. USAEC uses a MS Excel spreadsheet to provide cost data information encompassing the environmental life cycle cost of a weapon system related to sustaining/protecting the environment in which the system must operate as intended. This is known as Environmental Quality Life Cycle Cost Estimate (EQLCCE). The EQLCCE is arranged in tabular sections namely; *Summary & Overview, Phased Results, Production/Fielding Schedule & Assumptions, Environmental Documents, Base Operations & Support (O&S), and Unit Demil Cost.* Oftentimes extra tabs for *OMA* and *Other Procurement Army (OPA)* are included for inflation indices.

The following steps are considered when developing an EQLCCE or D&D cost analysis. All these are accomplished through participating in the Cost Review Board Working Group (CRB WG), interactions with the PMO and DLA.

- Familiarization with the Program Status (Pre-MS-A,MS-A, MS-B or MS-C)
- Determination of components & specifications of the new system (as they become available)
- Determination of the program procurement quantity and fielding schedule
- Reference current demilitarization cost database with the DLA; this includes demilitarization preparation, transportation and storage costs and current changes to the demilitarization & disposal contracting strategy for lowering government D&D cost
- Determine hazardous material disposal and waste stream that a system will generate during its life cycle.

The following information is vital to performing EQLCCE or D&D cost analysis. These are typically obtained from the PMO and other database such as the OSMIS library.

- Weight, power and size of the system
- System OPTEMPO
- POL and hazardous material property and waste stream anticipated with the system life cycle
- Demilitarization & Disposal Plan specific to the system
- System National Environmental Policy Act (NEPA) document in support of the installation NEPA manager where a new system is to be fielded

Depending on the program, not all weapon systems require a complete EQLCCE; for example electronics, laptop computers, radio & antenna, radar system and others do not require a complete EQLCCE. These systems may not have a direct impact on an Army Installation O&S program. However, the platforms on which these components are integrated, for example, vehicles, do have a direct impact. Tanks, combat support vehicles, power generation systems, tactical vehicles, and new facilities will have a direct impact to the installation O&S program and therefore will require an EQLCCE. Additionally, ammunitions and ordnances will potentially cause soil, surface or groundwater contamination, and may contribute to the air pollution at training ranges.

4. Example of EQLCCE or D&D Cost Analysis Using MS Excel

For illustration purposes, the following figures provide an EQLCCE example for a notional version of the Joint Light Tactical Vehicle (JLTV) program. Figure 8 shows the Summary and Overview Tab, Figure 9 shows the Phased Results Tab, Figure 10 shows the Production/Fielding Schedule and Assumptions Tab, Figure 11 shows the Environmental Documents Tab, Figure 12 shows the Base O&S Tab, and Figure 13 shows the Unit Demil Cost Tab.

EQLCCE (JLTV Variants)	BY_$K
EQLCCE Grand Total Cost	**$**
Demil & Disposal	
GP	$
ME	$
MC	$
Base O&S Environmental	
Conservation	$
Compliance	$

Pollution Prevention	$
Remediation & Restoration	$
NEPA & Env Documents	
LCEA	$
PESHE	$
HMMP	$
Installation Specific EA's (Categorical Exclusion (CATEX) or Record of Environmental Consideration (REC))	$
NEPA Compliance (Stationing/Programmatic EA)	$

Figure 7: Summary and Overview Tab

D&D cost for General Purpose (GP), Medical Evacuation (ME), and Mortar Carrier (MC) variants is summarized from the Phased Results Tab for each variant. The Base O&S Environmental cost is from the Base O&S Tab. The NEPA & Environmental Documents cost is from the Environmental Documents Tab.

The System EUL of 25 year is used for illustration purposes. Table reflects X1,Y1, & Z1 demil costs of a number of system variants subject to demilitarization in FY44 - 25 years from the initial fielding in FY19. The number of system for demilitarization is to be multiplied by the demil unit cost from the Unit Demil Cost Tab. Depending on the Base-Year (BY) used, the appropriate inflation indices will be applied to determine the Then-Year (TY) demil cost.

Phased Demil Cost								
JLTV Variant		**FY44**	**FY45..**	**FY65**	**FY66**	**FY67**	**FY68**	**FY69**
General Purpose - GP		X1	X2	X22	X23	X24	X25	X26
Medical Evacuation - ME		Y1	Y2	Y22	Y23	Y24	Y25	Y26
Mortar Carrier - MC		Z1	Z2	Z22	Z23	Z24	Z25	Z26

Figure 8: Phased Results Tab

In most cases not 100% of the total procured system will be subject to demilitarization as there will be some number sold through FMS, or donated for display or through Title 10. GP variant demil cost (X1) in FY44 calculation:

X1 = (20 less FMS, Title 10 qty)*Unit Demil Cost

Data on this Table is derived from the approved Cost Analysis Requirement Description (CARD). The schedule may change as the program evolves requiring update to the EQLCCE.

Production & Fielding Schedule

JLTV Variants	FY18	FY19	FY20…..	FY40	FY41	FY42	FY43	FY44
General Purpose - GP								
Medical Evacuation - ME								
Mortar Carrier - MC								

Figure 9: Production/Fielding Schedule and Assumptions Tab

Costs associated with the program Life Cycle Environmental Assessment (LCEA,) Programmatic Environmental Safety and Occupational Evaluation (PESHE) and Hazardous Material Management Plan (HMMP) are normally included in the Independent Cost Estimate with the Program Office. These costs are taken into account in putting together a complete EQLCCE only to demonstrate the overall environmental cost related to the system life cycle and should be recognized by the analyst to avoid duplicating cost.

Environmental Document Costs	Initial	Update
Program LCEA		
Program PESHE		
Program HMMP (CDRL)		
Installation Specific Environmental Assessments (CATEX or REC)		
NEPA Compliance (Stationing/Programmatic EA)		

Figure 10: Environmental Documents Tab

This section of the EQLCCE tabulates the big four (4) cost drivers for environmental compliance and sustainment at Army Installations. The cost is driven by the usage (OPTEMPO) of the equipment (i.e., ground vehicle, Tanks, Unmanned Aircraft Systems (UAS)/Unmanned Aerial Vehicles (UAVs), etc.), including the waste stream associated with repair & maintenance of the system at training ranges. Only a certain percentage of the total equipment procured are considered in the analysis as the majority of the equipment are stored at the Depot until deployment. *The Environmental Quality Consolidated Cost Handbook, Dec 2014,* prepared for the United States Army Environmental Command is used to project these costs adjusted against inflation.

System or System variant	Conservation Unit Cost (*1*)	Compliance Unit Cost (*2*)	P2 Unit Cost (*3*)	Remediation Unit Cost (*4*)

Figure 11: Base O&S Tab

1. Conservation Unit Cost - cost associated with maintaining training centers, test ranges, and installations to ensure extended life for these areas and ensure military readiness.
2. Compliance Unit Cost - cost include all activities that will ensure current operations at Army installations meet Federal, State and Local regulations/requirements to include wastewater discharge, noise abatement, wetlands, air quality attainment, historic properties, solid and hazardous waste management.

3. Pollution Prevention (P2) Unit cost - cost to eliminate, reduce and/or prevent pollution to the greatest extent possible.
4. Remediation & Restoration Unit Cost– cost associated with cleaning up of contamination resulting from peacetime training operations at training ranges.

This section of the EQLCCE presents data information leading to the prediction of the system or unit demil cost.

System Nomenclature (subj to Demil & Disposal)	Unit Qty	Trx (*1*)	Demil Prep (*2*)	Hazwaste Disp (*3*)	Non-Haz Disp (*4*)	Electronics Disp (*5*)	Scrap/PM (*6*)	Demil Cost per Unit

Figure 12: Unit Demil Cost Tab

1. Trx – Transportation cost shipping the system for demil at the demil site (typically at the Depot)
2. Demil Prep – Demil preparation includes admin cost per system. The Defense Logistics Agency (DLA) is currently responsible for this portion. Prior responsibility was with the Defense Reutilization and Marketing Office (DRMO). Historically, this cost was $950/vehicle, but DLA must be contacted to determine the current demil contracting approach.
3. Hazwaste Disp – Disposal cost of hazardous waste ($/lb)
4. Non-Haz Disp – Disposal cost for non-hazardous waste that is not reused or recycled
5. Electronics Disp – Disposal cost of electronics and components containing EPA regulated material (e.g., lead) ($/lb)
6. Scrap/PM – Scrap metal (mixed) for recycling and/or Precious Metal found in some electronics sold at current market value ($/lb)

The demil cost per unit is the total of *1* thru *5* less the amount of revenue from selling scrap metals (mixed).

The assumptions for weight (lb) and cost ($/lb) information are always shown within the same tab for which they are applied in the calculation. Weights used are based on the percentages of the overall system weight and the cost per pound taken from the most current environmental cost database.

Chapter 10 Force Costing

1. Introduction to Force Costing

Another special topic to consider is Force Costing. Years ago, DASA-CE recognized that while the Air Force and Navy largely focused their management attention on platforms (warships and aircraft), the Army's essential focus was on the unit. This focus makes the development of accurate cost estimates for force units an absolute necessity within the Army. With minor exceptions, every dollar that the Army spends is directly or indirectly in support of fielding and sustaining capable force units. Significant resources are devoted to supporting force units, including personnel, equipment, facilities, and supplies. The variety of the resources involved, and the complexities of the support structure contribute to the difficulties of projecting accurate force unit costs.

DASA-CE responded to this challenge by developing the FORCES suite of models, which provides DASA-CE and the Army with a powerful set of tools that can quickly provide answers to complex force costing questions. See Chapters 10.10 and 12.8 for additional detail on the FORCES suite of models.

2. Activation

Activation costs include moving personnel and equipment to the location at which the new unit is activated. If the equipment is already on station, no costs are incurred. However, we must assume that personnel for the new unit will be drawn from throughout the Army, so Permanent Change of Station (PCS) costs will be incurred.

Facilities for the new unit must be considered. If current barracks, headquarters buildings, vehicle parks, etc. are available for the new unit's use, no costs will be incurred. If adequate facilities are not available, costs for constructing them will be incurred.

3. Inactivation

Inactivation of a unit results in savings, but also incurs costs.

- Savings should reflect the decrease in expenditures for the annual operating and sustainment requirements. This should not include personnel basic pay and allowances since the personnel will likely be reassigned to other units.
- Costs should reflect the actions required to inactivate the unit, to include accelerated PCS for personnel, restoring all equipment to full readiness, and the cost to move equipment to a new location if necessary.

4. Acquisition of Resources

Basic force costing questions include how much does it cost to:

- Buy all the equipment in a unit's Table of Organization and Equipment (TOE)?
- Use available on-hand equipment (depot/war reserve/etc.) to fill as much of the TOE requirements as possible (no cost) and buy the remaining equipment?
- Buy the Munitions Basic Load for the weapon systems in the TOE?
- Buy the Common Table of Allowances items that the unit requires?
- Buy the Organizational Clothing & Equipment that the unit requires?
- Buy the authorized stockage repair parts that the unit requires?
- Buy the Class I, II, and III items that the unit requires?
- Produce the technical publications that the unit requires?

5. Operations & Sustainment (O&S)

O&S costs include the direct and indirect costs incurred to operate the selected force unit at the specified percentages of equipment, personnel, and OPTEMPO for the specified number of months, the geographic location, and the Component in the Base Year. Cost categories include:

- Direct Operations: the reparables, consumables, and POL costs of Air and Ground operations during normal home station training.
- Training Ammunition & Missiles: the average annual training ammunition expenditures
- Postproduction Software Support: the annual cost to maintain software and the 5-year amortized cost to modernize software.
- Indirect Support: those costs incurred as a result of training operations and other support

required to conduct training.

- Personnel:
    - Replacement Personnel Training includes the costs to train the personnel through initial military occupational specialty (MOS) qualification and their initial issue clothing.
    - PCS cost includes travel of the military personnel, their dependents, and the movement of household goods and privately owned vehicles.
    - Military Personnel includes the basic pay and allowances, basic allowance for housing (BAH)/overseas housing allowance (OHA), cost of living amount (COLA), and Special, Incentive, and Hazardous Duty Pay authorized the personnel in the unit based on the grade, military occupational specialty (MOS), special qualifications indicator (SQI), and/or additional skills identifier (ASI).
- Other Unit Support: costs of Installation Services and Medical Support from the Defense Health Program (DHP). The Installation Services costs are expended by the installation and the DHP costs are expended by the Department of the Defense.

6. Movement of Units

Costs to move a unit's personnel and equipment can be either a tactical deployment or an administrative unit relocation. Each type of movement must account for different rates of moving different categories of resources: aircraft, tracked vehicles, wheeled vehicles, other unit cargo (fits inside container), general cargo (does not fit inside container), and personnel.

An administrative movement is basically a PCS move of all personnel, dependents, household goods, and equipment.

A tactical movement is basically a unit deployment, moving only the unit's personnel and equipment anywhere in the world.

7. Contingency Operations/Exercises

The analyst must be able to develop cost estimates for any of the six identified phases of an operation or exercise. The phases consist of:

- Pre-deployment: costs to prepare for the operation or exercise at home station prior to movement.
- Deployment: costs to move the personnel and equipment from home station to the location of the operation or exercise.
- Operations and Sustainment: costs to operate and sustain the personnel and equipment at the location of the operation or exercise.
- Redeployment: costs to move the personnel and equipment from the location of the operation or exercise to home station or to a new location.
- Reconstitution: costs to restore the equipment used in the operation or exercise to full readiness.
- Demobilization: cost to demobilize Reserve Component units were used for the operation or exercise, the costs to demobilize and return the personnel to an inactive training status.

8. Force Design Update (FDU)/Concept Plan

The FDU is used to develop consensus within the Army on new organizations and changes to existing organizations and to obtain approval and implementation decisions. On a semi-annual basis, the FDU process addresses organizational solutions to desired capabilities and improvements to existing designs in which other training, materiel, personnel, or facilities solutions were insufficient.

A Concept Plan is a detailed proposal by a MACOM/Agency to create or change one or more units when the level of change reaches a specified threshold. The purpose of a Concept Plan is to ensure that appropriate resources are used to support Army objectives, priorities, and missions.

Once all changes are finalized, the cost of implementing those changes must be determined.

9. Stationing/Location

The location at which a unit is stationed or operates can significantly affect costs. The cost of living, cost of labor, regional differences, and laws/regulations/Status of Forces Agreements must be taken into account when estimating the cost for the unit.

10. FORCES Overview and Access

DASA-CE developed FORCES to produce realistic, current, and supportable force structure cost estimates quickly and efficiently, while meeting stringent user requirements and the needs of the Army cost community. The FORCES models, along with AMCOS and OSMIS, are available at https://www.cave.army.mil/.

i. FCM

The FORCES Cost Model (FCM) addresses the day-to-day costs to operate military units. FCM is used throughout the Army as a component for decisions at all levels. FCM provides quick, reasonable estimates for the following events in a force unit life cycle: Operations & Sustainment, Acquisition of Resources (modernized or with current equipment), Activation, Inactivation, and Movement.

ii. ACM

The Army Contingency Operations Cost Model (ACM) can assist planners in determining requirements for contingency operations and can assist with planning for training and exercise deployments. In ACM, costs estimates can be developed to include the following phases of an operation: Pre-deployment, Deployment, Operation & Sustainment, Redeployment, Reconstitution, and Demobilization.

iii. UCM

The Unit Conversion Model (UCM) provides the capability to estimate the cost to convert a unit type (by SRC) to another unit type (by SRC). The model uses existing equipment and personnel as well as provides the functionality to import an SRC from FMSWeb and modify the equipment and personnel. The UCM is flexible enough to add future enhancements that will provide additional costs associated with converting a unit, such as moving equipment and training personnel.

iv. TDA

The Table of Distribution and Allowances (TDA) provides analysts with the capability to estimate annual operating costs of the Army's non-TOE force down to the Unit Identification Code (UIC) level of detail. The model uses existing equipment, installation, personnel, and contractor cost data, and is flexible enough to add modules in the future to estimate additional costs.

v.CFH

The Cost and Factors Handbook (CFH) is a user-friendly version of the data contained in the costing models. The CFH also contains a subset of data available for analysts not primarily working in force costing. Dozens of data files with data useful for generating a variety of cost estimates are contained in the following subcategories:

- Military Personnel Costs
- Civilian Personnel Costs
- Operating Tempo/Flying Hours
- Transportation and Deployment Factors
- Unit Support Costs
- Force Structure Data
- General Factors
- Air and Ground Reimbursement Rates

Chapter 11 Acquisition Life Cycle Costing Considerations

1. Different Types of Cost Estimates

There are many different types of cost estimates used during the acquisition life cycle. When determining what type of estimate will be used at any given point, the analyst should be able to answer the following questions about the estimate at hand.

1. Who is responsible for it?
2. What will it be used for?
3. When is it required?
4. How will it be used? (ex: POE is used throughout the life cycle, ACP/ICE are required at milestones)

The Cost Analysis Requirements Description (CARD) provides a detailed description of the acquisition program and is used to prepare the cost estimates.

i.POE

DODI 5000.73 defines a Program Office Estimate (POE) as a cost estimate developed by the program management office (PMO) or by a government cost estimating organization on behalf of the PMO. The POE represents a snapshot in time.

ii.CCE

The Component Cost Estimate (CCE) is defined within the DOD 5000.73 as documenting the cost analysis conducted by the Service Cost Agency (SCA) in cases where the SCA is not developing an ICE. This cost analysis may range from an SCA non-advocate estimate, independent SCA assessment of another government estimate, or other SCA cost analysis, as determined by the SCA and reflected in DoD Component policy. The CCE is used to test the reasonableness of the POE. In conducting the analysis, the CCE analyst takes a different, independent approach from the POE.

iii.ICE

The ICE (Independent Cost Estimate) is defined in the DOD 5000.73 as an independent estimate that covers the entire life cycle of the program, including the development, production, operations and support, and disposal phases, regardless of funding source. The term “independent” refers to organizational and analytic independence. Organizational independence means that the cost estimate is prepared by an entity

that is outside of any organization that would provide undue influence over the estimate. Analytic independence means that the cost estimate is free of any bias or preconceived notions about the program's most likely cost.

iv. ACP

DoDI 5000.73 defines a Component Cost Position (CCP) as the cost position, a cost estimate, established by the DoD Component, derived from the CCE and the POE, required for decision reviews for ACAT I MCA and BCAT I DBS pathway programs. Army CCPs are called Army Cost Positions (ACPs). The DASA-CE CRB Office is responsible for preparing ACPs. DODI 5000.73 requires that CCPs must be signed by the DoD Component Deputy Assistant Secretary for Cost and Economics (or Defense Agency equivalent) and include a date of record. In the Army, the Assistant Secretary of the Army (Financial Management & Comptroller) (ASA-FMC) approves ACPs.

An ACP is the Army's consensus view, presented to the Milestone Decision Authority, of the lifecycle cost estimate for an acquisition program. The ACP should be the single cost estimate supporting the program's baselining (Acquisition Program Baseline), contracting, planning, programming, budgeting, and execution. For DoD milestone reviews, the ACP satisfies the DoDI 5000.73, 5000.85 MCA, and 5000.75 BDS requirement for a Component Cost Position. The ACP, as are POEs and CCEs, is a snapshot in time, based on the acquisition program's scope of work and schedule defined in the program's CARD at the given milestone. ACPs derive from an extended process starting with CRB review and approval of the program's CARD, followed by an ODASA-CE acquisition costing division developed CCE and culminating in a detailed reconciliation consolidating the best methodologies and data of the CCE and the POE into the ACP. The CRB Office analyst and CRB Working Group work the process from beginning to end, present and recommend approval of the proposed ACP to the CRB. The CRB may direct changes or forward the ACP to the ASA-FMC for approval.

A critical element of an approved ACP is an affordability analysis by HQDA DCS G-8 Program Analysis & Evaluation Directorate (PAED). This compares the ACP's estimated costs across the POM/FYDP years with the funding programmed to cover those costs, identifying any significant mismatches of fiscal year-phased costs vs. funding. In some cases, the CRB Working Group may recognize such mismatches during the ACP reconciliation effort and propose scope/schedule changes, e.g., rephasing procurement quantities to resolve these issues. The Army must have a credible plan to fully fund the acquisition program to the final ACP estimate. HQDA G-8 PAED documents their affordability analysis and the Army's plan for full funding in an official memo signed by the PAED civilian deputy SES. The CRB Office documents the ACP estimating methodologies and cost results in a Cost Analysis Brief (CAB) signed by the DASA-CE. The CAB and G-8 memo together comprise the ACP package approved by the ASA-FMC.

v. ACE

The Army Cost Estimate (ACE) is an Army-level cost estimate prepared by the DASA-CE CRB Office, when an Army Cost Position is not required, in support of acquisition decision reviews for a program reaching an MCA milestone, initiating an MTA Rapid Prototyping or Rapid Fielding phase, or entering the execution phase of a Software Pathway (SWP). The ACE satisfies DoDI 5000.73, 5000.80 for MTA, 5000.85 for MCA, or 5000.87 for SWP requirements, whichever are applicable. The concept of and approach to an ACE evolved out of the DoD's adoption of the Adaptive Acquisition Framework (AAF) in FY2020, with its emphasis on accelerating the speed of acquisition, and reducing documentation requirements. This drove the need for an "ACP-lite" to support AAF decisions, which are frequently used for ACAT II , III, or below level equivalent programs and may be focused only on the next several years. Development of an ACE follows most of the process steps of an ACP but on a shorter timeline and with

less documentation from the acquisition program office. The program, for example, may choose to submit a shorter "CARD-like" document, or program description, rather than the full-fledged narrative and tabular CARD required for an ACP. After reviewing the program's description and POE, the DASA-CE may tailor the path to the ACE, e.g., directing preparation of a "limited" CCE focused on selected cost elements, waiving briefing events, or reducing the phase of the program's lifecycle covered by the ACE. The latter is the exception to the rule, however: generally, an ACE must be a lifecycle estimate of the acquisition program, using the best assumptions and data available at the time, and not limited to the POM/FYDP or to the duration of the pathway phase being approved.

Like an ACP, HQDA DCS G-8 Program Analysis & Evaluation Directorate (PAED) will prepare an affordability review, but unlike an ACP, there's generally not a requirement to plan and document full funding of the pathway to the ACE estimated costs, and the PAED acquisition division O-6/GS-15 will sign the affordability review memo. The CRB Office documents the ACE estimating methodologies and cost results in a Cost Analysis Brief (CAB) signed by the DASA-CE. There's no requirement for the ASA-FMC to approve the ACE. DI 5000.73 defines a Component Cost Position (CCP) as the cost position (a cost estimate) established by the DoD Component, derived from the CCE and the POE before Milestones A, B, and C and FRP decisions for MCA pathway programs. The DASA-CE CRB Office is responsible for preparing ACPs. DODI 5000.73 requires that CCPs must be signed by the DoD Component Deputy Assistant Secretary for Cost and Economics (or Defense Agency equivalent) and include a date of record.

2. Cost Review Board

The Cost Review Board (CRB) process is an evaluation method for internal control. The CRB process provides an independent review of the cost of ACAT I and special interest ACAT II programs, safeguards assets, checks the accuracy and reliability of cost data, promotes efficiency within the discipline of cost analysis, and encourages adherence to prescribed cost analysis managerial policies.

The Assistant Secretary of the Army for Financial Management and Comptroller (ASA(FM&C)) formed the Army CRB to review cost estimates for major weapon and information systems. This was in response to the need for a comprehensive ACP acceptable to both the acquisition and financial management communities and to support the Planning, Programming, Budgeting and Execution (PPBE).

ASA (FM&C) is responsible for approving the recommended ACP, which is forwarded to the AAE and then briefed following the Army Systems Acquisition Review Council (ASARC), Information Technology Overarching Integrated Product Team (IT OIPT) or Defense Acquisition Board (DAB) briefing patterns. The task of recommending an ACP falls on the CRB Chairperson who is the Principal Deputy ASA(FM&C). The CRB Chair exercises the Army's financial management control responsibility through the operation of the Cost Review Board.

The CRB uses the Integrated Product Team (IPT) approach. This approach improves the quality of the ACP by bringing together experts from the acquisition, combat developments, financial management, and logistic communities. The membership of this board provides a broad range of Army perspectives and experiences required for making sound decisions. The CRB reviews major weapon and information systems at their critical acquisition decision points. All Army and Joint Army Acquisition Category (ACAT) I programs and programs of special interest must have a recommended ACP briefed to the CRB.

The CRB consists of

(a) Principal Deputy, Assistant Secretary of the Army (ASA), Financial Management & Comptroller (FM&C) is the Chairperson of the CRB

(b) Deputy for Cost Analysis ASA(FM&C), Secretary of the CRB:
(c) Permanent Voting Members:
1) Deputy, Chief of Staff for Programming, DCSPRO-FD
2) Deputy Director, Program Analysis & Evaluation Directorate, Army Staff, DCSPRO-PA
3) Director, Assessment & Evaluation, OASA(ALT)
4) Assistant Secretary of the Army for Installation and Environmental ASA (I&E)
5) Vice Director, Information Systems for Command, Control, Communications and Computers (DISC4)
6) Assistant Deputy for Army Budget, ASA(FM&C)
7) Director of Investment Assistant Secretary for Army Budget, ASA(FM&C)
8) Assistant Deputy Chief of Staff for Logistics, ODCSLOG
9) Director of Aviation, Munitions and War Reserve, ODCSLOG
10) Chief, Cost and Economic Analysis Division, Headquarters, AMC
11) Chief of Cost, Training & Doctrine Command, HQ TRADOC
12) Functional Proponent Representative (Information System only)
(d) Ad Hoc, Non-Voting Members:
1) Chief, Program & Manpower Division, HQ FORSCOM
2) Representative from the systems Program Executive Office
3) Other experts the CRB Chair deems necessary (e.g., OSD CAPE Analyst)

The timeline for CRB actions depends on the program ACAT level. A detailed timeline planner for ACP, ACE, and sufficiency review support from DASA-CE can be found at https://www.asafm.army.mil/Portals/72/Documents/Offices/CE/Cost_Product_Timeline_Planner_External_20240221.xlsx or requested from the Cost Review Board office.

3. Selected Acquisition Report (SAR)

If the program is designated as an MDAP or special interest program, the cost estimator will be involved in the Selected Acquisition Report (SAR) development. The APB will use the estimate's base year as the baseline. The estimate's base year will be used in annual percent change comparisons if your program is required to report in the SAR.

The annual SAR provides Congress with a comparison of costs from the prior year. Updated cost and funding information, earned value metrics (if applicable), and changes in fiscal forecasts are explained in detail. SARs can be submitted annually or out-of-cycle. Typically out-of-cycle SARs are conducted if the program's path forward has significantly deviated from the plan, or for an impending program termination.

i. Acquisition Program Baseline (APB) vs SAR:

The APB is the agreement between the MDA and the Program Manager and his or her acquisition chain of command that will be used for tracking and reporting for the life of the program or program increment. An APB outlines objective and threshold Key Performance Parameter (KPP) requirements as well as the projected costs – at that point in time – for the program. Typically, the cost estimator is responsible for providing the cost projection for the program. DAMIR requires that the forecast of costs be provided for each year of RDTE and Procurement. The estimator will also need to know the by-year inflation indices for each appropriation used to resource the assessed requirement.

It is possible to have multiple APBs if a program was restructured at a given point in time. These baseline positions will be important, especially if a program experiences a significant or critical Nunn-McCurdy unit cost breach:

- Original APB: The first approved baseline for a program.
- Current APB: The most recent representation of the current program. If the original APB is different from the current APB, it is likely that a program has been restructured. A program re-baseline/restructure does not eliminate the need to report against the original baseline.

ii. Variance Analysis

The cost estimator is typically the person who is able to explain cost changes over time. The cost estimator is also responsible for incorporating the most recent inflation indices for the affected appropriations. Costs and forecasts are included as a TY cost. The inflation indices that the analyst uses, will be used to deflate the costs to the APB base year. The calculation is done within DAMIR.

The system combines total costs and quantities – by color of money – and automatically populates the Unit Cost Report (UCR). The UCR includes percent change metrics for the program acquisition unit cost (PAUC) and average procurement unit cost (APUC).

Variance analysis for the procurement appropriations involve a more in-depth analysis. The SAR requires that costs are separated by Flyaway (Recurring and Non-Recurring) and Support elements. These categories also need to be explained in the variance analysis portion of the SAR.

iii. Nunn-McCurdy Breaches

There are two types of Nunn-McCurdy Cost Breaches: significant or critical. If a program experiences either a significant or critical Nunn-McCurdy breach, the program will need to submit an out of cycle, or exception, SAR. Analyst input is integral in this process.

1. Significant Nunn-McCurdy Cost Breach

Significant Nunn-McCurdy Cost Breaches occur when the program's cost is at least 15% over the PAUC and/or APUC for the current APB and at least 30% of the PAUC and/or APUC for the original APB.

2. Critical Nunn-McCurdy Cost Breach

Critical Nunn-McCurdy Cost Breaches occur when at least 25% over the PAUC and/or APUC for the current APB and at least 50% of the PAUC and/or APUC for the original APB.

iv. Other Breaches

A program may also experience a Schedule, Performance, or total cost breach (for each color of money). If a program manager believes that a breach is imminent, a program deviation report (PDR) need to be submitted to the Milestone Decision Authority (MDA).

4. Life Cycle Management Command (LCMC)

The Life Cycle Management Command (LCMC) resident cost activity is a resource to the acquisition activities on the installation. The role of the LCMC cost activity will vary depending on the amount of engagement requested by the PM. Since the PM is responsible for cradle-to-grave acquisition, the LCMC plays an active role – especially during the transition to sustainment process.

The AR 11-18 encourages PEOs and PMs to "coordinate cost and economic analyses with supporting major command cost analysis activities for validation, implement contractor cost data reporting, and coordinate cost and economic matters with the ASA(FM&C)." Since this is a best practice, including the POCs from the supporting major command cost activities in regularly scheduled cost working IPT (CWIPT) meetings throughout the RDTE and Procurement phases may help facilitate a broader understanding of the system during the document review and validation process. Early engagement also

allows for opportunities for estimate/document comments and suggestions to be incorporated earlier in the process, more streamlined reviews, more targeted discussions on how design modification, ECPs, etc. can impact sustainment activities, and a more coordinated effort in planning for, and understanding, the OMA funding process (for SS PEG activities).

Chapter 12 DASA-CE Cost Tools

This chapter details a variety of cost tools used by DASA-CE.

1. AMCOS

Website Address: https://www.cave.army.mil/Amcos; sign-in through Enterprise Access Management Service-Army (EAMS-A)

Help Desk: amcos@calibresys.com

Army Military-Civilian Cost System (AMCOS) estimates fully burdened (Army, DoD and Federal Government) costs for soldiers, civilians and contractors. AMCOS can be used to support cost analyses associated with weapon systems, information systems, cost benefit analyses, and workforce studies. AMCOS is compliant with DoDI 7041.04, "Estimating and Comparing the Full Costs of Civilian and Active Duty Military Manpower and Contract Support." AMCOS consists of three applications: AMCOS Lite, Project Manager and Xwalk. AMCOS Lite is a database in which users look up costs for one soldier, civilian or contractor at a time. Project Manager can estimate the cost of an entire organization of mixed manpower, including contractors. AMCOS Xwalk assists analysts in identifying similar occupations between Military, Civilian, and Contractor pay plans, as well as their resulting costs. Note that users must still abide by FAR 7.5 Inherently Governmental Functions (IGF) and thus may not convert an occupation doing IGF into that of a contractor. AMCOS provides costs for active soldiers and drilling costs for National Guard and Reserve Soldiers. Full time National Guard and Reserve soldiers are estimated using the active component costs.

Analysts costing weapon systems obtain the following costs from AMCOS.

Appropriation	**Army Cost Element Structure**	**OSD CAPE Cost Element Structure**
MPA	4.01/4.02/4.03 Crew, Maintenance (MTOE), & System-Specific Support	1 Unit Level Manpower
MPA	4.051 Replacement Personnel (Training)	4.1 System Specific Training
MPA	4.051 Replacement Personnel (Training)	6.3.1 Recruit and Initial Officer Training
MPA	4.051 Replacement Personnel (Training)	6.3.3 Professional Military Education
MPA	4.06 Other Military Personnel Costs	1 Unit Level Manpower
MPA	4.06 Other Military Personnel Costs	6.2.1.2 Acquisition of New Personnel
MPA Non-Pay	4.052 Replacement Personnel (PCS)	1 Unit Level Manpower
NGPA, RPA	4.01/4.02/4.03 Crew, Maintenance (MTOE) & System-Specific Support	1 Unit Level Manpower
NGPA, RPA	4.01/4.02/4.03 Crew, Maintenance (MTOE) & System-Specific Support	6.2.2 Personnel Benefits
NGPA, RPA	4.01/4.02/4.03 Crew, Maintenance (MTOE) & System-Specific Support	6.2.3 Medical Support

NGPA, RPA	4.051 Replacement Personnel (Training)	4.1 System Specific Training
NGPA, RPA	4.051 Replacement Personnel Training	6.3.1 Recruit and Initial Officer Training
NGPA, RPA	4.051 Replacement Personnel Training	6.3.2 General Skill Training
NGPA, RPA	4.051 Replacement Personnel Training	6.3.3 Professional Military Education
NGPA, RPA	4. 06 Other Military Personnel Costs	6.2.1.2 Acquisition of New Personnel
OMA	5.11 Training	4.1 System Specific Training
OMA	5.11 Training	6.3.1 Recruit and Initial Officer Training
OMA	5.11 Training	6.3.3 Professional Military Education
OMA	5.12 Other	1 Unit Level Manpower
OMA	5.12 Other	6.2.1.2 Acquisition of New Personnel
OMA	5.12 Other	6.2 Personnel Support
OMA_1	5.12 Other	4.1 System Specific Training
OMA_1	5.12 Other	6.2.1.2 Acquisition of New Personnel
OMA_1	5.12 Other	6.3.1 Recruit and Initial Officer Training
OMA_1	5.12 Other	6.3.3 Professional Military Education
OMAR_1, OMNG_1	5.12 Other	4.1 System Specific Training
OMAR_1, OMNG_1	5.12 Other	6.3.1 Recruit and Initial Officer Training
OMAR_1, OMNG_1	5.12 Other	6.3.2 General Skill Training
OMAR_1, OMNG_1	5.12 Other	6.3.3 Professional Military Education
Federal OM	None	1 Unit Level Manpower
Federal OM	None	6.2.2.2 Dependent Support Program
Federal OM	None	6.2.3 Medical Support
OMDW	Other	6.2.2.2 Dependent Support Programs
OMDW	Other	Commissaries and Exchanges

Figure 13: Data Available in AMCOS

2. Army Civilian Pay Rates

Website Address: https://www.asafm.army.mil/Cost-Materials/Army-Civilian-Pay-Rates/

Help Desk: ccs@calibresys.com

The Army Civilian Pay Rates are used to estimate the cost of civilian pay for Army Commands for the Program Objective Memorandum (POM) and to cost civilian manpower throughout the Army Planning, Programing, Budget and Execution (PPBE) process. The rates provide cost per Command, Civilian Type (CTYPE), Appropriation (APPN), Sub Activity Group (SAG), Budget Activity (BA), and Management Decision Package (MDEP). The Civilian Pay Working Group comprised of Army Budget Office, G-1 and DASA-CE is responsible for making sure the rates are updated each year and reflect average pay. The aim is for the Army to distribute civilian pay dollars to the Commands using these rates so that the Commands are not under- or over-funded. While the rates include series, grade, and step, as they are created using budget execution data, the rates are presented in summary level format and cannot be filtered on series, grade or step. The rate format and levels displayed are driven by the Army PPBE process and support Army budget reporting applications.

3. Reimbursable Rates

i. Aviation Reimbursable Rates:

DASA-CE, is responsible for retrieving, analyzing, and normalizing the cost data from multiple data sources to develop the reimbursable rates for aircraft in four categories (Department of Defense (DoD) customers, Other Federal Agencies, Foreign Military Sales, and Public) in accordance with DoD Financial Management Regulation Volume 11A, Chapter 6, Appendices E and G. The reimbursable rates considers costs for fuel, depot maintenance, contract logistics support (CLS), reparable and consumable parts, and crew salary resulting in a combined hourly rate. Personnel costs is calculated using the DoD Military Personnel Composite Standard Pay and Reimbursable Rates.

These rates are published annually and valid for the period beginning October 1 until September 30 of the current fiscal year. The rates will reside on the Army Financial Management and Comptroller site at https://www.asafm.army.mil/. Examples of Aviation Reimbursable Rates charged for services outside DoD uses are i.e., airshows, static demonstrations, and commercial filming.

ii. Ground Reimbursable Rates:

DASA-CE is responsible for retrieving, analyzing, and normalizing the cost data from multiple data sources to develop the reimbursable rates for ground systems. The primary goal is to establish a reimbursable rate for each vehicle per day without personnel, and each vehicle per day with personnel. The ground reimbursable rate considers costs for reparable and consumable parts, and Petroleum Oil and Lubricant (POL) per mile cumulating to a total daily combined rate. Additionally, rates consider vehicle depreciation per day, based on the Logistic Data Analysis Center (LDAC) vehicle cost; formerly known as Logistics Support Activity (LOGSA), and an estimated useful life. Finally, the personnel cost per day is calculated using the DoD Personnel Reimbursable Rate.

Unlike the Aviation Reimbursable Rates, the ground rates are not mandated. However, we apply the same Financial Management Regulation that annual rate billable to other Federal Agencies shall be used when obtaining reimbursement for services provided to agencies outside of the DoD calculated in accordance with provisions of Volume 11A Reimbursable Operations Policy, Chapter 6, Appendix I of the DoD Financial Management Regulations (DoD 7000.14R). These rates are published annually and valid for the period beginning October 1 until September 30 of the current fiscal year. The rates will reside on the Army Financial Management and Comptroller site at https://www.asafm.army.mil/. Examples of Ground Reimbursable Rates charged for services outside DoD uses are i.e., civil disturbances, hazardous substance spills, United States Secret Service activities, drug and narcotics interdiction activities.

*Special Note: Army Reimbursable Rates are not intended for Army program lifecycle cost estimating because these rates include additional areas of cost that exceed what is required and would be overstated.

4. ACEIT

Help Desk: aceit_support@tecolote.com

Automated Cost Estimating Integrated Tools (ACEIT) is a PC-based model that provides a standard framework for cost estimating and risk analysis tasks. ACEIT automates the storage, retrieval, and analysis of cost information. It also facilitates building cost models, risk analysis, budget time phasing and narrative documentation of the cost estimates. Army analysts are required to use ACEIT on all Acquisition Category I and II programs. The ACEIT suite of tools includes ACE, CO$TAT, POST, JACS, ACDB, Tools, and ACEIT Plug-Ins. Automated Cost Estimator (ACE) is a model-building tool that provides a standardized approach for developing cost estimates. Cost Analysis Statistics Package (CO$TAT) is a MS Excel add-in designed to allow the analyst to perform statistical analysis. Program Office Support Tool (POST) allows an analyst to create MS Excel charts and reports based on an ACE session. Joint Cost and Schedule Analysis (JACS) allows an analyst to perform integrated uncertainty analysis of a cost-loaded schedule. Automated Cost Databases (ACDB) have cost and technical data, including normalized CSDRs. At the moment, Army ACDBs are accessible via the Joint Integrated Analysis Tool (JIAT). Tools and Plug-Ins extend ACE functionality. The various Tools and Plug-Ins allow an ACE user to incorporate data from external 3rd party applications into an ACE session.

As of 2004, the Army requires the use of ACEIT on all ACAT I and II programs.[17]

For more information, visit http://www.aceit.com/.

5. GFEBS

The General Fund Enterprise Business System (GFEBS) is a web-enabled system that allows the Army to share financial data across the organization. GFEBS is an Enterprise Resource Planning (ERP) financial system that was implemented to standardize financial management and accounting functions, as well as real property inventory and management across the Army. GFEBS gives the Army access to timely, reliable and accurate information. This will improve cost management and control, it will allow more time to focus on financial analysis and facilitate a more accurate understanding of the value of assets.
GFEBS includes many financial and accounting functions such as:

- General Ledger
- Accounts Payable
- Revenue and Accounts Receivable
- Funds Control and Budgetary Accounting
- Cost Management
- Financial Reporting
- Real Property Inventory and Management

There are GFEBS roles for each of the following business processes:

- Financials (FI)
- Funds Management and Budget Formulation (FM)
- Property, Plant, & Equipment (PP&E)
- Reimbursables and Debt Management (RM)

[17] Office of the Assistant Secretary of the Army Memorandum. *"Automated Cost Estimating Integrated Tools (ACEI-IT),"* 15 April 2004.

- Spending Chain (SC)
- Cost Management (CO)

DASA-CE is primarily concerned with the Cost Management role. Cost Management is the practice of considering total costs. Decision-makers, at all levels within the Army, need to make accurate and timely decisions that optimize their resources. The Army will be able to achieve success in Cost Management when our Resource Managers and Operational Managers work together using cost and performance data in conjunction with experience-based knowledge to make more effective use of scarce resources.
Cost Management collects and links fund expenditure data with functional and operational output and performance data, and presents information in a way directly related to the major missions of the Army. Linking real-time costs with both operational and functional outcome data will enable Army decision-makers to identify cost performance differences, and will provide analytical information to determine best value decisions and best practices.

6. GCSS-Army

The Global Combat Support System- Army (GCSS-Army) is a web-based automated logistics system, for use by U.S. Department of Defense logistics specialists. This tool aids the specialists as they plan, and provide for, the materiel requirements for combat support. The GCSS-Army System has ultimately replaced several aging and outdated Army management information systems across tactical logistics environments within the Army's Active and Reserve components as well as the National Guard. A state-of-the-art, web-based, logistics and finance system based upon commercial best business practices and off-the-shelf (SAP) software, GCSS-Army serves as an automated combat enabler for soldiers. Integrated with Department of Defense financial systems, it provides highly accurate cost management and financial visibility for tactical materiel and sustainment.

GCSS-Army provides many functions when analyzing cost factors to include

1. The ability to track all processes from the users level on each piece of equipment in real time
2. The ability to differentiate the types of work-orders, if they are scheduled, unscheduled or reimbursable
3. To track parts that have been ordered against actual work-orders or for stock
4. The ability to view all equipment on each units hand receipt real time
5. The ability to view usage by equipment
6. The ability to research any of the above on an individual basis's at the lowest level

7. FORCES

Website Address: https://www.cave.army.mil/Forces/; sign-in through Enterprise Access Management Service-Army (EAMS-A)

Help Desk: https://helpdesk.cave.army.mil/

FORCES is a comprehensive suite of web-based costing tools designed to provide realistic, current, and supportable cost estimates in a timely manner for a wide variety of Army unit life cycle events. The FORCES suite of models provides DASA-CE with the tools required to assist Army leaders in constructing a future force that meets projected threats and is sustainable within constrained resourcing. FORCES has over 3000 registered users throughout the Army and government, to include HQDA, OSD, Combatant Commands, Army Commands, Force Units, Installations, ARNG/USAR, Schools, CAA, GAO, CBO, and more.

i. Unit Structure

FORCES models use unclassified Standard Requirements Codes (SRC) to designate units. Tied

to each SRC is a document called a Table of Organization and Equipment (TOE) that, along with its structure, describes its wartime mission and capabilities. The FORCES models contain the approved TOE force structure for both Active and Reserve Component units. The TOE structure represents the unclassified doctrinal structure of the Army versus the classified Modified TOE (MTOE) operations structure. The TOE structure allows flexibility in costing notional force units.

Four codes are needed to uniquely identify an SRC's TOE:

- Series Code - a category (branch) of like units, designated by the first two characters of the SRC;
- Variation number - Used to identify variations in the unit's structure, designated by the seventh character of the SRC;
- Edition Code – to identify a specific edition of the TOE within the SRC, identified by the sixth character of the SRC;
- Modernization Code - to identify different levels of modernization (personnel and equipment) applied to the SRC, identified by the ninth character of the SRC. Using the ninth character is unique to FORCES – it is not found in any doctrinal publication.

The following figures show the series, edition, and modernization codes used in FORCES.

Series	Title	Series	Title
01	Aviation/Aviation Logistics	34	Combat Electronics Warfare and Intelligence (CEWI)
02	Band	35	Interpreter/Translator
03	Chemical	37	Maneuver Enhancement Brigade
05	Engineer	40	Space/Missile
06	Field Artillery	41	Civil Affairs
07	Infantry	42	Supply
08	Medical	43	Maintenance (except Missile)
09	Ordinance (Missile/Munitions)	44	Air Defense Artillery
10	Quartermaster	45	Public Affairs
11	Signal	47	Stryker Brigade Combat Team
12	Adjutant General	49	Battlefield Surveillance Brigade
14	Finance	51	Army
16	Chaplain	52	Corps
17	Armor	53	Information Operations
19	Military Police	54	Logistics Organizations & Ops
20	Military History	55	Transportation
27	Judge Advocate	63	Sustainment
30	Military Intelligence	71	Cyber
31	Special Forces	77	Infantry Brigade Combat Team
32	Security (INSCOM)	87	ABCT/Division Hqtrs
33	Military Information Support Ops	90	Acquisition Logistics & Technical Support

Figure 14: FORCES Series Codes

Edition Code	TOE
A	Force Projection Army Concepts and Doctrine
E	Applicable to a specific mission
F	ForceXXI
G	Transformation/Modular
K	Army 2020
L	Army of Excellence (AOE)
R	Force Design Assessment
S	Study
X	Unique/Exception

Figure 15: FORCES Edition Codes

Acronym	Code	Description
BTOE	B	The Base Table of Organization and Equipment is a design document based on doctrine and equipment currently available.It is the lowest common denominator of modernization and identifies the mission essential wartime requirements for personnel equipment based on equipment common to all units of the given type organization.
OTOE	0	The Objective Table of Organization and Equipment is a planning document, fully modernized and doctrinally sound that sets the goal for planning and programming of the Army's force structure and supporting acquisition systems.
MTOE	1	A Modified Table of Organization and Equipment is an authorization document that prescribes the organizational structure and the personnel and equipment requirements for a military unit to perform specific missions. If units in the Army have significant levels of modernization, you may see another average MTOE.

Figure 16: FORCES Modernization Codes

The FORCES suite is comprised of five cost models designed to help the Army decision-makers develop rapid and accurate force cost estimates to support mission requirements. The FORCES models provide common structures that make it simple for users to create detailed and rapid cost estimates with each model focused on one aspect of an organization's mission. FORCES is flexible to accommodate changes in cost data and Army requirements and is regularly updated to incorporate changes in acquisition, operations, transportation, and personnel costs.

ii.FCM

The FORCES Cost Model (FCM) was first developed in 1988 to meet the needs of multiple users for a comprehensive force cost estimating model, using data provided by numerous U.S. Army and governmental agencies. The model can be used to produce cost estimates for more than 2000 unique units

described by SRCs. These SRCs cover all TOE units in the Total Force – Active and Reserve Components. The FCM is used throughout the Army as a component for decisions at all levels to provide quick reasonable estimates for Army units. FCM produces estimates costs for the following unit life cycle events:

- Operations & Sustainment – The O&S estimate calculates the direct and indirect costs to operate the selected force units at the specified percentages of equipment, personnel, and OPTEMPO for the specified number of months, the MACOM geographic location and the Component in the Base Year. The estimate includes the cost of: Direct Operations, Post-Production Software Support, Indirect Support, Personnel, and Other Unit Support.
    - FCM O&S estimates can be useful when addressing questions such as: how much does it cost to operate and sustain a unit, to include Direct OPTEMPO, Training Ammunition, Post Software Support, Indirect Support, Personnel, Installation Services, and Medical costs?
- Acquisition of Resources – The options for an Acquisition of Resources (AOR) Estimate are Current Equipment (Inherited Assets) and Modernized Equipment (All New Procurement). Both options estimate the cost to procure the personnel, equipment, and material required for the selected force unit. This includes all equipment in the SRC at the designated percentage of equipment, the cost of Ammunition Initial Issue, Organizational and Common Table of Allowances (CTA) equipment, Prescribed Load List/Authorized Stock List (PLL/ASL), Basic Load of Class I, II, and III, Wholesale-level Replenishment Spares and Repair Parts, and Technical Publications

  The AOR Current Equipment option costs the equipment in the SRC that is currently listed in the Consolidated TOE Update (CTU). The AOR Modernized Equipment option costs the SRC's equipment by substituting the most modern LIN for equipment that is no longer in production and is no longer available for procurement. For example, if an SRC has M2 Bradley in the TOE, this option will use the unit price of the M2A3 Bradley, rather than the unit price of the M2. Since any future acquisition will be for the most modern equipment, using the cost of the most modern equipment will give a more realistic estimate and recognizes that the Army isn't going to procure systems that are no longer in production.
    - FCM AOR estimates can be useful when answering questions such as: how much does it cost to acquire the personnel and equipment for a unit?
- Activation – The estimate calculates the costs to move all of the unit equipment and personnel from the location at which the unit was formed to its permanent home station. If the unit is formed at its home station, no costs to move the equipment are incurred; however, the cost to move the personnel and their dependents to the duty station is incurred. The estimate also calculates the Military Construction costs associated with a unit's facility requirements.
    - FCM activation estimates can be useful when answering: how much does it cost to move personnel and equipment from one location to another to stand up a new unit? How much does it cost to build the facilities required by a new unit?
- Inactivation – The estimate displays the net difference between Savings and Costs resulting from the inactivation of a force unit. The Costs portion of the estimate reflects the costs incurred to inactivate the force unit and includes Accelerated PCS, the cost of maintenance of unit equipment to bring it up to transfer standards and the cost to move the equipment if necessary.
    - FCM Inactivation estimates are useful when answering questions such as: how much does it cost and save to take a unit out of the force?
- Movement – The estimate calculates the costs to move an entire unit. Within FCM, various options are presented for the movement of aircraft, tracked vehicles, wheeled vehicles, other unit cargo,

and personnel. It should be noted that the FCM movement estimates give less detailed cost estimates than the Army Contingency Operations Cost Model (ACM) movement estimate; the ACM has a detailed leg-by-leg capability not available in the FCM.

  - FCM movement estimates are useful in answering: how much does it cost to move units worldwide, both tactically (personnel and equipment) and administratively (PCS to include dependents, household goods, etc).

- In the FCM, parameters subject to sensitivity analysis include location, Component, readiness (percentage of ready equipment on hand, personnel, and operating tempo), and year to which costs should be escalated. Personnel and equipment quantities can also be modified in the FCM.

iii.ACM

The Army Contingency Operations Cost Model (ACM) was first developed in 1997 to meet the needs of users to estimate the costs of contingency operations, deployments, and training exercises. The ACM is flexible and highly customizable to meet user requirements. All cost factors used in the model can be modified to reflect the reality of the situation on the ground for a specific operation/exercise. In addition, within ACM users can:

- Tailor the contingency force.
- Import a list of SRCs or UICs tailored to a specific operation.
- Import a User Defined SRC Vary the quantity of force assets required by the contingency force for the mission or exercise.
- Tailor the cost factors for individual SRCs or globally for all SRCs.
- View and print output in the Office of the Secretary Defense (OSD) prescribed format.
- Export data in relevant formats for processing in external productivity applications for briefings or further analysis.

The ACM provides analysts with the capability to use the official and most current Army cost estimating data to develop cost estimates for any of the six identified phases of an operation, to include:

- Pre-deployment – The estimate captures the costs to prepare for the operation or exercise at home station prior to movement. These costs can include, but are not limited to, facilities/base support, training, medical prep, family support, special equipment/clothing, C4I, supplies, and contracts for services.
  - Including predeployment in an ACM estimate is useful when answering questions like: how much does it cost for the common costs incurred during the preparatory phase of an operation/exercise?
- Deployment – The estimate captures the costs to move the personnel and equipment from home station to the location of the operation or exercise. In the ACM deployment phase, analysts can plot multiple origins and destinations for personnel and multiple categories of equipment, by unit. Analysts can also incorporate prepositioned and leave-behind equipment into the estimate, as well as move personnel and equipment by various modes of transport.
  - Including deployment in an ACM estimate can be useful in answering questions like: how much does it cost to move units from any place in the world to any other place in the world using designated modes along the route?
- Operations & Sustainment – The estimate captures the costs to operate and sustain the personnel and equipment at the location of the operation or exercise. The ACM incorporates both unit-level O&S and general O&S for the operation/exercise. Unit O&S includes personnel-related O&S factors, unit sustainment-related O&S factors, and Direct OPTEMPO-related cost factors. General

O&S includes costs associated with LOGCAP, Personnel Augmentees, Base Support, and Climate/Terrain.

  - Including O&S in an ACM estimate can be useful in answering questions like: how much does it cost to operate and sustain a unit for the duration of the operation/exercise, to include personnel, sustainment, and operating costs?

- Redeployment – The estimate captures the costs to move the personnel and equipment from the location of the operation or exercise to home station or to a new location. In the ACM Redeployment phase, movements can occur in the exact mirror image of the Deployment or users can specify new destinations for personnel and multiple categories of equipment, by unit.
  - Including Redeployment in an ACM estimate can be useful in answering questions like: how much does it cost to return units from the deployed location to home station using designated modes along the route? Or, how much does it cost to move units from the deployed location to a new location?
- Reconstitution – The estimate captures the costs to restore the equipment used in the operation or exercise to full readiness. In ACM, reconstitution cost are separated out, by equipment category, for equipment replacement, equipment recapitalization, and equipment reset (depot-level and field-level). Users can also specify any additional operating and/or Facilities/Base Support costs related to the Reconstitution Phase.
  - Including Reconstitution in an ACM estimate can be useful to answer questions like: how much does it cost to return units to full readiness after an operation?
- Demobilization – The estimate captures the costs to demobilize Reserve Component units (if used for the operation or exercise) and return the personnel to an inactive training status. These costs cover activities related to out processing, medical processing, and return to home station.
  - Including Demobilization in an ACM estimate can be useful in answering questions like: how much does it cost to demobilize activated Guard/Reserve personnel after an operation/exercise?
- All cost factors used in the model can be modified to reflect the reality of the situation on the ground for a specific operation/exercise.

iv. TDA

The Table of Distribution & Allowances (TDA) model was first developed in 2015 to provide analysts with the capability to estimate annual operating costs of the Army's Generating Force down to the UIC level of detail. The model uses existing equipment, installation, personnel, and contractor cost data. It is flexible enough to add modules in the future to estimate additional costs.

v. UCM

The Unit Conversion Model was first developed in 2019 to assist the analyst with estimating the cost to convert a unit type by SRC to another unit type by SRC. The model uses existing equipment and personnel as well as provides the functionality to import a SRC from FMSWeb and modify the equipment and personnel. UCM is designed to estimate the cost to convert one Unit to another, including equipment additions or drops, personnel additions or drops, and training costs (MOS). The UCM is flexible enough to add future enhancements that will provide costs associated with converting a unit, such as moving equipment and training personnel.

vi.CFH

The Cost & Factors Handbook (CFH) was designed to support cost research related to equipment, personnel, operating temperature, transportation, force structure, and unit support. CFH is a user-friendly version of the data contained in the FORCES models. In addition, the CFH contains a subset of data not used in the models that analysts not primarily working in force costing may find useful. CFH includes numerous tables with data useful for generating a wide range of cost estimates in the following categories:

- Military Personnel Costs
- Civilian Personnel Costs
- Operating Tempo/Flying Hours
- Transportation and Deployment Factors
- Unit Support Costs
- Force Structure Data
- General Factors
- Air and Ground Reimbursement Rates

8. OSMIS

Website Address: https://www.cave.army.mil/osmis/; sign-in through Enterprise Access Management Service-Army (EAMS-A)

i.Overview of O&S

Based on the OSD CAPE Operating and Support Cost Estimating Guide (March 2014), Operations and Support (O&S) costs include:

- Sustainment costs incurred from the initial system deployment through the end of system operations.
- All costs of operating, maintaining, and supporting a fielded system, specifically the costs of personnel, equipment, supplies, software and services associated with operating, modifying, maintaining, supplying, training and supporting a system in the Department of Defense (DoD) inventory.
- Interim contractor support when it is outside the scope of the production program and the acquisition baseline.
- Costs directly and indirectly attributable to the system (costs that would not occur if the system did not exist), regardless of funding source or management control.

Direct costs refer to the resources immediately associated with the system or its operating unit. Indirect costs refer to the resources that provide indirect support to the system's manpower or facilities. For example, the pay and allowances (which are reflected in composite standard rates) for a unit-level maintenance technician would be treated as a direct cost, but the (possibly allocated) cost of the medical support for the same technician would be an indirect cost.

The O&S phase typically represents the largest cost within a program's lifecycle and is especially difficult for analysts to estimate since it involves trends in materiel, parts, and manpower over long periods. O&S cost estimates differ from other estimates because O&S extends from deployment through steady state to disposal, usually a period of 10 years or more. Estimates are needed for projected Operational Tempo

(OPTEMPO) and other operational usage data over the same extended period of time, requiring collaboration between analysts from the acquiring, using and training Army Commands (ACOMs).

ii. Introduction to OSMIS Database

The Army developed the Operating and Support Management Information System (OSMIS) to provide a centralized database for O&S information on fielded weapon/materiel systems. OSMIS originated in a 1974 initiative from OSD to improve the visibility and control over weapon/materiel systems' O&S costs. The initiative called for the Services to develop a management information system to report the actual O&S costs for fielded materiel systems. OSMIS is the Army's response to that requirement.

OSMIS tracks operating and support information for over 3,900 major Army weapon/materiel systems (see Table 2 below). It is managed by the Office of the Deputy Assistant Secretary of the Army, Cost and Economics (DASA-CE). OSMIS captures data from over 20 different logistical data sources throughout the Army including Enterprise Resource Planning (ERP) systems such as the Global Combat Support System – Army (GCSS-Army) covering costs for Class III (POL) consumption, Class V training ammunition, and Class IX consumable and reparable consumption.

Army weapon/materiel systems are the heart of the OSMIS database. Data is collected on Army weapon/materiel systems as identified by a National Item Identification Number (NIIN) in the national supply inventory. OSMIS maintains a list of Army units and the OSMIS-tracked weapon/materiel systems that they own down to the battalion level. Each unit is identified by a Unit Identification Code (UIC). Each unit is based at an installation and Army Commands which OSMIS identifies by a two-character Command code.

For OSMIS reporting purposes, units not assigned to a Command are grouped into the Undistributed Command. Army units may also be grouped into divisions or non-divisional organizations identified by a Troop Sequence Number (TPSN.) For reporting purposes, OSMIS data is summarized at the Total Army, Command, Installation, Division, or Battalion level. Army National Guard data is also summarized at the state level.

Each OSMIS-tracked weapon/materiel system is owned by units that consume parts that are used in their weapon/materiel system during training exercises, combat and other endeavors. OSMIS develops a weapon/materiel system definition for each system it tracks. OSMIS tracks the consumption of these parts and allocates them to a specific weapon/materiel system.

As units use their weapon/materiel systems, the activity of those systems is also tracked. Odometer readings are checked monthly for ground vehicles and flight hours are logged for aircraft. For weapon/materiel systems that consume fuel, consumption can be calculated by multiplying the weapon/materiel activity by the fuel consumption rate.

OSMIS is an analytical tool that can be used to:

- Identify all the units that own a specific weapon/materiel system and the density (quantity) that they own.
- Identify all the variants of a specific weapon/materiel system.
- Identify the parts that are consumed on a specific weapon/materiel system.
- Identify the number of systems owned by an Army Command, Installation, Division, Brigade Combat Team (BCT), or Battalion and the miles/hours, the weapon/materiel system has been driven or flown.
- Identify the quantity of Class IX demands (consumables/reparables) consumed by a specified weapon/materiel system, priced at an Army Master Data File (AMDF) or President's Budget parts pricing for a specified year.
- Identify the Class IX cost drivers at NIIN level for a specified weapon/materiel system and organization.
- Identify the fuel cost per mile/hour for a specific weapon/materiel system of a commodity

group by organization.

- Identify cost data on end item or secondary item maintenance programmed to be worked on under a specific Work Breakdown Structure (WBS) at a specific Depot site.
- Identify NIIN-specific parts and pricing information for Class IX parts.
- Identify weapon/materiel system cost factors, as developed by DASA-CE for building the OPTEMPO Budget Requirements.
- Assist in programming and budgeting.
- Identify the average lifespan of a Class IX part based on the activity of the weapon/materiel system.
- Identify the number of Class II, IV, and IX parts ordered per weapon/materiel system owned by a specific Army unit.
- Identify and predict future part demands based upon averages and trends, over a given time period.
- Identify actual ground vehicle mileage driven as reported at UIC/equipment number level of detail for a specified month.

Additionally, OSMIS provides data such as: Class IX Consumables/Reparables, Class IX Cost Drivers, Equipment Density, Activity (Miles/Hours), Unit Information, Fuel, Ammunition, Depot Maintenance, Light Utility Helicopter (LUH) Contractor Logistics Support, Monthly Activity Reports, Fleet Age, CONOPS Filtering, OSMIS Fuel Usage Rates, Aviation Reset Costs, and Training Costs.
Each year OSMIS increases the amount of weapon/materiel system cost data available. These systems are the top cost drivers in the Army and represent those systems for which cost factors are produced. The figure below shows the number of systems that are tracked by OSMIS.

FISCAL YEARS (NUMBER OF SYSTEMS)										
Systems	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Aviation (A)	57	57	57	76	90	91	109	112	113	115
Combat (C)	86	86	86	126	133	138	141	142	142	142
Comm./ Electronic (E)	499	501	580	757	770	902	1,074	1,203	1,301	1,505
Armament (R)/ Missiles (M)	45	45	47	86	88	89	91	95	100	117
Engineering/ Constr. (N)	162	162	166	395	413	519	533	580	627	739
Other (O)	0	0	17	24	69	83	103	130	135	185
Medical (S)	5	5	5	7	61	63	63	70	112	112
Tactical (T)	724	725	725	756	777	797	807	818	824	844
Wheeled Combat (W)	97	97	97	135	142	144	144	144	145	147
Total	1,675	1,678	1,780	2,362	2,543	2,826	3,065	3,294	3,499	3,906

FISCAL YEARS (NUMBER OF SYSTEMS)										
SYSTEMS	09	10	11	12	13	14	15	16	17	18
Aviation	53	53	54	54	55	56	57	57	57	76
Combat	80	80	83	84	85	86	86	86	86	126
Wheeled Combat	57	74	78	82	86	96	97	97	97	135
Artillery / Missiles	33	37	45	45	45	45	45	45	47	86
Tactical	678	689	713	714	716	721	724	725	725	756
Engineering / Constr.	148	148	151	160	162	162	162	162	166	395
Comm. / Electronic	444	459	476	483	492	496	499	501	580	757
Medical	4	5	5	5	5	5	5	5	5	7

DoD analysts and contractors may gain access to OSMIS at https://www.cave.army.mil/osmis. All users are assigned an ID and password. User help is provided via an "Email Us" icon on the right hand corner of the screen.

iii. Cost Element Structure (CES)

The OSMIS CES describes and defines the specific elements to be included in the cost estimate. Using a formal CES (prepared and coordinated in advance of the actual estimating) identifies all of the costs to be considered and organizes the results. For instances with both program office and independent cost estimates, a common CES allows meaningful comparisons. Using a CES is important for O&S estimation as it provides a framework for the O&S discussion.

Provided below is the Army's CES for O&S, which is also included in Appendix 3.

1. Unit-Level Manpower

The unit-level manpower element includes the costs of all operator maintenance and other support manpower at operating units (or at maintenance and support units that are organizationally related and adjacent to the operating units). Unit-level manpower includes active and reserve military, government civilian and contractor manpower costs. While the cost elements in this category make the distinction between operators, maintainers and other unit-level manpower, that distinction may not apply to all situations.

Unit-level manpower costs are intended to capture direct costs (i.e., costs of unit-level individuals that can be clearly associated with the system performing its intended defense mission). The scope of unit-level includes the lowest-level operating unit capable of independent system operations, and associated augmenting maintenance and support units (if any) integral to system operations. For systems owned by deploying units, the scope of unit-level manpower includes operator, maintenance, and other support personnel that consistently deploy with the systems to their deployment locations. For example, for an Army tank, the scope of unit-level includes the tank battalion and associated maintenance and support companies (typically organized in support battalions) in the same division. For systems not organized into units, such as ground radar stations, the unit-level concept does not apply, and unit manpower costs may be estimated on an individual system basis.

To the extent possible, government manpower costs should be based on personnel grades and skill categories. Costs of military, government civilian, and contractor personnel should be shown separately in the estimate of unit-level manpower costs. Manpower costs for active officers and enlisted personnel should include all of the elements of the DoD Standard Composite Rates for military personnel, which includes the following items: basic pay, retired pay accrual, basic allowance for quarters and variable housing allowance, basic allowance for subsistence/subsistence-in-kind, incentive and special pays, permanent change of station and miscellaneous expenses, such as the employers contribution to social security (FICA) and uniform/clothing allowances. (See DoD Financial Management Regulation (ref f), Volume 11A, Chapter 6, Appendix I for full definitions of categories, or refer to the web site: http://www.defense/ink. mi//comptroller/defense.gov/fmr/11a/Volume_11a.pdf).

Manpower costs for reserve officers and enlisted personnel should include pay and allowances, retired pay accrual, 13 FICA, clothing, and subsistence. Permanent Change of Station (PCS) costs will be included for full-time members. Reserve manpower costs vary significantly among different categories of reserve personnel. Cost estimates of Reserve Component (RC) personnel should separately identify the number of personnel using the following categories.

- Fulltime - Active Guard Reserve (AGR) members

- Drill Personnel (Pay Group A) - drilling members of a Selected Reserve Unit
- The cost of drill personnel depends on the extent of their annual drill time. The average annual drill time should be used and documented when developing a cost estimate.
- The cost of government civilian manpower should include all of the components of the DoD Composite Standard Rates for civilian employees, including the following elements: basic pay, additional variable payments for overtime, holiday pay, night differentials, cost-of-living allowances and the government contribution to employee benefits, insurance, retirement and Social Security contributions. (See DoD Financial Management Regulation (ref f), Volume 2A, Chapter 3 and Exhibit OP-8 or refer to the web site: http://www.defenselink.mil/comptroller.defense.gov/fmr/02a/Chapter3.pdf).
- The costs of contractor manpower should be based on the full price of contract labor to the government (i.e., fully burdened).

2. Operations

Operations consist of the cost of all military, civilian, and contractor manpower required to operate a weapon/materiel system.

- Aircraft and Helicopters - Aircrews (pilots, navigators, mission specialists, load masters, etc.)
- Electronic System - Console operators
- Armored Vehicles - Crew chief, tank commander, gunner, driver, loader

For cases where individuals operate more than one system, manpower costs should be allocated on a relative workload basis.

3. Unit-Level Maintenance

Unit-level maintenance includes costs of all military, civilian, and contractor manpower that performs unit-level maintenance on a primary system, associated support equipment, and unit-level training devices. This element includes the costs of organizational maintenance manpower (usually resident in the system's operating unit) and unit-level intermediate maintenance personnel.

The costs of intermediate-level maintenance personnel resident in a support organization that is not unit-level relative to the operating unit, such as an Intermediate Maintenance Support Activity, are included in element Field Level (Intermediate Maintenance). For cases where individuals maintain more than one system, manpower costs should be allocated on a relative workload basis.

4. Other Unit-Level

Unit-level costs include costs of all military, civilian and contractor manpower that perform administrative, security, logistics, safety, engineering and other mission support functions at the unit level. These costs include only the costs of manpower positions that exist to solely or predominately support the weapon/materiel system whose costs are being estimated. For weapon/materiel systems that deploy, these costs include the costs of manpower positions that routinely deploy to support the weapon/materiel system. Some examples are:

- **Unit Administrative Staff:** Manpower required for unit command, administration, supervision, operations control, planning, scheduling, safety, quality control of crew training and operational proficiency, etc.
- **Security:** Manpower required for system security. Duties may include system level entry control, close and distant boundary support and security alert operations. (Does not include base level access control unless the entire facility exists solely to support the weapon/materiel /materiel system).
- **Logistics:** Manpower required for logistics support. Functions may include supply, transportation, inventory control, fuel handling, etc.
- **Ordnance Support:** Includes manpower providing munitions handling, weapon/materiel s assembly, etc. Excludes any ordnance support manpower included in element 1.2 (Unit-Level maintenance).
- **Other Support:** Manpower required to provide system-specific fixed and mobile communications, information, intelligence, photo interpretation, and other special mission support.

5. Unit Operations

Unit operations includes the unit-level consumption of operating materials such as fuel, electricity,

expendable stores, training munitions and other operating materials. Also included are unit-funded support activities, temporary additional duty/temporary duty (TAD/TDY) associated with the unit's normal concept of operations; and other unit-funded services. Unit-funded service contracts for administrative equipment, as well as unit-funded equipment and software leases, are included in this portion of the estimate. Unit operating costs provided through a system support contract should be separately identified from those provided organically. (Simulator costs that provide support to multiple units should be included in Simulator Operations and Repair).

6. Operating Material

- Energy (Fuel, Petroleum, Oil and Lubricants [POL], Electricity)
  These costs include cost of POL, propulsion fuel and fuel activities used by systems in performing their normal peace- time missions. These costs also include the cost of field-generated electricity and commercial electricity necessary to support the operation of a weapon/materiel system.
- Training Munitions and Expendable Stores
  These costs include the unit-level consumption of training munitions, rockets, missiles, and expendable stores in the course of normal peacetime training missions. Training munitions costs include the costs of live and inert ammunition, bombs, rockets, training missiles, sonobuoys, and pyrotechnics expended in training and non-combat firings such as firepower demonstrations. This category also includes other expendable stores such as chaff, flares, fuel tanks, travel pods, or other items that lose their identity in use and may be dropped from stock record accounts when issued or used.
- Other Operational Material
  This element includes operating material costs other than energy, training munitions, or expendable stores. The costs identified must be related to the weapon/materiel system whose O&S requirements are being assessed. Illustrative examples include computer supplies, paper, diskettes, ribbons, charts, maps, and administrative supplies used for housekeeping, health, and safety.

7. Support Services

This includes unit-level costs for purchased support services. These services may vary greatly from one unit to another. They may include:

- Unreimbursed food services, rations, postal services (postage/box rental), laundry services.
- Lease or rental of administrative, computational, or support equipment or software.
- Lease costs of special facilities or land (e.g., for the storage of warheads and missiles).
- Unit-funded service contracts for administrative, computational, or support equipment.
- Communications services (e.g., data/voice links, dedicated lines, and microwave channels), port services, and other unit-funded utilities not part of base operating support costs.

8. Temporary Duty

Temporary additional duty or temporary duty (TAD/TDY) pay and allowances costs include unit personnel travel for training, administrative or regularly scheduled training away from the unit's permanent operating location that are associated with a unit's concept of operations and support. TAD/TDY costs include military and commercial transportation charges, rental costs for passenger vehicles, mileage allowances, and subsistence expenses (e.g., per diem allowances and incidental travel expenses). Excludes temporary duty associated with contingencies or wartime operations.

9. Transportation

Transportation costs funded by the unit. Typically includes the transportation costs for moving equipment, personnel, and supplies to and from training sites, remote operating sites, or test ranges.

10. Maintenance

Maintenance includes the costs of labor (outside of the scope of unit-level) and materials at all levels of maintenance in support of the primary weapon/materiel system and associated support equipment. Where costs cannot be separately identified to distinct levels of maintenance, the category that represents the

predominant costs should be used. Any maintenance costs provided through a system support contract should be separately identified within the appropriate cost element.

11. Organizational Maintenance and Support

Organizational maintenance includes the cost of materials and other costs used to maintain a primary weapon/materiel system and associated support equipment. Maintenance materials are broken into categories that may not be applicable in all services or for all types of weapon/materiel systems. It is therefore acceptable to combine consumable and repair part costs where a service's logistic system does not differentiate between them

12. Organization-Level Consumables

Organizational consumable maintenance material includes the costs of material consumed in the maintenance and support of a primary weapon/materiel system and its associated support and training equipment at the unit level.

Illustrative types of maintenance consumables are coolants and deicing fluids. To the extent possible, the consumable material cost of the primary system, support equipment, training devices and simulators should be separately identified.

13. Organization-Level Repair Parts

Organizational repair parts include the costs of materials used to repair primary weapon/materiel systems and associated support and training equipment at the unit level. Items may include circuit cards, transistors, capacitors, gaskets, fuses, filters, batteries, tires, and other materials that are not repaired. To the extent possible, the repair material cost of the primary system, support equipment, training devices and simulators should be separately identified.

14. Organization-Level Depot Level Reparables (DLRs)

Organizational level DLRs include the net cost the operating unit incurs for DLR spares (also referred to as exchangeable items) used to maintain equipment at the unit level. To the extent possible, the DLR costs of the primary system, support equipment, training devices and simulators should be separately identified.

15. Contract Maintenance Services

The separate costs of contract labor, material, and assets used in providing maintenance services to a weapon/materiel system, subsystem, support equipment, training device or simulator at the unit level. To the extent possible, the contract support cost of the primary system, support equipment, training devices and simulators should be separately identified.

*Note: Contractor support during the pre-operational phase of a system is typically funded as a system development or investment cost. However, post-operational contractor support is an O&S cost and should be included in this element.

16. Other Unit Maintenance

Organizational maintenance costs are not otherwise accounted for. Items may include costs for environmental protection or cleanup, transportation of repair parts, calibration, and technical assistance that are unique to the system and not included elsewhere in the estimate.

17. Intermediate Maintenance

Intermediate maintenance includes the cost of labor and materials and other costs expended by intermediate-level maintenance organization in support of a primary weapon/materiel system and associated support equipment. Where intermediate-level maintenance activities cannot be separately identified from organizational level maintenance, the costs are often combined as either organizational or intermediate maintenance.

Where Organizational and Intermediate maintenance material or labor costs are combined, the cost estimate should note that fact in the documentation to avoid an interpretation that a portion of the maintenance costs were omitted.

18. Intermediate-Level Consumable Parts

The cost of government furnished consumable materials used in maintaining and repairing a primary

weapon/materiel system and associated support equipment by intermediate-level maintenance activities.

19. Intermediate-Level Repair Parts

The cost of government furnished repair parts used in maintaining and repairing a primary weapon/materiel system and associated support equipment by intermediate-level maintenance activities.

20. Intermediate-Level DLRs

The cost of government furnished DLRs used in maintaining and repairing a primary weapon/materiel system-and associated support equipment by intermediate-level maintenance activities.

21. Government Labor

The government labor rate (using DoD Standard Composite Rates or hourly equivalents) for military and government civilian manpower that perform intermediate maintenance on a primary weapon/materiel system. For cases where individuals maintain more than one weapon/materiel system, manpower costs should be allocated on a relative workload basis.

*Note: In some cases, there may be contingents within the intermediate maintenance activity that deploy with the operating unit. The normal practice in O&S cost estimates is to assign the manpower costs of such contingents to element 1.2 (unit-level maintenance), and to assign the remaining intermediate maintenance manpower associated with the system to this element.

22. Contractor Maintenance

The separate costs of burdened contract labor, material and assets used in providing maintenance services to a primary weapon/materiel system

23. Other Intermediate Maintenance

Intermediate Maintenance costs are not otherwise accounted for. Items may include costs for environmental protection or cleanup, handling hazardous materials, transportation of repair parts, calibration, and technical assistance that are unique to the weapon/materiel system and not included elsewhere in the estimate.

24. Depot Maintenance

Depot maintenance includes the fully burdened cost of labor, material, and overhead incurred in performing major overhauls or other depot level maintenance on a weapon/materiel system, its components, or other associated equipment at centralized repair depots, contractor repair facilities, or on site by depot teams.

Some depot maintenance activities occur at intervals ranging from several months to several years. For major weapon/materiel systems (e.g., aircraft, tracked vehicles, ships), these costs should be included in the estimate for the years in which they are expected to occur. They should be accompanied by documentation on the cost per event and the number of events forecast per year. For major secondary items and other weapon/materiel system components (e.g., propulsion systems) costs may be provided on a cost per operating-hour.

Costs of major subsystems that have different overhaul cycles (e.g., structural subsystems such as hull, frame, or airframe; power subsystems such as engines or drive train; and electronic/mechanical subsystems such as fire control system, armaments, guidance, and command and control equipment) should be reported separately within this element.

25. Government Depot Repair

This element includes government labor, material and support service costs for depot repair. If depot repair costs are estimated based on a total charge for a specific function, such estimates should separately identify costs for labor, material, and support services, if possible.

This element also includes the cost of government furnished equipment (GFE) and other materials used for depot level maintenance activities. Included in the costs for government depot repair are consumables, DLRs, repair parts, assemblies, subassemblies, and material consumed in the maintenance and repair of a primary system or associated support equipment. DLR costs and other material detail costs are most often included in depot repair costs as part of the overall charge to the customer and are not typically identified

separately; however, they may be identified separately if they are significant cost elements.

26. Government Support Services

The cost of government-provided support services associated with depot level maintenance.

27. Contractor Depot Repair

The separate costs of burdened contract labor, material and assets used in providing maintenance services to a primary weapon/materiel system, subsystem or associated support equipment. If possible, labor, material and other costs should be displayed separately. If significant, the burdened cost of contract labor for contractor industrial engineering, plant technical services, or systems engineering and program management that is a part of the contractor's depot repair efforts should be included with this element.

28. Other Depot Maintenance

This includes Depot maintenance costs not otherwise accounted for. For example, this could include second-destination transportation costs for weapon/materiel systems or subsystems requiring major overhaul or rework, special testing, environmental costs, transportation of field repair teams, and technical assistance that is unique to the system and not included elsewhere in the estimate.

29. Sustaining Support

This category includes support services provided by centrally managed support activities external to the units that own the operating weapon/materiel systems. It is intended that costs included in this category represent costs that can be identified to a specific weapon/materiel system and exclude costs that must be arbitrarily allocated. Where a single cost element includes multiple types of support, or where contractors provide the support, each should be separately identified in the cost estimate.

30. System-Specific Training

System-specific training includes the costs for system-specific specialty training for individuals that need to be replaced due to attrition and normal rotation. Training costs should include the costs of instructors, training support personnel, training devices, course support costs and course materials, as well as all the costs of trainees, per diem, and travel directly associated with the training. (Travel of individuals to training from operational units is included in Unit Operations/Temporary Duty, element 2.3).

31. System-Specific Operator Training

The costs for training conducted in units designated as primary training sites for individuals to become proficient in specific system knowledge. This includes units such as Air Force wings Army Aviation units assigned a primary mission of weapon-specific aircrew training, Navy air readiness training units, Navy Afloat Training Groups, and the Army Armor Center. Alternatively, these costs may be included as unit costs and included in elements 1.0, 2.0, and 3.0. They may also be tracked separately under sustaining support. If included in other cost elements, their costs should be clearly shown. (These costs do not include skill training not related to a specific system such as undergraduate aviation training).

32. System-Specific Maintenance Training

The costs of advanced system-specific training associated with maintenance and other support functions in units designated as primary training facilities.

33. System-Specific Other Support Training

The costs of advanced system-specific training associated with maintenance and other support functions in units designated as primary training facilities.

34. Support Equipment Replacement

The costs incurred to replace or repair equipment that is needed to operate or support a primary weapon/materiel system, subsystems, training systems and other support equipment. The support equipment being replaced (e.g., tools and test sets) may be unique to the system or it may be common to a number of systems, in which case the costs must be allocated among the respective systems.

*Note: This element addresses replacement and repair of equipment. The cost of initial support equipment procurement is normally regarded as an investment cost, and not as an O&S cost.

35. Operating Equipment Replacement

The costs incurred to replace mission equipment or software due to technical obsolescence or to a life expectancy that is less than that for the entire weapon/materiel system. This may include the costs of periodic technical refreshment in automated systems. Other examples may include mission equipment that has an expected life less than the system's mission life (e.g., some satellite systems) or perishable components of a weapon/materiel system.

These costs are not intended to account for losses due to accidental loss (e.g., attrition). If these changes result in or are a part of a weapon/materiel system's modifications, the costs may be reported under hardware or software modifications, elements 5.1 and 5.2.

Replacement of operating equipment and software may include more than procurement. If development, testing, and installation are also required, these costs are included here as well. In the case of satellite constellations that require periodic replacement, launch costs are also applicable O&S costs unless these costs have been included in the investment cost portion of the lifecycle cost estimate.

36. Sustaining Engineering and Program Management

The labor, material, and overhead costs incurred in providing continued systems engineering and program management oversight to manage the program and to determine the integrity of a weapon/materiel system, to maintain operational reliability, to approve design changes and to ensure conformance with established specifications and standards. In the case of weapon/materiel systems that are simultaneously in production and operations, the costs over and above the costs that the acquisition program office incurs to oversee and manage acquisition phase activities are included in the O&S estimate. When a separate sustainment program management office is established or is separately identifiable from the acquisition support management office, the costs of the sustainment program management office will be included in the O&S estimate.

Costs reported in this category may include, but are not limited to, government and/or contract engineering services, studies and technical advice. Examples might include aircraft structural integrity monitoring or corrosion monitoring. Specific modifications to hardware or software are included in element 5.0: Continuing System Improvements. Sustaining support costs provided through a weapon/materiel system support contract should be separately identified within the appropriate cost element, if possible.

9. Vantage

Vantage is the Army's data analytics platform, and it is located at https://vantage.army.mil/. Logins are managed through Enterprise Access Management Service-Army (EAMS-A) via Common Access Card (CAC), and signup requires a current information assurance training certificate. Access to the DASA-CE project within Vantage will require another approval layer but is granted to all DASA-CE analysts on request.

Vantage contains relational database tables, dashboards, and other data from a variety of Army electronic systems, including but not limited to GFEBS, GCSS-Army, LMP, AESIP, EDA, cPROBE, and FPDS. The platform contains a data catalog with a number of prebuilt datasets of interest (Army unit information, status of funds data, equipment information, etc.) and allows users to build their own data models and visualizations using almost any of the data on the platform by default (some organizations have imported specific data for which access requests will have to be made). Specific data can also be uploaded into Vantage when needed, provided that the data is relatively small. Vantage contains several tools for data model and visualization construction: Contour for a flowchart-based and low code approach, Code Workbooks for a coding but still flowchart-based approach using SQL, Python, or R, and Code Repositories for a full code approach. Interactive visualizations can be constructed using Contour to generate dashboards with variable filters (parameters in the verbiage of the platform). Vantage includes

several other tools as well, including a spreadsheet and time-series analysis applications, and allows for data export of relatively small datasets for outside analysis.

i. Cost Analysis Datasets

1. Acquisition Execution Data

The Acquisition Execution Data report examines GFEBS/GCSS-A execution data and any contracts associated with that execution with specific search filters for narrowing to an acquisition program. All execution data from the GFEBS/GCSS-A combined status of funds dataset is included whether it is acquisition or contract related or not – the filters and visuals are simply designed with an acquisition or contract focus. The report begins with a brief description of the different possible acquisition program parameters (APEs, MDEPs, RDTE projects, and OSD PEs among others) and an initial summary table of data found under each of those parameters. Text searching of those parameter descriptions is also provided for analysts who are unsure of the specific parameter codes. The report also shows time summaries by appropriation and by mapped CES elements according to ASA(ALT) policy, and it closes with summaries of contract-specific costs by contract number and order number. A table of the raw data is also included.

2. G-Army Work Order Analytics Dashboard & Contour

The G-Army Work Order Analytics Dashboard & Contour report examines G-Army maintenance cost data, primarily associating parts and labor costs with individual systems through aggregating transactions against maintenance work orders and their corresponding pieces of equipment. The work orders are also associated with UICs and their hierarchies to enable pulling of data aggregated by unit (either a specific unit or that unit and every one of its subordinate units). Visualizations in the report provide summaries by fiscal year, cost type (labor, material, or other), order type (preventative maintenance, regular maintenance, etc.), and material class of supply. A top 10 list of NIINs used in orders by cost is also included, as is the raw data.

3. LMP Project Summary Report and Contour

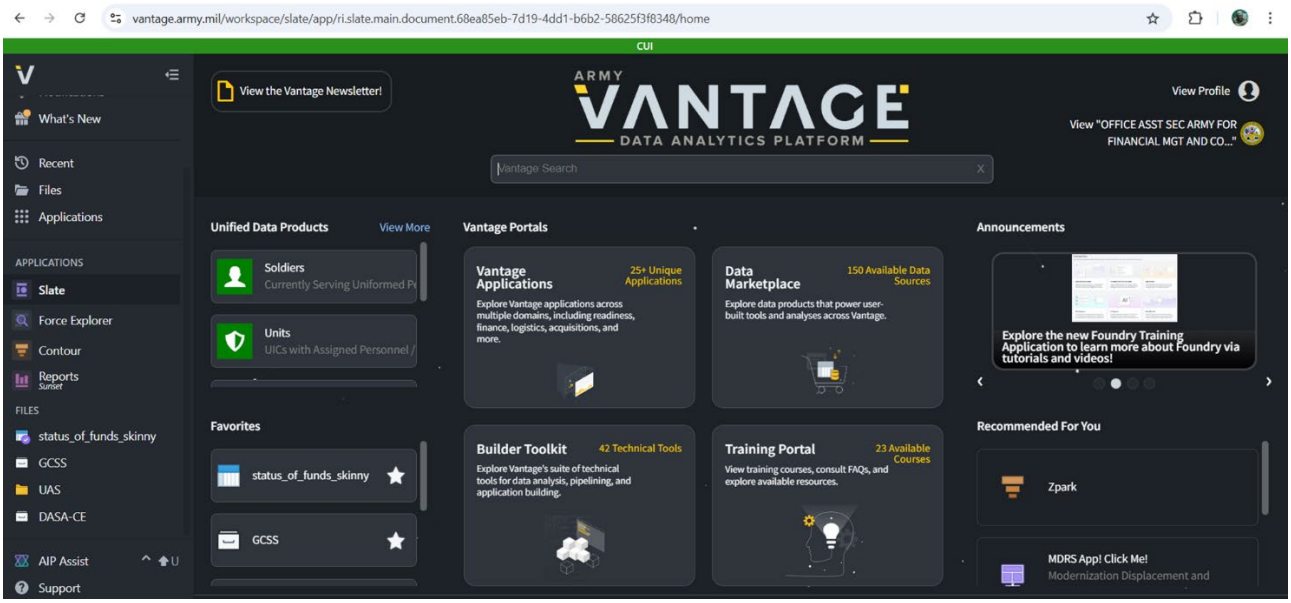
The LMP Project Summary Report and Contour report examines Army depot maintenance project cost data from LMP. All transactions related to production orders or WBS elements that are associated with depot projects are included along with descriptive data about the projects, WBS elements, and orders. In addition to cost data for the projects, labor hours, labor type, statuses, descriptions, material quantities, part NIINs, system NIINs, customer data, provider data, and funding information are also provided. Time phasing is also provided with three different levels of aggregation: one where all data is aggregated to one row per project, another where each fiscal year within a project has a separate row, and finally the raw dataset where each transaction within a project is separate.

4. Installation Infrastructure Data

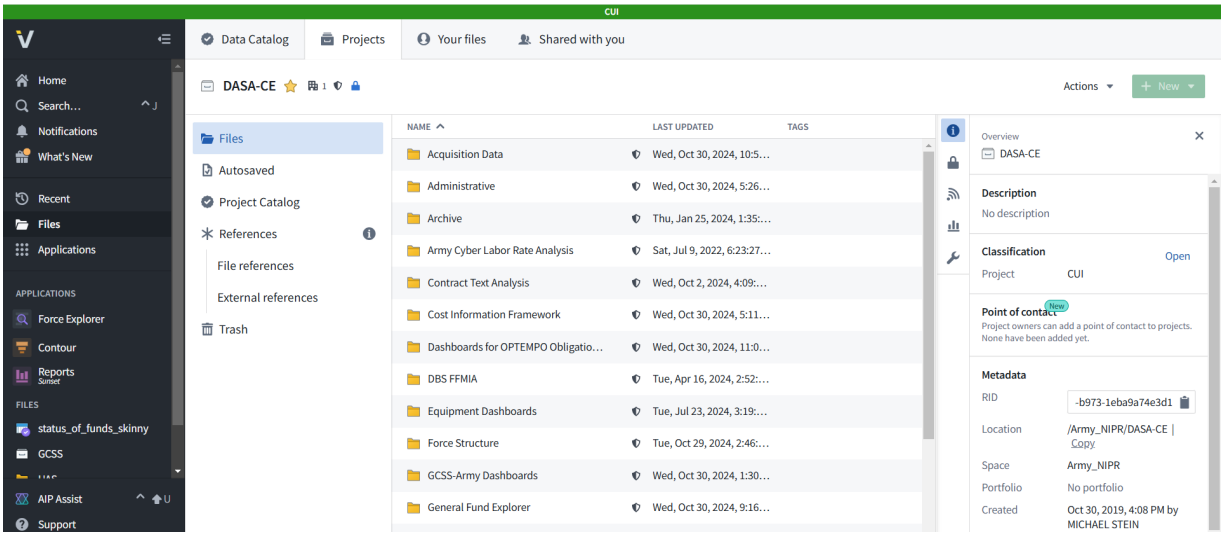
The Installation Infrastructure Data report costs of facility maintenance orders and projects and associates those costs with the specific installation and building/structure where the work was performed. The data includes only GFEBS orders identified as maintenance work orders and GFEBS WBS elements than can be associated with a building/structure through their functional locations and account assignments (WBS elements encompassing the orders are also included, though usually they can be directly associated as well). The work order and WBS data is organized by cost type (types of labor, material, other costs) and time, and provides quantity information including labor hours. The building/structure metadata associated with the work orders and WBS elements provides descriptions for the buildings/structures and the installations, addresses, construction and acquisition dates, space sizing data (like square footage), and many other parameters.

ii. Dashboards for OPTEMPO Obligation Reporting (DOOR)

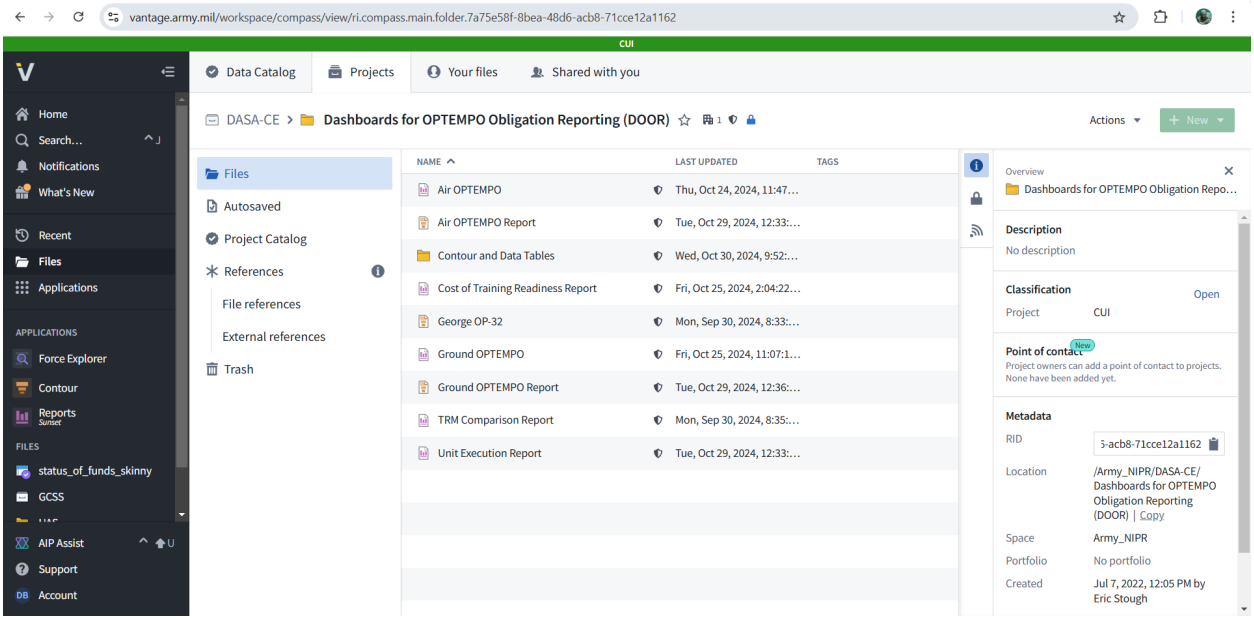
The Vantage Dashboards for OPTEMPO Obligation Reporting (DOOR) are a suite of dashboard and reporting tools in Vantage that takes obligation execution data from the ERPS especially GFEBS to align OTEMPO Obligation through different views including Ground OPTEMPO, AIR OPTEMPO, UIC, by Operational Unit or Commitment Item / Element or Resource (EOR). To access the Vantage DOOR reports the analyst must first go to the Vantage website.



Once the analyst validates their login information and gets to the Vantage main page, the DASA CE folder is on the left side under 'FILES.'



When the analyst follows the link to the DASA CE folder, they will find the Dashboards for OPTEMPO Obligations (DOOR) folder and can click to open it.



When the analyst follows the link to the DOOR folder, they will find the DOOR suite of reports.

1. Air OPTEMPO Report Description

This is an Air OPTEMPO report that compiles historical General Fund Enterprise Business System (GFEBS) obligations based on the Flying Hour Program Management Decision Packages (MDEPs) in Training Resource Model (TRM). The report's primary filter is set to display GFEBs obligations for the MDEPs: Fixed Wing Life Cycle Contract Support (AMAS), Training Aerial Intelligence, Surveillance, and Reconnaissance (TISR), Army Counterdrug Flying Hour Program (VCNA), Flying Hour Program (VFHP). It includes all SAGs. It does not include the Ground OPTEMPO for aviation units.

The Air OPTEMPO report contains 9 data tables, data from each table can be exported via the 'more actions' link at the bottom of each table:

1. MDEP & SAG Summary
2. Class II/IV Supply Summary
3. Class III Supply Summary
4. Class VIII Supply Summary
5. Class IX Supply Summary
6. Other Supply Summary
7. Commitment Item Summary
8. Overseas Operations Cost Summary
9. GFEBs Raw Obligation Data

Data in the tables can be filtered; filters can be changed, values can be added or excluded. The default filters and default values are:

1. Year_Exec_Fund funds = most recent FY, by default. Other values include: Execution year which displays a given fiscal year's appropriated funds by what year the funds were obligated and/or de-obligated and Fund Year which displays all funds obligated and/or de-obligated for a given FY.
2. APPN default = OMA, code 2020. Other values are OMNG, code 2065, and OMAR, code 2080.
3. Fund Type default = direct funds only, or not reimbursable.

4. Base_OCO funding = 0, or Base funding. Other values are, 1 for OCO, 2 for OCO-to-BASE, 3 for Base-to-OCO, 4 for European Reassurance Initiative.
5. SAG = All by default alternatively the analyst may specify a valid SAG.
6. MDEP = AMAS, by default. Other values are TISR, VCNA, and VFHP.
7. Dollar_Type = Base by default. The other possible value is OOC (Overseas Operations Costs) as an effort to capture OOC, this includes obligations for the MDEPs VIAD, VEIR, VOFS, VEDI, VEFS, VIRQ, VESS (SAG 116 only) for costs incurred FY22 and earlier. In FY23, OOC are captured via select GFEBs FCA codes (F1201/BBES, F1202/BBIR, F1203/BHOA, F1205/BOES, F1206/BOIR, F1501/BGMO, F1811/BCTO, F2204/BOSS, F2307/BEDI). This supports tracking different base "dollar type" obligations in accordance with the 14 SEP 22 Memorandum; SUBJECT: Fiscal Year (FY) 2023 Army Fund Structure Guidance.
8. Command = all by default, or a specified command maybe selected.
9. Class of Supply = all by default or a specified class maybe selected.

2. Cost of Training Readiness Report Description

This report is an OMA, OMNG and OMAR APPN report that compiles historical GFEBs obligations. The report compiles GFEBS execution data by UIC. It includes all the SAGs.

The Cost of Training Readiness report provides GFEBs obligation raw data with multiple variables to include UIC, Fund, Fund Center, command, UIC, commitment item, MDEP, SAG, APE, monthly posting period and other details. The data can be exported via the more actions link located at the bottom of each cited table. Due to downloadable data size limitations, a command filter was included to enable one to download to excel in a piecemeal fashion.

Data in the tables can be filtered; filters can be changed, values can be added or excluded. The default filters and default values are:

1. Year_Exec_Fund funds = most recent FY, by default. Other values include: Execution year which displays a given fiscal year's appropriated funds by what year the funds were obligated and/or de-obligated and Fund Year which displays all funds obligated and/or de-obligated for a given FY.
2. FUND or APPN default = OMA, code 2020. Other values are OMNG, code 2065, and OMAR, code 2080.
3. Base_OCO funding = 0, or Base funding. Other values are, 1 for OCO, 2 for OCO-to-BASE, 3 for Base-to-OCO, 4 for European Reassurance Initiative.
4. Period = all by default but can be set to any month of the fiscal year.
5. Command = FORSCOM by default, or a specified command maybe selected.

3. George-32 / OMA OP-32 Budget Report Description

This report displays GFEBs OMA historical obligations in the format used for the annual OP-32 exhibit for the Army budget request to Congress. It crosswalks all GFEBs OMA commitment items to the appropriate Element of Resource (EOR).

The George-32 summary table provides GFEBs obligations for the OMA appropriation only and displays a summary of table of the EORs by a given fiscal year.

Data in the tables can be filtered; filters can be changed, values can be added or excluded. The default filters and default values are:

1. Year_Exec_Fund funds = most recent FY, by default. Other values include: Execution year which displays a given fiscal year's appropriated funds by what year the funds were obligated and/or de-obligated and Fund Year which displays all funds obligated and/or de-obligated for a given FY.
2. APPN default = OMA, code 2020.
3. Fund Type default = direct funds only, or not reimbursable.
4. Base_OCO funding = 0, or Base funding. Other values are, 1 for OCO, 2 for OCO-to-BASE, 3 for Base-to-OCO, 4 for European Reassurance Initiative.
5. SAG is all by default or may be specified.
6. MDEP is all by default or may be specified.
7. Dollar_Type = Base by default. The other possible value is OOC (Overseas Operations Costs) as an effort to capture OOC, this includes obligations for the MDEPs VIAD, VEIR, VOFS, VEDI, VEFS, VIRQ, VESS (SAG 116 only) for costs incurred FY22 and earlier. In FY23, OOC are captured via select GFEBs FCA codes (F1201/BBES, F1202/BBIR, F1203/BHOA, F1205/BOES, F1206/BOIR, F1501/BGMO, F1811/BCTO, F2204/BOSS, F2307/BEDI). This supports tracking different base "dollar type" obligations in accordance with the 14 SEP 22 Memorandum; SUBJECT: Fiscal Year (FY) 2023 Army Fund Structure Guidance.

4. Ground OPTEMPO Report Description

The Ground OPTEMPO report compiles historical GFEBs obligations programmed for Ground OPTEMPO MDEPs in TRM. The report's filter defaults are set to display GFEBs obligations for the MDEPs: 50 each in total (see filter for the listing). It includes all the SAGs. It does include the ground OPTEMPO for all aviation units.

The report provides 9 dashboard views:

1. MDEP & SAG Summary
2. Class II/IV Supply Summary
3. Class III Supply Summary
4. Class VIII Supply Summary
5. Class IX Supply Summary
6. Other Supply Summary
7. Commitment Item Summary
8. Overseas Operations Cost Summary
9. GFEBs Raw Obligation Data

Data in the tables can be filtered; filters can be changed, values can be added or excluded. The default filters and default values are:

1. Year_Exec_Fund funds = most recent FY, by default. Other values include: Execution year which displays a given fiscal year's appropriated funds by what year the funds were obligated and/or de-obligated and Fund Year which displays all funds obligated and/or de-obligated for a given FY.
2. APPN default = OMA, code 2020. Other values are OMNG, code 2065, and OMAR, code 2080.
3. Fund Type default = direct funds only, or not reimbursable.
4. Base_OCO funding = 0, or Base funding. Other values are, 1 for OCO, 2 for OCO-to-BASE, 3 for Base-to-OCO, 4 for European Reassurance Initiative.
5. SAG = All by default alternatively the analyst may specify a valid SAG.
6. MDEP = 50 each by default. Other values can be selected from a drop down.

7. Dollar_Type = Base by default. The other possible value is OOC (Overseas Operations Costs) as an effort to capture OOC, this includes obligations for the MDEPs VIAD, VEIR, VOFS, VEDI, VEFS, VIRQ, VESS (SAG 116 only) for costs incurred FY22 and earlier. In FY23, OOC are captured via select GFEBs FCA codes (F1201/BBES, F1202/BBIR, F1203/BHOA, F1205/BOES, F1206/BOIR, F1501/BGMO, F1811/BCTO, F2204/BOSS, F2307/BEDI). This supports tracking different base "dollar type" obligations in accordance with the 14 SEP 22 Memorandum; SUBJECT: Fiscal Year (FY) 2023 Army Fund Structure Guidance.
8. Command = all by default, or a specified command maybe selected.
9. Class of Supply = all by default or a specified class maybe selected.

5. Unit Execution Report Description

The Unit Execution report provides a historical GFEBs OPTEMPO obligation summary for the Brigade Combat Teams (BCT's) at UIC level of detail. It assigns a UIC to each cost collector in GFEBS according to the following precedence: for direct obligation transactions we use the cost center UIC; then for WBS obligation transactions we capture the requesting cost center, owning unit, UIC; then the responsible cost center, unit doing the work, UIC; finally, we those GFEBs UICs are matched to the FMS Web MTOE UIC data. Each fiscal year transaction is matched to the appropriate year pulled from GFM-DI exports.

For example, if a GFEBS transaction occurs on a WBS in FY 2019, and that WBS has a requesting and a responsible cost center, then the UIC will be assigned based on the requesting cost center according to its UIC in FY 2019 and FMS Web data from FY 2019 will be matched to that UIC.

The FMS Web attachment process takes two forms. The simplest is a lookup by UIC against the GFM-DI export, but not all UICs in GFEBS appear in those exports. For example, derived UICs do not appear. The second form looks for derived UICs with no match. Typically, these are UICs ending in letter and number, e.g. A0, B0, etc., then a modified UIC is generated by replacing those last two characters with 'AA'. Then a match is made to the FMS Web data for that UIC. The first form is always prioritized, and when that returns a match the second form will be evaluated.

The Unit Execution summary table provides GFEBs obligation at Brigade level rollup with multiple variables to include BCT Type, Command, Brigade UIC, BCT Name, TRM Name, TRM Critical Requirement, TRM Funded amount and obligation amounts for a given year. A second table provides one a view and download capability of the raw data that is used to build the summary table. The data can be exported via the more actions link located at the bottom of each cited table.

Data in the tables can be filtered; filters can be changed, values can be added or excluded. The default filters and default values are:

1. Year_Exec_Fund funds = most recent FY, by default. Other values include: Execution year which displays a given fiscal year's appropriated funds by what year the funds were obligated and/or de-obligated and Fund Year which displays all funds obligated and/or de-obligated for a given FY.
2. APPN default = OMA, code 2020. Other values are OMNG, code 2065, and OMAR, code 2080.
3. Fund Type default = direct funds only, or not reimbursable.
4. Base_OCO funding = 0, or Base funding. Other values are, 1 for OCO, 2 for OCO-to-BASE, 3 for Base-to-OCO, 4 for European Reassurance Initiative.
5. SAG = 111 by default alternatively the analyst may specify a SAG from 111 to 116.
6. MDEP = all each by default. Other values can be selected from a drop down.
7. Dollar_Type = Base by default. The other possible value is OOC (Overseas Operations Costs) as an effort to capture OOC, this includes obligations for the MDEPs VIAD, VEIR, VOFS, VEDI,

VEFS, VIRQ, VESS (SAG 116 only) for costs incurred FY22 and earlier. In FY23, OOC are captured via select GFEBs FCA codes (F1201/BBES, F1202/BBIR, F1203/BHOA, F1205/BOES, F1206/BOIR, F1501/BGMO, F1811/BCTO, F2204/BOSS, F2307/BEDI). This supports tracking different base "dollar type" obligations in accordance with the 14 SEP 22 Memorandum; SUBJECT: Fiscal Year (FY) 2023 Army Fund Structure Guidance.

8. Command = all by default, or a specified command maybe selected.
9. Class of Supply = all by default or a specified class maybe selected.

Chapter 13 C-BAs and Guidance

1. Introduction

Cost-Benefit Analyses (C-BAs) are a tool that the Army uses to exercise stewardship of its resources in today's resource-constrained environment. C-BAs can be used throughout all requirement and resourcing processes. For every proposed program, initiative or decision point that will be presented to decision-makers, it is important to provide an accurate and complete picture of both the costs estimates and the benefits to be derived.

The Secretary of Defense, along with Senior Leaders of the Department of the Army, have mandated the use of C-BAs to support resource-informed decision making. To implement this directive, the Office of the Assistant Secretary of the Army (Financial Management and Comptroller) has developed the U.S. Army Cost Benefit Analysis Guide, found on the Cost Performance Portal (https://cpp.army.mil). The C-BA Guide is applicable to a wide range of requirements, issues, tasks, and problems that require a deliberate analysis to arrive at the optimum course of action. This Chapter provides a basic overview of a C-BA but the Army Cost Benefit Analysis Guide should be consulted for step-by-step instructions and guidance. Figure 28 below shows an overview of the C-BA process.

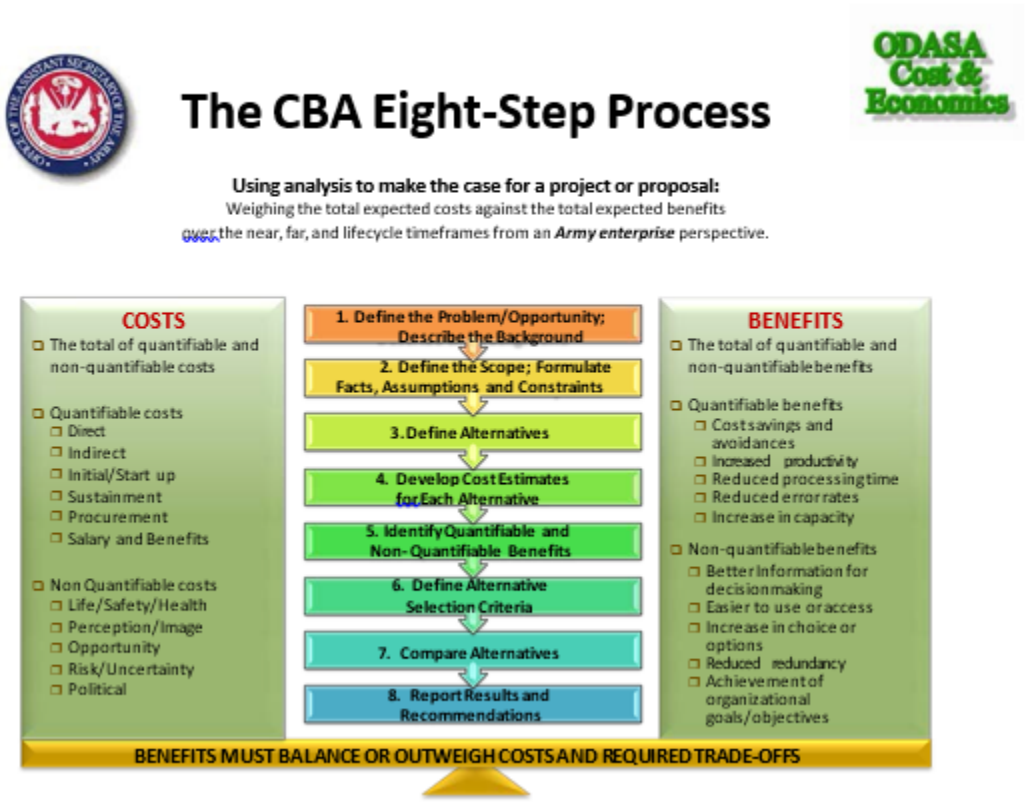


Figure 17: C-BA Overview

2. What is a Cost-Benefit Analysis?

A C-BA:

- Is a decision support tool that documents the predicted effect of actions under consideration to solve a problem or take advantage of an opportunity
- Is a structured proposal that functions as a decision package for organizational decision-makers
- Defines a solution aimed at achieving specific Army and organizational objectives by quantifying the potential financial impacts and other business benefits
- Provides decision-makers with facts, data, and analysis required to make an informed decision
- Considers all benefits to include non-financial or non-quantifiable benefits of a specific course of action or alternative.
- Provides an analysis of needs and problems, their proposed alternative solutions, and a risk analysis to lead the analyst to a recommended choice.
- Must be tailored to fit the problem, because finding the optimal solution is the focus of the C-BA
- Supports the decision making process, but will not make a final decision.

3. When Should a Cost-Benefit Analysis Be Performed

A C-BA must be performed to support leadership decisions, including during the following situations:

- Per financial thresholds established within the annual Command Program Guidance Memorandum (CPGM) and Army Regulation (AR) 11-18 (The Cost and Economic Analysis Program), 29 AUG 2019.
- With Force Design updates and Concept Plans or as part of Vice Chief of Staff of the Army (VCSA) portfolio analyses.
- When issues will be considered by ACP, Budget, Requirements, and Program (BRP) Board, or Army Requirements and Resourcing Board (AR2B).
- In response to directives from Army or Office of Secretary of Defense (OSD) leadership.
- When the organization is requesting capital budget funds.

Appendix 1: Acronyms

AAO: Army Acquisition Objective

AAP: Office of Acquisition, Analytics and Policy

ABCT: Armored Brigade Combat Team

ACAT: Acquisition Category

ACDB: Automated Cost Database

ACE: Automated Cost Estimator

ACES: Army Cost Element Structure

ACEIT: Automated Cost Estimating Integrated Tools

ACM: Army Contingency Operations Cost Model

ACOM: Army Command

ACP: Army Cost Position

ADC: Assured Delivery Cost

AMC: Army Materiel Command

AMCOS: Army Military-Civilian Cost System

AMDF: Army Master Data File

AMUC: Average Manufacturing Unit Cost

AOA: Analyses of Alternatives

AOR: Acquisition of Resources

APB: Acquisition Program Baseline

APGM: Army Program Guidance Memorandum

APO: Army Procurement Objective

APPN Appropriation

APUC: Average Procurement Unit Cost

AR2B: Army Requirements and Resourcing Board

ARSTAF: Army Staff

ASA (ALT): Assistant Secretary of the Army (Acquisition, Logistics and Technology)

ASA (FM&C): Assistant Secretary of the Army (Financial Management and Comptroller)

ASA (I&E): Assistant Secretary of the Army for Installation and Environmental

ASARC: Army Systems Acquisition Review Council

ASI: Additional Skills Identifier

ASL: Authorized Stock List

BA: Budget Activity

BAH: Basic Allowance for Housing

BCA: Business Case Analysis

BCT: Brigade Combat Team

BOIP: Basis of Issue Plan

BRP: Budget, Requirements, and Program

BY: Base Year

CAC: Common Access Card

CADE: Cost Assessment Data Enterprise

CAIV: Cost as an Independent Variable

CAM: Cost Analysis Manual

CAPE: Cost Assessment Program Evaluation

CARD: Cost Analysis Requirements Description

CASE: Computer-Aided Software Engineering

CATEX: Category Exclusion

C-BA: Cost-Benefit Analysis

CCA: Component Cost Analysis

CCDR: Contractor Cost Data Reports

CCE: Component Cost Estimate

CCP: Component Cost Position

CDRL: Contract Data Requirements List

CER: Cost Estimating Relationship

CES: Cost Element Structure

CFH: Cost and Factors Handbook

CFSR: Contract Funds Status Reports

CLIN: Contract Line Item Number

CO: Cost Management (GFEBS)

CO$TAT: Cost Analysis Statistics Package

COLA: Cost of Living Amount

CPP: Cost & Performance Portal

CRB: Cost Review Board

CRB WG: Cost Review Board Working Group

CSDR: Cost and Software Date Reporting (CSDR)

CTA: Common Table of Allowances

CTU: Consolidated TOE Update

CTYPE: Civilian Type

CWIPT: Cost Working Group Integrated Product Team

D&D: Demilitarization and Disposal

DA: Department of the Army

DAB: Defense Acquisition Board

DAES: Defense Acquisition Executive Summary

DAMIR: Defense Acquisition Management Information Retrieval

DAMO-TR: Department of the Army Military Operations-Training

DASA-CE: Deputy-Assistant Secretary of the Army - Cost & Economics

DBS: Defense Business System

DCAPE: Director of Cost Assessment and Program Evaluation

DCARC CSDR-SR: Defense Cost and Resource Center CSDR-Submit & Review

DCS PRO-FD: Deputy Chief of Staff Programming-Force Development

DCS PRO-PA: Deputy Chief of Staff Programming-Program Analysis

DEMIL: Demilitarization

DID: Data Item Description

DISC4: Director, Information Systems for Command, Control, Communications and Computers

DHP: Defense Health Program

DHS: Department of Homeland Security

DLA: Defense Logistics Agency

DoD: Department of Defense

DoDCAS: Department of Defense Cost Analysis Symposium

DoDI: Department of Defense Instruction

DRMO: Defense Reutilization and Marketing Office

DUSA (IA): Deputy Under-Secretary of the Army for International Affairs

EA: Economic Analysis

EMD: Engineering and Material Development

EPA: Environmental Protection Agency

EQLCCE: Environmental Quality Life Cycle Cost Estimate

ERP: Enterprise Resource Planning

ESLOC: Equivalent Source Lines of Code

EUL: Economic Useful Life

EUSA: Eight United States Army

EVM: Earned Value Management

EVM-CR: Earned Value Management Central Repository

F: Financials (GFEBS)

FBCE-F: Fully Burdened Cost of Energy-Fuel

FBCF: Fully-Burdened Cost of Fuel

FCM: Forces Cost Model

FDU: Force Design Update

FLIS: Federal Logistics Information System

FM: Funds Management and Budget Formulation (GFEBS)

FMS: Foreign Military Sales

FORCES: Force and Organizational Cost Estimating System

FORSCOM: United States Army Forces Command

FRP: Full-Rate Production

FY: Fiscal Year

FYDP: Future Years Defense Program

GAO: Government Accountability Office

GDP: Gross Domestic Product

GFE: Government Furnished Equipment

GFEBS: General Fund Enterprise Business System

GP: General Purpose

GR&A: Ground Rules and Assumptions

HMMP: Hazardous Material Management Plan

ICE: Independent Cost Estimate

IOC: Initial Operational Capability

IPMR: Integrated Program Management Reports

IPT: Integrated Product Team

IT OIIT: Information Technology Overarching Integrated Product Team

JACS: Joint Cost and Schedule Analysis

JIAT: Joint Integrated Analysis Tool

JUON: Joint Urgent Operational Need

KPP: Key Performance Parameter

LCC: Life Cycle Cost

LCCE: Life Cycle Cost Estimate

LCEA: Life Cycle Environmental Assessment

LIN: Line Item Number

LRIP: Low Rate Initial Production

MACOM: Major Army Command

MAIS: Major Automated Information System

MDA: Milestone Decision Authority

MDAP: Major Defense Acquisition Program

MDEP: Management Decision Package

MILCON: Military Construction

MOS: Military Occupational Specialty

MP: Military Personnel

MTA: Middle-Tier Acquisition

NDAA: National Defense Authorization Act

NEPA: National Environmental Policy Act

O&M: Operations and Maintenance

O&S: Operations and Sustainment

ODASA-CE: Office of the Deputy Assistant Secretary of the Army- Cost and Economics

ODCSOPS: Office of the Deputy Chief of Staff, Operations and Plans

OHA: Overseas Housing Allowance

OIPT: Overarching Integrated Product Team

OMA: Operations and Maintenance, Army

OMB: Office of Management and Budget

OPA: Other Procurement, Army

OPTEMPO: Operations Tempo

OSD: Office of Secretary of Defense

OSD CAPE: Office of the Secretary of Defense Cost Assessment and Program Evaluation

OSMIS: Operations and Support Management Information System

OTS: Off-the-Shelf

P2: Pollution Prevention

PAUC: Program Acquisition Unit Cost

PCS: Permanent Change of Station

PEO: Program Executive Officer

PESHE: Programmatic Environmental Safety and Occupational Evaluation

PLL: Prescribed Load List

PM: Product Manager

PME: Prime Mission Equipment

PMO: Project Management Office

POE: Program Office Estimate

POM: Program Objective Memorandum

POST: Program Office Support Tool

PP&E: Property, Plant, & Equipment (GFEBS)

PPBE: Planning, Programming, Budgeting and Execution

PPSS: Post Production Software Support

Proc: Procurement

RDT&E: Research, Development, Test, and Evaluation

REC: Record of Environmenal Consideration

RFP: Request for Proposal

RM: Reimbursables and Debt Management (GFEBS)

ROM: Rough Order of Magnitude

RPC: Real Price Change

SAG: Sub Activity Group

SAR: Selected Acquisition Reports

SC: Spending Chain (GFEBS)

SEPM: Systems Engineering Program Management

SLOC: Source Lines of Code

SME: Subject Matter Expert

SOP: Standard Operating Procedure

SQI: Special Qualifications Indicator

SRC: Standard Requirements Code

SRDR: Software Resource Data Reports

SRM: Sustainment, Restoration and Modernization

STS: System Technical Support

TAMIS: Total Ammunition Management Information System

TDA: Table of Distribution and Allowances

TMRR: Technology Maturation and Risk Reduction

TOE: Table of Organization and Equipment

TY: Then Year

UAS: Unmanned Aircraft System

UAV: Unmanned Aerial Vehicle

UON: Urgent Operational Need

US: United States

U.S.C.: United States Code

USAEC: US Army Environmental Command

USAREUR: United States Army Europe

USARPAC: United States Army Pacific

USD (A&S): Under Secretary of Defense for Acquisition and Sustainment

USD(R&E): Undersecretary of Defense for Research and Engineering (USD(R&E)

UIC: Unit Identification Code

VCSA: Vice Chief of Staff of the Army

WBS: Work Breakdown Structure

Appendix 2: Definitions

Army Cost Position (ACP): The ACP is the Army's approved Life Cycle Cost (LCC) estimate for the materiel system. It is the basis for Army planning, contracting, programming, budgeting, and execution. For Department of Defense (DoD) milestone reviews, the ACP satisfies the DoD 5000.2-R requirement for a Component cost position.

AoA: Analyses of Alternatives (AoA): AoA is an analytical comparison of the operational effectiveness, suitability and Life-Cycle Cost of alternatives that satisfy established capability needs. AoAs provide a comparison between the cost and operational parameters of a program and one or more alternative programs. AoA also provide a structure to review design, acquisition, and life cycle cost options.

Cost Analysis: The Government Accountability Office (GAO) defines cost analysis as the following:

- the effort to develop, analyze, and document cost estimates with analytical approaches and techniques;
- the process of analyzing, interpreting, and estimating the incremental and total resources required to support past, present, and future systems—an integral step in selecting alternatives; and
- a tool for evaluating resource requirements at key milestones and decision points in the acquisition process.

Average Manufacturing Unit Cost (AMUC): The AMUC is the program's recurring production costs plus the contractor systems engineering program management (SEPM) divided by the number of production units. Contractor SEPM is included for AMUC as in determining AMUC, analysts often look to Contract Line Item Number (CLIN) pricing, and contractor SEPM is almost always rolled into the CLIN total price.

Average Procurement Unit Cost (APUC): The APUC is the program procurement cost divided by the procurement quantity. The APUC procurement quantity includes any EMD quantities that have been refurbished using procurement dollars. APUC is displayed in constant dollars of a base year fixed for each program.

Component Cost Analyses (CCA): An agency not in the acquisition community develops the CCA to support specific regulatory acquisition milestone requirements. Analysts use the CCA to test the reasonableness of the POE.

Independent Cost Estimate (ICE): The ICE is required by 10 USC 2434 (ICEs, operational manpower requirements). The Office of the Secretary of Defense Cost Assessment and Program Evaluation (OSD CAPE) conducts or approves ICEs at the following points:

(a) In advance of any Milestone A certification under section 2366a of Title 10, U.S.C., or Milestone B certification under section 2366b of Title 10, U.S.C.

(b) In advance of any decision to enter low-rate initial production (LRIP) or full-rate production (FRP).
(c) In advance of any certification for critical Nunn-McCurdy breaches under section 2433a of Title 10, U.S.C.
(d) At any other time considered appropriate by the DCAPE or upon the request of the USD(R&E), USD(A&S), or MDA.

Additionally, the CAPE conducts or delegates ICEs for the remainder of the life-cycle of the program for sustainment reviews required by section 2441 of Title 10, U.S.C.

Program Acquisition Unit Cost (PAUC): The PAUC is statutorily defined as the amount equal to (A) the total cost for development and procurement of, and system-specific military construction for, the acquisition program, divided by (B) the number of fully-configured end items to be produced for the acquisition program. Acquisition O&M may be included in the "(A)" portion of the calculation.

Program Office Estimate (POE): The program office develops the POE to support specific acquisition milestone requirements. The POE should reflect the program described in the Cost Analysis Requirements Description (CARD) or other system definition documents, if a CARD is not available.

Unit Cost: There are a wide variety of unit cost definitions further discussed in Appendix 3: Key Unit Cost Definitions.

Appendix 3: Key Unit Cost Definitions

The following are key unit cost terms, including what ACES elements are part of the definition.

1. Hardware Unit Cost

- Recurring Production (2.2)
  - Manufacturing (2.2.1)
  - Recurring Engineering (2.2.2)
  - Sustaining Tooling (2.2.3)
  - Quality Control (2.2.4)

4. Rollaway Cost

- All elements of Hardware Unit Cost
- Nonrecurring Production (2.1)
  - Production Facilities (2.1.1)
  - Production Equipment (2.1.2)
  - Depot Maintenance Plant Equipment (2.1.3)
  - Engineering Services/System Technical Support (STS) (2.1.4)
  - Other Non-Recurring Production (2.1.5)
- Other Recurring Production (2.2.5)
- System Engineering/Program Management (2.3)
  - System Engineering/Program Management (Government)(2.3.1)
  - System Engineering/Program Management (Contractor) (2.3.2)
- System Test & Evaluation (2.4)
- Transportation (2.9.4)
- Sustaining Systems Engineering (2.11.2)
- Software Program Management (2.11.5)
- Facilities (2.11.6)
- Field Software Engineering (2.11.7)

5. Weapon System Cost

- All elements of Rollaway Cost
- Training (2.5)
- Data (2.6)
- Support Equipment (2.7)
  - Peculiar (2.7.1)
  - Common (2.7.2)
- Operational Site Activation (2.8)
- Initial Support Equipment (2.9.3)
- New Equipment Training (2.9.5)
- Contractor Logistics Support (2.9.6)
  - Operations (2.9.6.1)
  - Unit-Level Maintenance (2.9.6.2)
  - Other Unit Level 92.9.6.3)
  - Consumable Materials and Repair Parts (2.9.6.4)
- Software Maintenance (2.11)

  - Software Change Product (2.11.1)
  - Licenses (2.11.3)
  - Cybersecurity (2.11.4)
  - Follow-On Training (2.11.8)
- Help Desk (2.13)
- Other Procurement (Retrofit costs) (2.14)

6. APUC: Also known as Procurement Unit Cost

- All elements of Weapon System Cost
- Initial Depot Level Reparables (Spares) (2.9.1)
- Initial Consumables (2.9.2)

7. PAUC

- All elements of Procurement Unit Cost
- RDT&E Funded Elements (1.0)
- Acquisition Operations and Maintenance (3.0)
  - 3.1 Systems Engineering/Program Management Government RDTE
  - 3.2 Systems Engineering/Program Management Government Proc
  - 3.3 Other Acquisition Operations and maintenance
- Military Construction (MILCON) Funded Elements (4.0)

8. Life Cycle

- All elements of PAUC
- War Reserve Ammo/Missiles (2.10)
- Technical Refresh (2.12)
- Operating and Support Elements (5.0)

Appendix 4: Army Cost Estimating Structure (ACES)

This Appendix includes the ACES for both DBS and non DBS systems

1. ACES for DBS

Section I - Cost Element Structure

1.0 INFORMATION SYSTEMS (IS)/DEFENSE BUSINESS SYSTEMS (DBS) (INVESTMENT)

1.01 IS/DBS CONFIGURATION/DEVELOPMENT/CUSTOMIZATION

1.01.01 CUSTOM APPLICATION 1…N (SPECIFY)

1.01.01.01 SUBSYSTEM HARDWARE (SPECIFY)

1.01.01.02 SUBSYSTEM SOFTWARE CSCI 1…N (SPECIFY)

1.01.01.03 SUBSYSTEM SOFTWARE LEVEL INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

1.01.02 ENTERPRISE SERVICE ELEMENT 1…N (SPECIFY)

1.01.02.01 ENTERPRISE SERVICE ELEMENT HARDWARE (SPECIFY)

1.01.02.02 ENTERPRISE SERVICE ELEMENT SOFTWARE CSCI 1…N (SPECIFY)

1.01.02.03 ENTERPRISE SERVICE ELEMENT INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

1.01.03 ENTERPRISE/MANAGEMENT INFORMATION SYSTEM 1…N (SPECIFY EACH RELEASE)

1.01.03.01 BUSINESS AREA HARDWARE (SPECIFY)

1.01.03.02 BUSINESS AREA SOFTWARE CSCI 1…N (SPECIFY)

1.01.03.03 BUSINESS AREA INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

1.01.04 EXTERNAL SYSTEM INTERFACE DEVELOPMENT 1…N (SPECIFY)

1.01.04.01 EXTERNAL SYSTEM INTERFACE HARDWARE (SPECIFY)

1.01.04.02 EXTERNAL SYSTEM INTERFACE SOFTWARE CSCI 1…N (SPECIFY)

1.01.04.03 SYSTEM LEVEL HARDWARE (SPECIFY)

1.01.05 SYSTEM LEVEL HARDWARE (SPECIFY)

1.02 SYSTEM LEVEL INTEGRATION

1.03 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

1.03.01 SEPM GOVERNMENT

1.03.02 SEPM CONTRACTOR

1.04 CHANGE MANAGEMENT

1.05 DATA MANAGEMENT

1.06 SYSTEM TEST AND EVALUATION

1.06.01 DEVELOPMENTAL TEST AND EVALUATION

1.06.02 OPERATIONAL TEST AND EVALUATION

1.06.03 OTHER TEST AND EVALUATION

1.06.04 MOCK-UPS/SYSTEM INTEGRATION LABS (SILS)

1.06.05 TEST FACILITIES

1.07 TRAINING

1.07.01 EQUIPMENT

1.07.02 SERVICES

1.07.03 FACILITIES

1.07.04 TRAINING SOFTWARE 1…N (SPECIFY)

1.08 DATA

1.09 PECULIAR SUPPORT EQUIPMENT

1.10 COMMON SUPPORT EQUIPMENT

1.11 OPERATIONAL INFRASTRUCTURE/SITE ACTIVATION BY SITE 1…N (SPECIFY)

1.11.01 INITIAL HARDWARE PROCUREMENT

1.11.02 INITIAL SOFTWARE LICENSE PROCUREMENT

1.11.03 INITIAL SOFTWARE RELEASE

1.11.04 SITE ACTIVATION

1.11.04.01 DATA MIGRATION

1.11.04.02 USER TRAINING

1.11.04.03 USER DOCUMENTATION

1.11.04.04 MANAGEMENT/ENGINEERING SUPPORT

1.11.04.05 SITE INSTALLATION, TEST AND CHECKOUT

1.11.05 INTERIM OPERATIONS AND SUPPORT

1.12 INDUSTRIAL FACILITIES

1.13 INITIAL SPARES AND REPAIR PARTS

2.0 DBS OPERATIONS AND MAINTENANCE

2.01 PROGRAM/PROJECT MANAGEMENT

2.01.01 GOVERNMENT PERSONNEL

2.01.02 CONTRACTOR PERSONNEL

2.01.02.01 LEAD SYSTEM INTEGRATOR

2.01.02.02 GOVERNMENT PMO

2.01.03 TRAVEL TDY

2.01.04 INDIRECT SUPPORT

2.01.05 NON-LABOR PROGRAM MANAGEMENT

2.02 SYSTEMS ENGINEERING

2.03 CHANGE MANAGEMENT/BUSINESS PROCESS RE-ENGINEERING

2.04 HELP DESK/SERVICE DESK SUPPORT

2.04.01 SYSTEM ADMINISTRATION

2.04.02 HELP DESK – TIER 1 SUPPORT

2.04.03 HELP DESK – TIER 2 SUPPORT

2.04.04 HELP DESK – TIER 3 SUPPORT

2.04.05 HELP DESK – TIER 4 SUPPORT

2.05 ANNUAL OPERATIONS PROCUREMENT

2.06 CENTRAL DATA CENTER OPERATING SUPPORT

2.06.01 MIGRATION

2.06.02 RECURRING

2.07 TECHNOLOGY REFRESH/UPGRADE

2.07.01 UPDATE DEVELOPMENT (SYSTEM SOFTWARE)

2.07.02 LIFE CYCLE UPDATES PROCUREMENT

2.07.03 CENTRAL DATA CENTER UPDATES

2.07.04 SYSTEM HARDWARE

2.07.05 OTHER TECHNOLOGY REFRESH/UPGRADE

2.08 SYSTEM MAINTENANCE

2.08.01 HARDWARE MAINTENANCE

2.08.02 SOFTWARE MAINTENANCE

2.08.02.01 SOFTWARE LICENSES

2.08.02.02 DEVELOPED SOFTWARE MAINTENANCE (SW RELEASE LABOR)

2.08.02.03 CYBER/RMF

2.08.03 OTHER MAINTENANCE

2.09 SYSTEM DOCUMENTATION & RELATED DATA

2.10 SYSTEM DATA MAINTENANCE

2.11 SITE OPERATIONS

2.11.01 SYSTEM OPERATION/SUSTAINING ENGINEERING PERSONNEL

2.11.01.01 LSI SUSTAINING ENGINEERING

2.11.01.02 GOVERNMENT PMO SUSTAINING ENGINEERING

2.11.02 FACILITIES LEASE & MAINTENANCE

2.11.03 COMMUNICATIONS/NETWORK

2.11.04 RECURRING/SUSTAINMENT TRAINING

2.11.05 ENVIRONMENTAL & HAZARDOUS MATERIAL STORAGE & HANDLING

2.11.06 MISCELLANEOUS SUPPORTLS AND REPAIR PARTS

2.12 OTHER OPERATIONS & MAINTENANCE

Section II - Cost Element Definitions

1.0 INFORMATION SYSTEMS (IS)/DEFENSE BUSINESS SYSTEMS (DBS) (INVESTMENT)

Summary element.

1.01 IS/DBS CONFIGURATION/DEVELOPMENT/CUSTOMIZATION

The hardware, software, and associated effort used to analyze, design, integrate, and test the entire information system (IS)/ Defense Business System (DBS) prime mission product.

1.01.01 CUSTOM APPLICATION 1…N (SPECIFY)

Custom Application is anything that is not considered Enterprise Services such as intelligence system, mission planning system, etc. This element includes all the hardware, software, and associated effort needed to analyze, design, build, and test a custom software application, at the system developer's site, to fulfill a capability gap not captured by COTS only software packages. (COTS only are captured under J.4.2.2.2 Enterprise Service Element Software CSCI (1...n)). Examples of custom applications are mission planning systems for aircraft/ship (e.g. JMPS), intelligence systems (e.g. DCGS-IC), Shipboard (or Shore Based) Communication Subsystem (e.g. GCCS-M, DCGS-N), Ground Operations and Processing Center for Spacecraft (e.g. GPS OCX, JMS).

Excludes, for example, software development necessary for external system interfaces.

1.01.01.01 SUBSYSTEM HARDWARE (SPECIFY)

This element includes all the associated hardware equipment needed to analyze, design, build, and test a custom software application at the system developer's site to fulfill a capability gap not captured by the COTS only software packages. Use lower levels to identify individual hardware items (servers, routers, etc.).

Includes, for example, development and test hardware.

Excludes, for example, deployment hardware at each operational site.

1.01.01.02 SUBSYSTEM SOFTWARE CSCI 1…N (SPECIFY)

This effort consists of two primary phases. The first phase is plan and analyze which consists of release planning, fit-gap analysis, and blueprinting. The following activities are generally included:

a. Software Requirements
b. Software GOTS/COTS approach
c. Software COTSGOTS component identification
d. Software COTS/GOTS assessment and selection
e. Software prototyping

The second phase is design/build. The following activities are generally included:

a. Software architecture and design
b. Software code and unit test
c. Software integration
d. Software qualification testing
e. Software COTS/GOTS glue code development
f. Software COTS/GOTS tailoring and configuration
g. Subsystem software product engineering (e.g., configuration management, quality assurance, managed services, etc.)
h. Both the design of the interface specification and the development of the interface

1.01.01.03 SUBSYSTEM SOFTWARE LEVEL INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

The element includes the effort and material associated with integrating and testing subsystem software CSCIs and hardware of an individual (or group of) subsystem software application that have undergone individual CSCI qualification test.

Excludes, for example, software development efforts necessary for external system interfaces.

1.01.02 ENTERPRISE SERVICE ELEMENT 1…N (SPECIFY)

This element includes all the hardware, software, and associated effort needed for developing functionality or software services: unassociated, loosely coupled units of functionality that have no calls to each other embedded in them. These services can be integrated or used by several organizations, even if their respective client systems are substantially different. Examples of Enterprise Service Elements are cloud services (SaaS), enterprise email, and Office 365 migration.

Includes, for example:

a. Enterprise service management (monitoring, fault management)
b. Machine-to-machine messaging
c. Service discovery
d. People and device discovery
e. Metadata discovery
f. Mediation
g. Service security
h. Content discovery and delivery
i. Federated search
j. Enterprise catalog service
k. Data source integration
l. Enterprise content delivery network (caching specification, distributed caching, forward staging)
m. Session management
n. Presence and awareness
o. Audio over internet protocol (IP)
p. Video over IP
q. Text collaboration (chat, instant messaging)
r. White boarding and annotation
s. Application sharing
t. Application broadcasting
u. Virtual spaces
v. Identity management (people and device discovery)
w. Content discovery
x. Collaboration
y. User profiling and customization

1.01.02.02 ENTERPRISE SERVICE ELEMENT SOFTWARE CSCI 1…N (SPECIFY)

This effort consists of two primary phases. The first phase is plan and analyze which consists of release planning, fit-gap analysis, and blueprinting. The following activities are generally included:

a. Software Requirements
b. Software GOTS/COTS approach
c. Software COTSGOTS component identification
d. Software COTS/GOTS assessment and selection
e. Software prototyping

The second phase is design/build. The following activities are generally included:

a. Software architecture and design
b. Software code and unit test
c. Software integration
d. Software qualification testing
e. Software COTS/GOTS glue code development
f. Software COTS/GOTS tailoring and configuration
g. Subsystem software product engineering (e.g., configuration management, quality assurance, managed services, etc.)

Both the design of the interface specification and the development of the interface

1.01.02.03 ENTERPRISE SERVICE ELEMENT INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

This element includes the effort and material associated with integrating and testing the required software and hardware of an individual (or group of) Enterprise Service Element(s).

1.01.03 ENTERPRISE/MANAGEMENT INFORMATION SYSTEM 1…N (SPECIFY EACH RELEASE)

This element includes all the hardware equipment and effort to plan, analyze, design, build, and test functionality(s) of an enterprise information system that uses an integrated database to support typical business processes within business/functional areas and consistent information access across areas and systems. Examples of Enterprise/Management Information Systems are ERPs and other COTS based systems.

1.01.03.01 BUSINESS AREA HARDWARE (SPECIFY)

This element includes all the associated hardware equipment needed at the system developer's facility for planning, analyzing, designing, building, and testing functionalities that can be attributed, in whole or in-part, to a specific functional/business area or module within the EIS system.

Includes, for example, development and test hardware.

Excludes, for example, deployment hardware at each operational site

1.01.03.02 BUSINESS AREA SOFTWARE CSCI 1…N (SPECIFY)

This element includes all the associated effort needed at the system developer' facility for planning, analyzing, designing, building, and testing functionalities that can be attributed, in whole or in-part, to a specific functional/business area or module within the EIS system.

Includes, for example:

a. All necessary labor and materials for analyzing, designing/building/configuring, and testing the required business objects -- reports, forms, interfaces, conversions, workflows, fact tables, dimension tables, scripts, enhancements, etc. -- that can be attributed, in whole or in-part, to a specific functional module or business area within the EIS system
b. Effort for assessing and tailoring COTS software applications or modules that can be attributed, in whole or in-part, to a specific functional module or business area within the EIS system

1.01.03.03 BUSINESS AREA INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

This element includes the effort and material associated with integrating and testing the required software and hardware of an individual (or group of) Business Area Element(s).

1.01.04 EXTERNAL SYSTEM INTERFACE DEVELOPMENT 1…N (SPECIFY)

The hardware equipment and effort necessary for developing the set of software artifacts (threads, reports, queries, or scripts, or data export schemas) for a specific external system interface. Use lower levels to identify each specific external system interface that must be developed or modified. Example of External System Interface Development are interfaces between external systems and reporting systems.

Includes, for example, design of the interface specification and the development of the interface.

Excludes, for example, data migration/cleansing

1.01.04.01 EXTERNAL SYSTEM INTERFACE HARDWARE (SPECIFY)

The hardware equipment necessary at the system integrator’s facility for developing the set of software artifacts (threads, reports, queries, or scripts, or data export schemas) for a specific external system interface. Use lower levels to identify each specific hardware item.

Includes, for example, development and test hardware if different from developer.

Excludes, for example:

a. Deployment hardware at each operational site
b. Hardware and system developer’s facility

1.01.04.02 EXTERNAL SYSTEM INTERFACE SOFTWARE CSCI 1…N (SPECIFY)

This effort consists of two primary phases. The first phase is plan and analyze which consists of release planning, fit-gap analysis, and blueprinting. The following activities are generally included:

a. Software Requirements
b. Software GOTS/COTS approach
c. Software COTSGOTS component identification
d. Software COTS/GOTS assessment and selection
e. Software prototyping

The second phase is design/build. The following activities are generally included:

a. Software architecture and design
b. Software code and unit test
c. Software integration
d. Software qualification testing
e. Software COTS/GOTS glue code development
f. Software COTS/GOTS tailoring and configuration
g. Subsystem software product engineering (e.g., configuration management, quality assurance, managed services, etc.)
h. Both the design of the interface specification and the development of the interface

1.01.04.03 EXTERNAL SYSTEM INTERFACE INTEGRATION, ASSEMBLY, TEST AND CHECKOUT

The element includes the effort and material associated with integrating and testing the required software and hardware of an individual (or group of) External System Interface(s).

1.01.05 SYSTEM LEVEL HARDWARE (SPECIFY)

This element includes all the associated hardware equipment needed at the system developer's facility for planning, analyzing, designing, building, and testing functionalities that can be attributed to all system level functional/business areas.

Excludes, for example:

a. All associated hardware equipment needed at the system developer's facility for planning, analyzing, designing, building, and testing functionalities that can be attributed to specific functional/business areas or modules within the Custom Application, Enterprise Service, and Enterprise/Management Information Systems.
b. The hardware equipment necessary at the system integrator's facility for developing the set of software artifacts for specific external system interfaces.
c. Deployment hardware at each test site.

1.02 SYSTEM LEVEL INTEGRATION

This element includes all effort and equipment to assemble, integrate, and test the entire IS/DBS system as a whole at the system developer's facility.

1.03 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

Summary element.

1.03.01 SEPM GOVERNMENT

This element includes government PM's office (civilian, SETA, and matrix personal) for system engineering and technical control, as well as the business management of the system/program to support RDT&E efforts. This encompasses overall planning, direction, and control of the definition, development, and production of the system/program, including functions of logistics engineering and integrated logistics support (ILS) management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system).

This element excludes system engineering/program management efforts that can be associated specifically with the individual hardware/software element(s).

Military personnel costs will be captured in 4.04.04.

1.03.02 SEPM CONTRACTOR

This element includes contractor (or lead system integrator) PM's office for system engineering and technical control, as well as the business management of the system/program to support RDT&E. This encompasses the overall planning, direction, and control of the definition, development, and production of the system/program, including functions of logistics engineering and integrated logistics support (ILS) management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system).

This element excludes system engineering/program management efforts that can be associated specifically with the individual hardware/software element(s).

1.04 CHANGE MANAGEMENT

This element includes effort associated with managing organizational change. Change management encompasses planning, oversight or governance, project management, testing and implementation.

1.05 DATA MANAGEMENT

This element includes data stewardship, quality management, governance, and data security management in support of the IS/DBS.

1.06 SYSTEM TEST AND EVALUATION

Summary element.

1.06.01 DEVELOPMENTAL TEST AND EVALUATION

This element includes test and evaluation efforts to demonstrate that the engineering design and development process is complete, the design risks have been minimized, the system will meet specifications, and whether the engineering design is supportable (practical, maintainable, safe, etc.). All Government and contractor efforts from test planning to submitting the final test report should be included in this element.

1.06.02 OPERATIONAL TEST AND EVALUATION

This element includes test and evaluation efforts to assess the prospective system's military utility, operational effectiveness, operational suitability, logistics supportability (including compatibility, inter-operability, reliability, maintainability, logistic requirements, etc.), and need for any modifications. All Government and contractor efforts from test planning to submitting the final test report should be included in this element.

1.06.03 OTHER TEST AND EVALUATION

The developmental test and evaluation and operational test and evaluation conducted and monitored by the contractor and developing agency of the DoD not included in 1.7.1 or 1.7.2. An example of such technical efforts could be testing to ensuring the confidentiality, integrity, and availability of information and technology by monitoring and defending against cyber (network) attacks.

1.06.04 MOCK-UPS / SYSTEM INTEGRATION LABS (SILS)

This element includes:

a. The design engineering and production of system or subsystem mock-ups that have special contractual or engineering significance or that are not required solely for the conduct of one of the above elements of testing. SILs are often used in lieu of (or in addition to) mock-ups. SILs are risk reduction facilities where software and hardware can be developed, integrated, tested and evaluated for both standalone functionality and/or interoperability prior to being fielded.
b. Efforts associated with Hardware/Lab Equipment, SIL Software (written to simulate the operating environment or written to operate the SIL), contractor support (e.g., technical assistance, maintenance, labor, materiel, etc.) consumed during this phase of testing, and logistics testing efforts to evaluate the achievement of supportability goals and the adequacy of support for the system (e.g., deliverable maintenance tools, test equipment, technical publications, maintenance instructions, personnel skills and training requirements, and software support facility/environment elements).

1.06.05 TEST FACILITIES

This element includes the special test facilities required for performance of the various developmental tests necessary to prove the design and reliability of the system or subsystem.

1.07 TRAINING

Summary element.

1.07.01 EQUIPMENT

Distinctive deliverable end items of training equipment or material required to meet specific training objectives.

1.07.02 SERVICES

Deliverable training services, accessories, and aids necessary to accomplish the objectives of training.

Includes, for example:

a. Training course materials; contractor-conducted training (in-plant and service training); and the materials and curriculum required to design, execute, and produce a contractor developed training program (e.g. Operator Instructional Software, Maintainer Instructional Software).
b. Materiel, courses, and associated documentation (primarily the computer software, courses).

1.07.03 FACILITIES

The special construction necessary to accomplish training objectives.

Includes, for example, modification or rehabilitation of existing training facilities and infrastructure used to accomplish training objectives.

Excludes, for example:

a. Installed equipment used to acquaint the trainee with the system or establish trainee proficiency.
b. The brick and mortar-type facilities identified as industrial facilities.

1.07.04 TRAINING SOFTWARE 1…N (SPECIFY)

Software developed for training purposes.

1.08 DATA

This element includes investment efforts for:

a. Government-peculiar data: acquiring, assembling, reproducing, packaging and shipping the data.
b. Transforming data into Government format, reproducing and shipping data identical to that used by the contractor but in a different format.
c. Technical data providing instructions for installation, operation, maintenance, training, and support, formatted into a technical manual. Data may be presented in any form regardless of the form or method of recording. Technical orders that meet the criteria of this definition may also be classified as technical manuals.
d. Recorded scientific or technical information (regardless of the form or method of recording) including computer software documentation. Engineering data defines and documents an engineering design or product configuration (sufficient to allow duplication of the original items) and is used to support production, engineering and logistics activities.

e. The data items necessary for configuration management, cost, schedule, contractual data management, program management, etc., required by the Government.
f. The data items designed to document support planning in accordance with functional categories.
g. The activity and enterprise data storage entity (or sometimes entities) for Government approved documents that are the property of the Government in which data has been specifically partitioned for an analytical or reporting purposes. As custodian for the Government, the repository, authorized by approved change orders, maintains master documents at the latest approved revision level.
h. Government's license rights of valuable intellectual property including technical data of any recorded information of a scientific or technical nature (e.g., product design or maintenance data, computer databases, and computer software documentation); and computer software including executable code, source code, code listings, design details, processes, flow charts, and related material.

1.09 PECULIAR SUPPORT EQUIPMENT

This element includes the design and development of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application peculiar to the given system.

1.10 COMMON SUPPORT EQUIPMENT

This element includes the design and development of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application common to systems other than the given system.

1.11 OPERATIONAL INFRASTRUCTURE/SITE ACTIVATION BY SITE 1...N (SPECIFY)

Summary element.

1.11.01 INITIAL HARDWARE PROCUREMENT

This element includes commercial off the shelf hardware required for various types of facilities supporting end-user equipment, cybersecurity equipment, and IT infrastructure and enterprise software equipment.

Includes, for example:

a. Processing equipment
b. Network/communications equipment
c. Security/crypto equipment
d. Storage, etc.

1.11.02 INITIAL SOFTWARE LICENSE PROCUREMENT

This element includes COTS software purchased for various site types. This includes the purchase of software licenses related to the IS/DBS solution.

Includes, for example:

a. End-user software licenses
b. Cybersecurity software licenses
c. IT infrastructure and Enterprise Services software, licenses etc.

1.11.03 INITIAL SOFTWARE RELEASE

This element includes the effort to modify or enhance the software developed for the system to meet the site requirements necessary to support the IS/DBS.

Includes, for example:

a. Routine fixes/deficiency corrections
b. Modifications/enhancements
c. Testing,
d. Verification/validation of software.

1.11.04 SITE ACTIVATION

Summary element.

1.11.04.01 DATA MIGRATION

This element includes the effort for translating data from one format to another. This should cover only those efforts that are incurred at the implementation site. Also include any expense associated with the transition of data from the legacy systems to the AIS solution. Use lower levels to identify individual legacy systems.

Includes, for example:

a. Data translation
b. Data cleansing
c. Data loading

Excludes, for example, external system interface development

Note: Data migration is necessary when an organization decides to use a new computing systems or database management system that is incompatible with the current system. Typically, data migration is performed by a set of customized programs or scripts that automatically transfer the data.

1.11.04.02 USER TRAINING

This element represents the effort involved with training the users of the implemented AIS solution at the user sites. The primary cost captured here will be the labor costs of instructors to train users on the new system and business processes required to operate within the new system(s). Any costs incurred as a result of revising the training courses and/or materials once implementation has begun should also be captured here.

Excludes, for example, any up-front costs associated with training the trainers, as well as course development and material costs that are not incurred as a result of circumstances encountered at the user sites.

1.11.04.03 USER DOCUMENTATION

This element is documentation on how systems are set up and used. This includes practices, procedures, and set up information. It is maintained by the application system users who are responsible for the operation of the application system.

1.11.04.04 MANAGEMENT/ENGINEERING SUPPORT

This element captures those support elements that are attributable only to specific user /implementation sites. This would include systems engineering/program management effort associated with a specific site, as well as any system test and evaluation specific to particular user sites.

1.11.04.05 SITE INSTALLATION, TEST AND CHECKOUT

The materials and services involved in the assembly of mission equipment at the site.

Includes, for example:

a. Installation of mission and support equipment in the operations or support facilities and complete system checkout or shakedown to ensure operational status. Where appropriate, specify by site, ship or vehicle.
b. The efforts and activities associated with shipping the system from contractor facility to customer site. That site could be a DT&E site, an installation and checkout site or any similar site that is outside the direct control of the contractor.

1.11.05 INTERIM OPERATIONS AND SUPPORT

This element includes costs associated with transitioning the system from a contractor supported system to an organically supported system. This could include system maintenance, business process re-engineering, and change management efforts performed by the contractor in the interim before the Government is able to perform these tasks. Also includes Operation and Maintenance up to FOC. This element captures the costs of supporting the AIS solution once Operational Site Activation (element L.6.9) is complete and the

system has reach full operational capability (FOC). These could be costs incurred as a result of continuing contractor support or by the Government.

Includes, for example:

a. Systems engineering and program management
b. System operations / sustaining engineering
c. Help desk (Tier I-III, specify as appropriate)
d. System database administration
e. Deployment hardware/software refresh
f. Software maintenance
g. Follow on training
h. Accreditation
i. Independent verification and validation

1.12 INDUSTRIAL FACILITIES

The construction, conversion, or expansion of industrial facilities for production, inventory, and contractor depot maintenance required when that service is for the specific system. This may be a Software Integration Laboratory (SIL).

Includes, for example:

a. Equipment acquisition or modernization, where applicable
b. Maintenance of these facilities or equipment
c. Industrial facilities for hazardous waste management to satisfy environmental standards.

Excludes, for example, capital equipment

1.13 INITIAL SPARES AND REPAIR PARTS

This element includes initial spare components, assemblies, and subassemblies (reparable items) necessary to fill initial ASL/PLL stockage to support end-item fielding throughout the system life cycle.

2.0 DBS OPERATIONS AND MAINTENANCE

This element is a rollup of all sub element costs incurred to operate and maintain the Defense Business System (DBS) after Full Operational Capability (FOC) at all sites. It includes the cost to manage and maintain the hardware and software, whether centrally or at each unit, to sustain operations throughout the remainder of the life cycle (i.e. post-FOC).

2.01 PROGRAM/PROJECT MANAGEMENT

This summary element includes the costs of all Operating & Support (O&S) costs associated with the program management function after FOC. Program management is the centralized management of the

system form design through disposal. Support breakdown includes management and general administrative support staff including Military, Civilian, Contractor, and other indirect and non-labor costs.

2.01.01 GOVERNMENT PERSONNEL

This element includes the costs of all Government Operating & Support (O&S) costs associated with the program management function after FOC. Program management is the centralized management of the system form design through disposal.

2.01.02 CONTRACTOR PERSONNEL

This summary element includes the costs of all contractor (within PMO and/or Lead System Integrator) personnel Operating & Support (O&S) costs associated with the program management function after FOC. Program management is the centralized management of the system form design through disposal.

2.01.02.01 LEAD SYSTEM INTEGRATOR

This element includes the costs of Prime Contractor or LSI program management.

2.01.02.02 GOVERNMENT PMO

This element includes the costs of contractor program management working within the government Program Management Office.

2.01.03 TRAVEL TDY

This element includes all government/contractor TDY required for 2.01 efforts.

2.01.04 INDIRECT SUPPORT

This element includes any indirect support associated with the 2.01 efforts.

2.01.05 NON-LABOR PROGRAM MANAGEMENT

This element includes the indirect and non-labor costs associated with the program management function after FOC. Program management is the centralized management of the system form design through disposal.

2.02 SYSTEMS ENGINEERING

This summary element includes the costs of any Out-of-Scope or Exploratory Systems Engineering or Systems analysis costs incurred after FOC at all sites due to technology updates and mandates. Excludes any costs accounted for in the program management or Business Process Reengineering (BPR) cost elements. Excludes 2.01/2.03/2.11.

2.03 CHANGE MANAGEMENT/BUSINESS PROCESS RE-ENGINEERING

This element includes the costs for change management or Business Process Reengineering (BPR) incurred after FOC at all sites. Excludes any costs accounted for in the program management or systems engineering cost elements.

2.04 HELP DESK/SERVICE DESK SUPPORT

This element includes the costs associated with help desk/service desk support. Includes all personnel costs incurred in order to provide independent user assistance to troubleshoot technical issues.

2.04.01 SYSTEM ADMINISTRATION

This element includes the costs of system administration and software engineers who correct or fix technical issues with the software itself rather than the user.

2.04.02 HELP DESK- TIER 1 SUPPORT

This element includes the costs of automated or self-service solutions that users can access themselves without the aid of the Help Desk Technician. Examples are automated password, knowledge base lookup, etc.

2.04.03 HELP DESK- TIER 2 SUPPORT

This element includes the costs of personnel who filter help desk calls and provide basic support and troubleshooting, such as password resets, printer configurations, break/fix instructions, ticket routing and escalation to Tier 3 and Tier 4 support. Technician gathers and analyzes information about the user's issue and determines the best way to resolve their problem.

2.04.04 HELP DESK- TIER 3 SUPPORT

This element includes the costs of personnel responsible to solve break/fix issues, configuration issues, troubleshooting, software installations, hardware repair (including in-house repair or coordinating depot services).

2.04.05 HELP DESK- TIER 4 SUPPORT

This element includes the costs of troubleshooting, configuration, database administration, and repair for server, network, infrastructure, data center, email, file shares, and other infrastructure issues.

2.05 ANNUAL OPERATIONS PROCUREMENT

This element includes the costs of Post FOC activities associated with the acquisition and first destination transportation of replacement components, replenishment spares, supplies, and consumables required of the specific system post-FOC. Included are costs incurred in the acquisition of replacement parts, supplies, and consumables to re-supply the pipeline. This is the service(s) related to obtaining and transporting items rather than the items themselves.

2.06 CENTRAL DATA CENTER OPERATING SUPPORT

This cost element contains the costs associated with services received by the IT system from a data center in support of the Systems operations. It includes any data services such as software as a service (SaaS) or migration to a cloud.

2.06.01 MIGRATION

This cost element includes non-recurring costs associated with migrating to the data center.

2.06.02 RECURRING

This cost element includes recurring costs associated with migrating to the data center.

2.07 TECHNOLOGY REFRESH/UPGRADE

This element includes the costs of enhancements to the IT system throughout the life cycle. Normally, equipment wear and technological obsolescence results in turnover of equipment every five to ten years. In many cases when hardware changes are made, software is also updated to take maximum advantage of the increased hardware capability. This element is a rollup of Upgrade Development, Life Cycle Upgrades Procurement, Central Data Center Upgrades, System Hardware and Other Technology Refresh/Upgrade sub-elements (excludes new capabilities).

2.07.01 UPDATE DEVELOPMENT (SYSTEM SOFTWARE)

This element includes the costs of updates to system software, such as the Operating System, and associated efforts to keep the software functionally up to date.

2.07.02 LIFE CYCLE UPDATES PROCUREMENT

This element includes the costs of updated hardware or software upgrades that are required due to age or technological obsolescence.

2.07.03 CENTRAL DATA CENTER UPDATES

This element includes costs associated with technology refresh/upgrades at the data center.

2.07.04 SYSTEM HARDWARE

This element includes the costs of Modified Table of Organization and Equipment (MTOEs), Tables of Distribution and Allowance (TDA) and Common Table of Allowances (CTA) standalone operational hardware only, includes laptops, notebooks, ancillary devices, and non-Enterprise Resource Planning (ERP) licenses).

2.07.05 OTHER TECHNOLOGY REFRESH/UPGRADE

This element includes the costs of other technology refresh/upgrade activities that cannot be discretely allocated into upgrade development, life cycle upgrades procurement, central data center upgrades or system hardware.

2.08 SYSTEM MAINTENANCE

This element includes the costs incurred in providing maintenance and repair for the system hardware and software. This element is a rollup of the Hardware Maintenance, Software Maintenance and Other System Maintenance sub-elements.

2.08.01 HARDWARE MAINTENANCE

This element includes the costs of Hosting HW Maintenance and Contract HW Maintenance Support.

2.08.02 SOFTWARE MAINTENANCE

This element includes the costs of developed software (Non-Commercial Off-The-Shelf (COTS)), COTS, Central Data software, Sustainment of Enterprise Resource Planning (ERP) Licenses, Information Assurance & Vulnerability Assessment (IAVA) Patches (ex: CYBER), software labor costs, and other software costs.

2.08.02.01 SOFTWARE LICENSES

This element includes the costs of legally binding agreements that specify the terms of use for an application or product (whether they are Commercial-Off-The-Shelf (COTS), Government-Off-The-Shelf (GOTS), or open-source products) and defines the rights of the software producer and end-user.

2.08.02.02 DEVELOPED SOFTWARE MAINTENANCE (SW RELEASE LABOR)

This element includes the associated costs of modifying and updating a software application after delivery to correct faults and improve performance or other attributes. Includes, for instance, effort to configure or add/delete/modify RICE-FW objects.

2.08.02.03 CYBER/RMF

This element includes the costs of Cybersecurity, formerly Information Assurance (IA), and the Risk Management Framework (RMF) maintenance processes that verify the software system against externally defined domain performance criteria.

2.08.03 OTHER MAINTENANCE

This element includes the costs of system maintenance that cannot be discretely allocated into either hardware or software maintenance.

2.09 SYSTEM DOCUMENTATION & RELATED DATA

This element includes the costs of the post-FOC minor costs associated with various system documentation and data requirements including technical publications, engineering data, management data and support data.

2.10 SYSTEM DATA MAINTENANCE

This element includes the costs of maintenance activities necessary to keep the new system data current. Includes data cleansing and related tasks and labor expenses to accomplish data maintenance as well as specific supplies consumed during the maintenance of the mission application.

2.11 SITE OPERATIONS

This element includes the costs of personnel, as well as fuel and power requirements, training, communications, facilities maintenance, etc. This element is a rollup of the System Operation/Sustaining Engineering Personnel, Facilities Lease & Maintenance, Communications/Network, Recurring/Sustainment Training, Environmental & Hazardous Material Storage & Handling and Miscellaneous Support sub-elements.

2.11.01 SYSTEM OPERATION/SUSTAINING ENGINEERING PERSONNEL

This element includes the costs of decentralized system administrators and system operators. It includes the personnel necessary to operate the hardware/software and database administrators. In addition, this element may include the costs of Government Systems Operation Personnel, Contractor Systems Operation Personnel and Support to Systems Operation Personnel. It does not include functional personnel which interface with the system (i.e. the users).

2.11.01.01 LSI SUSTAINING ENGINEERING

This element includes the cost of sustaining engineering within the Prime contractor PM office or Lead System Integrator.

2.11.01.02 GOVERNMENT PMO SUSTAINING ENGINEERING

This element includes the cost of government System Operations/Sustaining Engineering within the Government PMO, such as SETA personnel.

2.11.02 FACILITIES LEASE & MAINTENANCE

This element includes the costs of facilities operations which can be directly attributed to the system being fielded or in support of its personnel. These costs include, but are not limited to: facilities, power (i.e. utility) requirements, fuel & Petroleum, Oil & Lubricants (POL), special material and supplies, leased or owned facilities and construction, operations, maintenance of facilities. Costs included in this element should only apply if the ERP system is hosted within an ERP enclave.

2.11.03 COMMUNICATIONS/NETWORK

This element includes the costs of Communications/Network, i.e. maintaining the local infrastructure but not the Enterprise-to-Enterprise (E2E) Network). This cost element typically aggregates the cost of leasing and maintenance for the system communication costs.

2.11.04 RECURRING/SUSTAINMENT TRAINING

This element contains all costs associated with training services, devices, accessories, aids, equipment, facilities, and parts used to facilitate instruction through which personnel will acquire sufficient concepts, skill, and aptitudes to operate and maintain the information management system. This element includes the effort associated with the maintenance of training equipment, as well as the execution of training services.

2.11.05 ENVIRONMENTAL & HAZARDOUS MATERIAL STORAGE & HANDLING

This element includes all support and maintenance costs associated with environmental studies, protection, and enhancements, including costs associated with the handling and storage of environmental and hazardous materials associated with the specific IT system.

2.11.06 MISCELLANEOUS SUPPORT

This element includes the costs all other resources necessary to support the IT system in the local areas. Includes second destination transportation.

2.12 OTHER OPERATIONS & MAINTENANCE

This element includes the costs of any operations & maintenance cost not included in the other sub-elements. The requirement would be evaluated by the functional proponent for decision. If required the decision would be forwarded to the Army Business Council.

2. ACES for Non-DBS

Section I - Cost Element Structure

1.0 RESEARCH, DEVELOPMENT, TEST, AND EVALUATION (RDT&E)-FUNDED ELEMENTS

1.01 DEVELOPMENT ENGINEERING

1.01.01 DEVELOPMENT ENGINEERING HARDWARE

1.01.02 DEVELOPMENT ENGINEERING SOFTWARE

1.02 PRODUCIBILITY ENGINEERING AND PLANNING (PEP)

1.03 DEVELOPMENT TOOLING

1.04 PROTOTYPE MANUFACTURING

1.05 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

1.05.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (GOVERNMENT)

1.05.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (CONTRACTOR)

1.06 SYSTEMS TEST AND EVALUATION

1.06.01 DEVELOPMENT TEST AND EVALUATION

1.06.02 OPERATIONAL TEST AND EVALUATION

1.06.03 MOCK-UPS/SYSTEM INTEGRATION LAB

1.06.04 TEST AND EVALUATION SUPPORT

1.06.05 TEST FACILITIES

1.06.06 OTHER TESTING

1.07 TRAINING

1.08 DATA

1.09 SUPPORT EQUIPMENT

1.09.01 PECULIAR

1.09.02 COMMON

1.10 DEVELOPMENT FACILITIES

1.11 OTHER RDT&E

2.0 PROCUREMENT ELEMENTS

2.01 NON-RECURRING PRODUCTION

2.01.01 PRODUCTION FACILITIES

2.01.02 PRODUCTION EQUIPMENT

2.01.03 DEPOT MAINTENANCE PLANT EQUIPMENT

2.01.04 ENGINEERING SERVICES/SYSTEM TECHNICAL SUPPORT (STS)

2.01.05 OTHER NON-RECURRING PRODUCTION

2.02 RECURRING PRODUCTION

2.02.01 MANUFACTURING

2.02.02 RECURRING ENGINEERING

2.02.03 SUSTAINING TOOLING

2.02.04 QUALITY CONTROL

2.02.05 OTHER RECURRING PRODUCTION

2.03 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

2.03.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (GOVERNMENT)

2.03.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (CONTRACTOR)

2.04 SYSTEMS TEST AND EVALUATION

2.05 TRAINING

2.06 DATA

2.07 SUPPORT EQUIPMENT

2.07.01 PECULIAR

2.07.02 COMMON

2.08 OPERATIONAL/SITE ACTIVATION

2.09 FIELDING

2.09.01 INTITIAL SPARES (REPARABLES)

2.09.02 INITIAL REPAIR PARTS (CONSUMABLES)

2.09.03 INITIAL SUPPORT EQUIPMENT

2.09.04 TRANSPORTATION FIRST DESTINATION

2.09.05 NEW EQUIPMENT TRAINING

2.09.06 CONTRACTOR LOGISTICS SUPPORT

2.09.06.01 OPERATIONS

2.09.06.02 UNIT-LEVEL MAINTENANCE

2.09.06.03 OTHER UNIT-LEVEL

2.09.06.04 CONSUMABLE MATERIALS AND REPAIR PARTS

2.10 WAR RESERVE AMMUNITION/MISSILES

2.11 SOFTWARE MAINTENANCE

2.11.01 SOFTWARE CHANGE PRODUCT

2.11.02 SUSTAINING/SYSTEMS ENGINEERING

2.11.03 LICENSES

2.11.04 CYBERSECURITY

2.11.05 SOFTWARE PROGRAM MANAGEMENT

2.11.06 FACILITIES

2.11.07 FIELD SOFTWARE ENGINEERING

2.11.08 FOLLOW-ON USER TRAINING

2.12 TECHNICAL REFRESH

2.13 HELP DESK

2.14 OTHER PROCUREMENT

3.0 ACQUISITION OPERATIONS AND MAINTENANCE

3.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT GOVERNMENT RDT&E EFFORTS

3.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT GOVERNMENT PROCUREMENT EFFORTS

3.03 OTHER ACQUISITION OPERATIONS AND MAINTENANCE

4.0 MILITARY CONSTRUCTION (MILCON)-FUNDED ELEMENTS

4.01 DEVELOPMENT CONSTRUCTION

4.02 PRODUCTION CONSTRUCTION

4.03 OPERATIONAL/SITE ACTIVATION CONSTRUCTION

4.04 OTHER MILCON

5.0 OPERATING AND SUPPORT ELEMENTS

5.01 UNIT-LEVEL MANPOWER

5.01.01 OPERATIONS

5.01.02 UNIT-LEVEL MAINTENANCE

5.01.03 OTHER UNIT-LEVEL

5.02 UNIT OPERATIONS

5.02.01 OPERATING MATERIAL

5.02.01.01 ENERGY

5.02.01.02 TRAINING MUNITIONS AND EXPENDABLE STORES

5.02.01.03 OTHER OPERATIONAL MATERIAL

5.02.02 SUPPORT SERVICES

5.02.03 TEMPORARY DUTY

5.02.04 TRANSPORTATION

5.03 MAINTENANCE

5.03.01 CONSUMABLE MATERIALS AND REPAIR PARTS

5.03.02 DEPOT LEVEL REPARABLES

5.03.03 INTERMEDIATE MAINTENANCE

5.03.03.01 INTERMEDIATE-LEVEL CONSUMABLE MATERIALS AND REPAIR PARTS

5.03.03.02 INTERMEDIATE-LEVEL GOVERNMENT LABOR

5.03.03.03 INTERMEDIATE-LEVEL CONTRACTOR MAINTENANCE

5.03.03.04 OTHER INTERMEDIATE-LEVEL MAINTENANCE

5.03.04 DEPOT MAINTENANCE

5.03.05 OTHER MAINTENANCE

5.04 SUSTAINING SUPPORT

5.04.01 SYSTEM SPECIFIC TRAINING

5.04.01.01 SYSTEM SPECIFIC OPERATOR TRAINING

5.04.01.02 SYSTEM SPECIFIC MAINTENANCE TRAINING

5.04.01.03 SYSTEM SPECIFIC OTHER SUPPORT TRAINING

5.04.02 SUPPORT EQUIPMENT REPLACEMENT AND REPAIR

5.04.03 SUSTAINING/SYSTEMS ENGINEERING

5.04.04 PROGRAM MANAGEMENT

5.04.05 INFORMATION SYSTEMS

5.04.05.01 TECH REFRESH

5.04.05.02 LICENSE FEES

5.04.05.03 MAINTENANCE

5.04.06 DATA AND TECHNICAL PUBLICATIONS

5.04.07 SIMULATOR OPERATIONS AND REPAIR

5.04.08 OTHER SUSTAINING SUPPORT

5.05 CONTINUING SYSTEM IMPROVEMENTS

5.05.01 HARDWARE MODIFICATIONS

5.05.02 SOFTWARE MAINTENANCE

5.05.02.01 SOFTWARE CHANGE PRODUCT

5.05.02.02 SUSTAINING/SYSTEMS ENGINEERING

5.05.02.03 LICENSES

5.05.02.04 CYBERSECURITY

5.05.02.05 SOFTWARE PROGRAM MANAGEMENT

5.05.02.06 FACILITIES

5.05.02.07 FIELD SOFTWARE ENGINEERING

5.05.02.08 FOLLOW-ON USER TRAINING

5.06 INDIRECT SUPPORT

5.06.01 INSTALLATION SUPPORT

5.06.01.01 BASE OPERATIONS SUPPORT

5.06.01.02 BASE COMMUNICATIONS

5.06.01.03 FACILITIES SUPPORT

5.06.02 PERSONNEL SUPPORT

5.06.02.01 PERSONNEL ADMINISTRATION

5.06.02.01.01 PERSONNEL MANAGEMENT

5.06.02.01.02 ACQUISITION OF NEW PERSONNEL

5.06.02.01.03 PERSONNEL NOT AVAILABLE FOR DUTY

5.06.02.02 PERSONNEL BENEFITS

5.06.02.02.01 FAMILY HOUSING

5.06.02.02.02 DEPENDENT SUPPORT PROGRAMS

5.06.02.02.03 COMMISSARIES AND EXCHANGES

5.06.02.03 MEDICAL SUPPORT

5.06.03 GENERAL TRAINING AND EDUCATION

5.06.03.01 RECRUIT AND INITIAL OFFICER TRAINING

5.06.03.02 GENERAL SKILL TRAINING

5.06.03.03 PROFESSIONAL MILITARY EDUCATION

6.0 DEMILITARIZATION

Section II - Cost Element Definitions

1.0 RESEARCH, DEVELOPMENT, TEST, AND EVALUATION (RTD&E-FUNDED ELEMENTS)

All RDT&E-funded costs associated with the research and development (R&D) of the materiel system, including development costs for system armament, training devices, ammunition, missiles, and modifications.

1.01 DEVELOPMENT ENGINEERING

Summary element of development engineering efforts.

1.01.01 DEVELOPMENT ENGINEERING HARDWARE

This element includes:

a. The study, analysis, design development, evaluation, testing, and redesign of the hardware system component(s) during the system development efforts.
b. Design efforts of preparing specifications, engineering drawings, parts lists, wiring diagrams, test planning and scheduling, analysis of test results, data reduction, report preparations and establishment of reliability, maintainability, and quality assurance control requirements.
c. Raw and semi-fabricated materiel plus purchased parts consumed in the performance of component engineering efforts.
d. Engineering test equipment and other equipment required to accomplish the engineering function for the specified system components. Examples include: oscilloscopes, transducers, recorders, radio transmitters, converters, discriminators, and receivers.
e. Engineering efforts in support of pre-planned product improvements and development costs for any neutralization process designed to change the physical, chemical, biological character or composition of hazardous waste produced by the system.

This element excludes engineering efforts (producibility engineering and planning) to ensure producibility of the item or system prior to quantity procurement, which is included in 1.02.

1.01.02 DEVELOPMENT ENGINEERING SOFTWARE

This element includes:

a. The development for system software to include all increments and/or spirals need to meet the requirement as well as activities under Software Support Processes.
b. Activities include: software requirements analysis, software architectural design, software detailed design, software construction, software integration, software qualification testing, and software support processes.

1.02 PRODUCIBILITY ENGINEERING AND PLANNING (PEP)

This element includes:

a. Ensuring the producibility of the developmental materiel system, item, or component.
b. Engineering tasks necessary to ensure timely, efficient, and economic production of essential materiel, primarily of a planning nature.
c. Efforts related to the development of the Technical Data Package (TDP), quality assurance (QA) plans, and special production processes to assess producibility.
d. The development of unique processes essential to the design and manufacture of the materiel and details of performance ratings dimensional and tolerance data; manufacturing assembly; sequences; schematics; mechanical and electrical connections; physical characteristics including form, fit, and finishes; inspection test and evaluation requirements; calibration information; and quality control procedures.

1.03 DEVELOPMENT TOOLING

This element includes:

a. Planning, design, fabrication, assembly, installation, modification, maintenance, and rework of all tools, inspection equipment, and test equipment supporting the development of a specified system component.
b. Time expended in determining tool, inspection, and test equipment requirements; planning of fabrication and testing operations; maintaining tool records; scheduling and control of all tools orders; and programming and preparing software for all numerically controlled machine tools used in development of a system component.
c. New materials used in the fabrication, assembly, installation, modification, and maintenance and rework of dies, jigs, fixtures, inspection equipment, handling equipment, work platforms, and test equipment used to develop each system component.
d. Tools normally purchased in final form or that require negligible effort to assemble.

1.04 PROTOTYPE MANUFACTURING

This element includes:

a. Fabrication, processing, subassembly, final assembly, reworking modification, and installation of parts and equipment, power plants, boosters, electronic equipment, explosives, and other items (including Government-Furnished Equipment [GFE]), and the proving of such equipment and instruments for the specified system prototype element.
b. Construction of piece parts from raw materials—the cutting, forming, stretching, and blanking operations performed on materials to make individual parts.
c. Bench assembling of all minor and major assemblies, mating or joining of primary sections, installation of special and general equipment, instruments, and accessories performed after the mating, as well as all other preparation and/or processing and preflight and production service operations.
d. Raw and semi-fabricated material plus purchased parts used in the manufacture of the specified system prototype item. The costs of prototype spare assemblies and parts are also included within this element.

1.05 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

Summary element of RDT&E system engineering & program management efforts.

1.05.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (GOVERNMENT)

This element includes the Government PM's office (civilian, SETA, and matrix personnel for system engineering and technical control, as well as the business management, and of the system/program to support RDT&E efforts. This encompasses overall planning, direction, and control of the definition, development, and production of the system/program, including functions of logistics engineering and

integrated logistics support (ILS) management (e.g., maintenance support, facilities, personnel, training, testing, risk management, and activation of a system).

This element excludes:

a. System engineering/program management efforts that can be associated specifically with the individual hardware/software element(s).
b. Military personnel costs will be captured in 4.04.04.

1.05.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (CONTRACTOR)

This element includes prime contractor(s) PM's office for system engineering and technical control, as well as the business management of the system/program to support RDT&E. This encompasses the overall planning, direction, and control of the definition, development, and production of the system/program, including functions of logistics engineering and integrated logistics support (ILS) management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system).

This element excludes system engineering/program management efforts that can be associated specifically with the individual hardware/software element(s).

1.06 SYSTEMS TEST AND EVALUATION

Summary element of RDT&E system test and evaluation.

1.06.01 DEVELOPMENT TEST AND EVALUATION

This element includes test and evaluation efforts to demonstrate that the engineering design and development process is complete, the design risks have been minimized, the system will meet specifications, and whether the engineering design is supportable (practical, maintainable, safe, etc.). All Government and contractor efforts from test planning to submitting the final test report should be included in this element.

1.06.02 OPERATIONAL TEST AND EVALUATION

This element includes test and evaluation efforts to assess the prospective system's military utility, operational effectiveness, operational suitability, logistics supportability (including compatibility, inter-operability, reliability, maintainability, logistic requirements, etc.), and need for any modifications. All Government and contractor efforts from test planning to submitting the final test report should be included in this element.

1.06.03 MOCK-UPS/SYSTEM INTEGRATION LAB

This element includes:

a. The design engineering and production of system or subsystem mock-ups that have special contractual or engineering significance or that are not required solely for the conduct of one of the above elements of testing. SILs are often used in lieu of (or in addition to) mock-ups. SILs are risk reduction facilities where software and hardware can be developed, integrated, tested and evaluated for both standalone functionality and/or interoperability prior to being fielded.
b. Efforts associated with Hardware/Lab Equipment, SIL Software (written to simulate the operating environment or written to operate the SIL), contractor support (e.g., technical assistance, maintenance, labor, materiel, etc.) consumed during this phase of testing, and logistics testing efforts to evaluate the achievement of supportability goals and the adequacy of support for the system (e.g., deliverable maintenance tools, test equipment, technical publications, maintenance instructions, personnel skills and training requirements, and software support facility/environment elements).

1.06.04 TEST AND EVALUATION SUPPORT

This element includes efforts necessary to operate and maintain (during test and evaluation) systems and subsystems which are not consumed during the testing phase and are not allocated to a specific phase of testing. This includes reparable spares, repair of reparables, repair parts, consumables, warehousing and distribution of spares and repair parts, test and support equipment, test bed vehicles, drones, surveillance aircraft, tracking vessels, contractor technical support.

1.06.05 TEST FACILITIES

This element includes the special test facilities required for performance of the various developmental tests necessary to prove the design and reliability of the system or subsystem. Efforts include test tank test fixtures, propulsion test fixtures, white rooms, test chambers, and range/targeting facilities.

1.06.06 OTHER TESTING

This element includes all other test efforts in RDT&E not covered in the above elements.

1.07 TRAINING

This element includes:

a. Services, devices, accessories, aids, equipment, facilities, and parts used to facilitate instructions through which personnel acquire sufficient concepts, skills, and aptitudes to operate and maintain the system with maximum efficiency.
b. Efforts associated with the design, development, and production of prototype training equipment, and the execution of training services.
c. Training initial service test crews and maintenance personnel, including temporary duty of Government personnel, involved in the testing and training needed on handling hazardous materials and proper use of personal protection equipment.

1.08 DATA

This element includes RDT&E efforts for:

a. Government-peculiar data: acquiring, assembling, reproducing, packaging and shipping the data.
b. Transforming data into Government format, reproducing and shipping data identical to that used by the contractor but in a different format.
c. Technical data providing instructions for installation, operation, maintenance, training, and support, formatted into a technical manual. Data may be presented in any form regardless of the form or method of recording. Technical orders that meet the criteria of this definition may also be classified as technical manuals.
d. Recorded scientific or technical information (regardless of the form or method of recording) including computer software documentation. Engineering data defines and documents an engineering design or product configuration (sufficient to allow duplication of the original items) and is used to support production, engineering and logistics activities.
e. The data items necessary for configuration management, cost, schedule, contractual data management, program management, etc., required by the Government.
f. The data items designed to document support planning in accordance with functional categories.
g. The activity and enterprise data storage entity (or sometimes entities) for Government approved documents that are the property of the Government in which data has been specifically partitioned for an analytical or reporting purposes. As custodian for the Government, the repository, authorized by approved change orders, maintains master documents at the latest approved revision level.
h. Government's license rights of valuable intellectual property including technical data of any recorded information of a scientific or technical nature (e.g., product design or maintenance data, computer databases, and computer software documentation); and computer software including executable code, source code, code listings, design details, processes, flow charts, and related material.

1.09 SUPPORT EQUIPMENT

Summary element of support equipment efforts.

1.09.01 PECULIAR

This element includes the design and development of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application peculiar to the given system. For example: vehicles, equipment, tools, etc. unique to the system used to fuel, service, transport, hoist, repair, overhaul, assemble, disassemble, test, inspect, or otherwise maintain the mission equipment.

1.09.02 COMMON

This element includes the design and development of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application common to systems other than the given system. For example: vehicles, equipment, tools, etc. not unique to the system used to fuel, service, transport, hoist, repair, overhaul, assemble, disassemble, test, inspect, or otherwise maintain the mission equipment.

1.10 DEVELOPMENT FACILITIES

This element includes:

a. Any new building, conversion or expansion of facilities or sites, and the acquisition of real estate for development and testing of the system.
b. Facilities to handle or store hazardous materials or waste including underground storage tanks.
c. Construction efforts for modification and testing of systems already in the Army inventory if necessary for the advancement of the R&D program.

1.11 OTHER RTD&E

This element includes any RDT&E-funded costs not included in the previous elements. Costs must be system specific and clearly identified.

2.0 PROCUREMENT-FUNDED ELEMENTS

Summary element of all procurement-funded elements.

2.01 NON-RECURRING PRODUCTION

Summary element of all non-recurring production efforts.

2.01.01 PRODUCTION FACILITIES

This element includes:

a. The construction, conversion, or expansion of industrial facilities for production, inventory, and contractor depot maintenance required when that service is for the specific system.
b. Maintenance of these facilities or equipment directory charged to the Government.
c. Facilities for hazardous waste management to satisfy environmental standards charged to the Government.

2.01.02 PRODUCTION EQUIPMENT

This element includes:

a. Initial hard tooling and production line setup to support low-rate and full-scale production of the system: fabrication, assembly, and installation of tools (including modification and rework of development tools for production purposes), dies, templates, patterns, form block manufacture, jigs, fixtures, master forms, inspection equipment, handling equipment, load bars, work platforms (including installation of utilities thereon), and test equipment (such as checkers and analyzers) to support the manufacture of the specified system.
b. Initial and duplicate sets of tools necessary to reach full-rate production plus modification of LRIP tool records, establishment of make-or-buy and manufacturing plans on nonrecurring tools and equipment, scheduling and control of tool orders, and programming and preparation of software for numerically controlled machine equipment.

2.01.03 DEPOT MAINTENANCE PLANT EQUIPMENT

This element includes the initial procurement of depot maintenance equipment needed to perform the maintenance activities for the full systems density.

2.01.04 ENGINEERING SERVICES/SYSTEM TECHNICAL SUPPORT (STS)

This element includes any engineering services or system technical support needed to support the production of the system that is not accounted for anywhere else in the WBS. The costs must be system specific and clearly identified.

2.01.05 OTHER NON-RECURRING PRODUCTION

This element includes any procurement-funded, non-recurring production costs not included in the above sub-elements. Costs must be system specific and clearly identified, e.g., warranty cost for a specific item.

2.02 RECURRING PRODUCTION

Summary element of all recurring production efforts.

2.02.01 MANUFACTURING

This element includes:

a. Materiel, labor, and other expenses incurred in the fabrication, checkout, and processing of parts, subassemblies, and major assemblies/subsystems needed for the final system.
b. Government-furnished equipment and materiel and subcontractor's purchased parts/equipment.
c. Integration and assembly of various subassemblies into a working system.
d. Installation special and general equipment.

e. Paint and package the system for shipment to its acceptance destination.
f. Preplanned product improvements.
g. Moves in order to assemble into a final system.

2.02.02 RECURRING ENGINEERING

This element includes:

a. Engineering efforts performed in support of production, including maintainability/reliability engineering, maintenance engineering, value engineering, and production engineering costs associated with the system.
b. Redesign, evaluation, and other support engineering efforts (either in-house, contract, or separate contractor) directly involved with production of the components/end item (e.g., maintenance of the TDP, preparation of engineering change proposals (ECPs), engineering change orders (ECOs), and analysis of test results).

2.02.03 SUSTAINING TOOLING

This element includes:

a. Maintenance, replacement, or modification of tools and test equipment after the start of production.
b. Replacement of initial tools that break down, and modification, maintenance, and rework of initial and duplicate sets of tools occurring after production begin.

2.02.04 QUALITY CONTROL

This element includes:

a. Implementing controls necessary to ensure that a manufacturing process produces a system that meets the prescribed standards.
b. Receiving, in-process, and final inspections of tools, parts, subassemblies, and complete assemblies.
c. Tasks such as reliability testing, establishment of acceptable quality levels (AQLs), statistical methods for determining performance of manufacturing processes, preparation and review of reports relating to these tasks, stockpile reliability testing, and the performance of production acceptance tests (PATs).

2.02.05 OTHER RECURRING PRODUCTION

This element includes any procurement-funded recurring production costs not included in the above sub-elements. Costs must be system specific and clearly identified (e.g., warranty cost for a specific item).

2.03 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT

Summary element of system engineering & program management efforts.

2.03.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (GOVERNMENT)

This element includes government PM's office (civilian, SETA, and matrix personnel) for system engineering and technical control, risk management as well as the business management of the system/program to support procurement efforts. This encompasses the overall planning, direction, and control of the definition, and production of the system/program, including functions of logistics engineering and ILS management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system).

This element excludes system engineering/management efforts that can be associated specifically with the individual hardware/software element(s). Military personnel as those will be captured in 4.04.04.

2.03.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT (CONTRACTOR)

This element includes prime contractor(s) PM's office for system engineering and technical control, as well as the business management of the system/program to support procurement efforts. This encompasses the overall planning, direction, and control of the definition, development, and production of the system/program, including functions of logistics engineering and integrated logistics support (ILS) management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system).

This element excludes system engineering/program management efforts that can be associated specifically with the individual hardware/software element(s).

2.04 SYSTEMS TEST AND EVALUATION

This element includes:

a. System-related production test activities that are identifiable with the evaluation of the system.
b. Hardware to obtain or validate data.
c. Planning, conduct, support, data reduction, and reports from such testing.
d. Test items consumed in the conduct of such operations, design, production, handling, storage, and disposal of models, specimens, fixtures, instrumentation, and hazardous materials or waste in support of the test program.
e. Articles for testing that are complete production units should be captured under recurring production.
f. Production acceptance tests (PATs) should be excluded as they are captures in 2.02.04

2.05 TRAINING

This element includes efforts associated with deliverable training services, devices, accessories, aids, equipment, and parts used to facilitate instruction through which personnel will learn to operate and maintain the system with maximum efficiency.

2.06 DATA

This element includes procurement efforts for:

a. Government-peculiar data: acquiring, assembling, reproducing, packaging and shipping the data.
b. Transforming data into Government format, reproducing and shipping data identical to that used by the contractor but in a different format.
c. Technical data, providing instructions for installation, operation, maintenance, training, and support, formatted into a technical manual. Data may be presented in any form regardless of the form or method of recording. Technical orders that meet the criteria of this definition may also be classified as technical manuals.
d. Recorded scientific or technical information (regardless of the form or method of recording) including computer software documentation. Engineering data defines and documents an engineering design or product configuration (sufficient to allow duplication of the original items) and is used to support production, engineering and logistics activities.
e. The data items necessary for configuration management, cost, schedule, contractual data management, program management, etc., required by the Government.
f. The data items designed to document support planning in accordance with functional categories.
g. The activity and enterprise data storage entity (or sometimes entities) for Government approved documents that are the property of the Government into which data has been specifically partitioned for an analytical or reporting purposes. As custodian for the Government, the repository, authorized by approved change orders, maintains master documents at the latest approved revision level.
h. Government's license rights of valuable intellectual property including technical data of any recorded information of a scientific or technical nature (e.g., product design or maintenance data, computer databases, and computer software documentation) and computer software including executable code, source code, code listings, design details, processes, flow charts, and related material.

2.07 SUPPORT EQUIPMENT

Summary element of support equipment efforts.

2.07.01 PECULIAR

This element includes production of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application peculiar to the given system. It includes, for example, vehicles, equipment, tools, etc. unique to the system used to fuel, service, transport, hoist, repair, overhaul, assemble, disassemble, test, inspect, or otherwise maintain the mission equipment.

This element excludes any initial support equipment costs.

2.07.02 COMMON

This element includes production of those deliverable items and associated software required to support and maintain the system or portions of the system while not directly engaged in the performance of its mission, and that have application common to other than the given system. It includes, for example, vehicles, equipment, tools, etc. not unique to the system used to fuel, service, transport, hoist, repair, overhaul, assemble, disassemble, test, inspect, or otherwise maintain the mission equipment.

This element excludes any initial support equipment costs.

2.08 OPERATIONAL/SITE ACTIVATION

This element includes:

a. Real estate, construction, conversion, utilities, and equipment to provide all facilities required to house, service, and/or launch prime mission equipment at the organizational and intermediate levels.
b. Conversion of site, ship, and vehicle, as well as system assembly, checkout, and installation into the site facility to achieve operational status. It also includes contractor support in relation to operational/site activation.
c. Procurement reimbursement costs for system-specific initial base operations (BASOPS)/real property maintenance activities (RPMA)—such as utilities, repair of real property, minor construction, fire prevention, supply operations, maintenance of materiel, and transportation—for site activation equipment installation and one-time BASOPS.

This element excludes any MC-funded efforts under operational/site activation construction or O&M-funded efforts under transportation, system testing and evaluation, training, or system-specific base operations.

2.09 FIELDING

Summary element of fielding efforts.

2.09.01 INTITIAL SPARES (REPARABLES)

This element includes initial spare components, assemblies, and subassemblies (reparable items) necessary to fill initial ASL/PLL stockage to support end-item fielding throughout the system life cycle.

This element excludes any items costed as part of manufacturing, such as engines.

2.09.02 INITIAL REPAIR PARTS (CONSUMABLES)

This element includes:

a. Consumables necessary to fill initial ASL/PLL stockage to support end-item fielding.

b. Consumable (non-reparable) individual parts, assemblies, or subassemblies required to support end-item fielding.

This element excludes consumables used in depot maintenance overhaul, repair, or modifications covered in redistribution of displaced equipment.

2.09.03 INITIAL SUPPORT EQUIPMENT

This element includes one-time, system-specific fielding effort (both labor and materiel) for special equipment, tools, and processing of new equipment, to include deprocessing. Normally, initial support equipment is packaged with equipment end items prior to delivery of the equipment to Army units.

2.09.04 TRANSPORTATION FIRST DESTINATION

This element includes:

a. The cost of shipping final end items from the manufacturer to the first receiving organization.
b. Transportation costs for shipments, which may be interrupted for test or modification before acceptance.
c. Temporary duty (TDY) of crews from duty station to manufacturing plant, to delivery point, and return to duty station; supplies, minor repairs, and fuel during delivery; transporting hazardous materials, and other costs.

This element excludes:

a. Transportation costs paid by a vendor as prescribed in procurement contracts for manufacturing,
b. All one-time costs of retrograding equipment that is being replaced by the materiel system.

2.09.05 NEW EQUIPMENT TRAINING

This element includes:

a. System-specific costs of training services for new equipment training through which personnel will acquire sufficient concepts, skills, and aptitudes to operate and maintain the system with maximum efficiency.
b. Materiel fielding team (both labor and materiel), who support the new materiel intro briefing (NMIBs), receive equipment at the unit, inventory it, set it up, test it, and hand it over to the acquiring unit.
c. TDY of Government personnel, of training initial-service test crews, maintenance personnel, instructors, initial crew, maintenance personnel and NET teams.
d. Establishment of system-specific individual training programs, including all services and manuals.

This element excludes replacement training.

2.09.06 CONTRACTOR LOGISTICS SUPPORT

Summary element of contractor logistics support.

2.09.06.01 OPERATIONS

This element includes effort associated with contractor manpower required to operate a system during the procurement phase of the program.

2.09.06.02 UNIT-LEVEL MAINTENANCE

This element includes:

a. Effort associated with contractor manpower that performs unit-level maintenance on the primary system during the procurement phase of the program.
b. Efforts for organizational maintenance manpower (often resident in the system operating unit) and unit-level intermediate maintenance personnel.
c. For cases in which individuals maintain more than one system, manpower costs should be allocated among the systems on a relative workload basis.

2.09.06.03 OTHER UNIT-LEVEL

This element includes the cost contractor manpower that performs administrative, security, logistics, safety, engineering, and other mission support functions at the unit level during the procurement phase of the program. Manpower positions that exist to wholly or predominantly support the system whose costs are being estimated. For systems that deploy, these costs include the costs of manpower positions that routinely deploy to support the system. Some examples are:

a. Staff. Manpower required for unit command, administration, supervision, operations control, planning, scheduling, safety, quality control of crew training and operational proficiency, etc. This may also include staff in a parent organization above the unit level where appropriate (i.e., staff is primarily dedicated to the system).
b. Security. Manpower required for system security. Duties may include system-level entry control, close and distant boundary support, and security alert operations (does not include base level access control unless the entire facility exists solely to support the weapon system).
c. Ordnance Support. Includes manpower providing munitions handling, weapons assembly, etc. Excludes any ordnance support manpower included in unit-level maintenance.
d. Other Support. Manpower required to provide system-specific fixed and mobile communications, information, intelligence, photo interpretation, and other special mission support.

For cases in which unit-level individuals support more than one system, manpower costs should be allocated among the systems on a relative workload basis.

2.09.06.04 CONSUMABLE MATERIALS AND REPAIR PARTS

This element includes:

a. This element captures the CLS cost the operating unit incurs for consumable materials and repair parts used to operate and maintain the primary system at the unit level.
b. Consumable materials refers to materials consumed in the maintenance or support of the primary system. Examples include: coolants and deicing fluids.
c. Repair parts refers to items used to in the repair of the primary system. Examples include: transistors, capacitors, gaskets, and filters.
d. The cost includes the costs of goods sold, as well as transportation, storage, inventory management and overhead charged the contractor.

2.10 WAR RESERVE AMMUNITION/MISSILES

This element includes:

a. War reserve (WR) ammunition/missiles required to sustain combat operations of approved forces through the prescribed period.
b. All system-specific WR ammunition and basic load.

2.11 SOFTWARE MAINTENANCE

This element includes the procurement-funded effort associated with software maintenance. Efforts include software specific SE/PM not included in 2.04.02.

2.11.01 SOFTWARE CHANGE PRODUCT

This element includes:

a. Efforts associated with defining, allocating, generating, integrating, and testing software changes for an operational software product or system.
b. Efforts associated with changing code to address defects, enhancements and IAVAs, as well as effort associated with integration baseline and test, Airworthiness/Safety/Networthiness certification, and Independent Verification and Validation for the software.

2.11.02 SUSTAINING/SYSTEMS ENGINEERING

This element includes:

a. Efforts associated with software specific sustaining engineering activities such as studies/investigations for SW specific issues.

b. Sustaining Engineering does not include any effort or cost for either maintenance (corrections) or capability enhancements; these are included in the release data. User support should not include Field Software Engineering, nor data in other sub-categories.

2.11.03 LICENSES

This element includes the costs of Commercial-Off-The-Shelf (COTS) software licenses.

2.11.04 CYBERSECURITY

This element includes:

a. Efforts associated with activities such as software Cybersecurity and Information Assurance Vulnerability Management (IAVM).
b. Cybersecurity, formerly Information Assurance (IA), and the Risk Management Framework (RMF) for DoD Information Technology, formerly DoD Information Assurance Certification and Accreditation (C&A) Process (DIACAP), are processes that verify the software system against externally defined domain performance criteria.

2.11.05 SOFTWARE PROGRAM MANAGEMENT

This element includes:

a. Efforts associated with system specific software maintenance project and technical management associated with system specific license management for procurement and renewal of software licenses for operational software.
b. The license management activities include managing licenses for the maintenance facility as well as deployed systems.

2.11.06 FACILITIES

This element includes efforts associated with establishing and operating software maintenance related development including development assets/workstations, integration, and test facilities, and support equipment and tools. Note: only report hours that are direct charge to the Government.

2.11.07 FIELD SOFTWARE ENGINEERING

This element includes efforts associated with the on-site support of a deployed software product or system in its operational environment. FSE duties include on- site technical assistance, problem troubleshooting, software installation, operational assistance, and on-site training.

2.11.08 FOLLOW-ON USER TRAINING

This element includes efforts associated with follow-on user training. This includes new release training/periodic training events driven by a software change.

2.12 TECHNICAL REFRESH

This element includes the effort associated with the procurement of system components identified during that system engineering process that will require a cyclical replacement schedule in order to keep the system operational effectiveness, operational suitability, and logistics supportability.

2.13 HELP DESK

This element includes:

a. Efforts associated with providing software specific help desk support for end users. For MAIS, the following applies:
b. This includes Levels I through III. This support will include user account management. The Help Desk/Operations Support Team (OST) will provide Tier I level support for problems related to systems administration and monitoring, event management, and database administration including restart, recovery, backups, and restorations. The help desk support staff is the initial focal point for answering questions and providing status information for the hosted site. The typical support hours are 24 X 7 X 365.

2.14 OTHER PROCUREMENT

This element includes any procurement-funded costs not included in the above elements. The costs must be system specific and clearly identified.

This may include any procurement-funded services to address environmental litigation and liabilities.

3.0 ACQUISITION OPERATIONS AND MAINTENANCE

Summary element of all Acquisition Operations and Maintenance funded elements.

3.01 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT GOVERNMENT RDT&E EFFORTS

This element includes government PM's office (civilian, SETA, and matrix personnel) for system engineering and technical control, risk management as well as the business management of the system/program to support procurement efforts. This encompasses the overall planning, direction, and control of the definition, and production of the system/program, including functions of logistics engineering and ILS management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system). These effort are funded with acquisition O&M but support RDT&E efforts.

This element excludes system engineering/management efforts that can be associated specifically with the individual hardware/software element(s). Military personnel as those will be captured in 4.04.04.

3.02 SYSTEMS ENGINEERING/PROGRAM MANAGEMENT GOVERNMENT PROCUREMENT EFFORTS

This element includes government PM's office (civilian, SETA, and matrix personnel) for system engineering and technical control, risk management as well as the business management of the system/program to support procurement efforts. This encompasses the overall planning, direction, and control of the definition, and production of the system/program, including functions of logistics engineering and ILS management (e.g., maintenance support, facilities, personnel, training, testing, and activation of a system). These effort are funded with acquisition O&M but support procurement efforts.

This element excludes system engineering/management efforts that can be associated specifically with the individual hardware/software element(s). Military personnel as those will be captured in 4.04.04.

3.03 OTHER ACQUISITION OPERATIONS AND MAINTENANCE

This element includes any acquisition O&M funded costs not included in the above elements. The costs must be system specific and broken out to a lower level. The lower level elements align to elements from 1.0 or 2.0. This may include any procurement-funded services to address environmental litigation and liabilities.

4.0 MILITARY CONSTRUCTION (MILCON)-FUNDED ELEMENTS

Summary element of all MILCON funded elements. Military construction projects associated with a materiel system are defined as either system specific or not system specific. =System-specific requirements and projects are defined as those that meet the following test:

a. The materiel system cannot be fielded without the construction; and
b. The need for the construction is generated by the decision to acquire and field a given materiel system or, conversely, if and when a materiel system acquisition is terminated prior to fielding, the need for the construction ceases and the construction project is automatically canceled along with materiel system program; and
c. Stationing and organizational requirements such as barracks, dining facilities, unit headquarters building, and the like oriented toward forces' support will be excluded from materiel system cost estimates, unless approved for inclusion as an exception to policy. An example of an exception that would be system specific is the construction of a new fielding location not contiguous to an existing Government facility (i.e., basic site construction for PATRIOT).

Examples of system-specific construction projects are: simulator buildings, missile bunkers, and billets associated with the fielding of new organizations for the new systems. All other military construction projects related to the materiel system, either directly or indirectly, is not considered system specific.

4.01 DEVELOPMENT CONSTRUCTION

This element includes:

a. Only the MILCON funded costs of any new building, conversion or expansion of facilities or sites, and acquisition of real estate, construction, conversion, utilities, and equipment for development and testing of the system.
b. Any construction costs for modification and testing of systems already in the Army inventory if necessary to the furtherance of the development program.
c. Any MILCON funded environmental remediation costs for preparation and cleanup of structures and real estate before, during, and after system specific development or testing.

4.02 PRODUCTION CONSTRUCTION

This element includes:

a. Only the MILCON funded costs of real estate, construction, conversion, utilities, and equipment to achieve initially the total production capability for the materiel system.
b. This includes planning, acquisition of real estate, minor construction, and other MILCON funded supporting activities.
c. Any MILCON funded environmental remediation costs for preparation and cleanup of structures and real estate before initial total production capability is achieved.

4.03 OPERATIONAL/SITE ACTIVATION CONSTRUCTION

This element includes:

a. Only the MILCON funded costs of real estate, construction, conversion, environmental remediation, utilities, and equipment to provide all facilities required to house, service, and/or launch prime mission equipment at the organizational and intermediate level.
b. Planning, acquisition of real estate, minor construction, and other MILCON funded supporting activities.

4.04 OTHER MILCON

This element includes any MILCON costs not included in the previous elements. The costs must be system specific and clearly identified.

5.0 OPERATING AND SUPPORT ELEMENTS

Summary element of all O&S efforts.

5.01 UNIT-LEVEL MANPOWER

The cost of operators, maintainers, and other support manpower assigned to operating units. This may include military, civilian, and/or contractor manpower.

5.01.01 OPERATIONS

The costs of all military, civilian, and contractor manpower required to operate a system. For example:

a. Aircraft and Helicopters. Aircrews including pilots, navigators, mission specialists, load masters, etc.
b. Ships. Command staff, combat information center personnel, fire control (if operations, maintenance, and other support categories are estimated separately).
c. Electronic Systems. Console operators.
d. Armored Vehicles. Crew chief, tank commander, gunner, driver, loader.
e. Space Systems. Operators at the ground station or similar facility.

For cases in which individuals operate more than one system, manpower costs should be allocated on a relative workload basis.

5.01.02 UNIT-LEVEL MAINTENANCE

The costs of all military, civilian, and contractor manpower that performs unit-level maintenance on the primary system. This element includes:

a. The costs of organizational maintenance manpower (often resident in the system operating unit) and unit-level intermediate maintenance personnel.
b. The costs of intermediate-level maintenance personnel resident in a support organization that is not unit-level relative to the operating unit, such as a Navy shore-based Intermediate Maintenance Activity, are included in element 4.03.03 (Intermediate Maintenance (External to Unit-Level)).

For cases in which individuals maintain more than one system, manpower costs should be allocated among the systems on a relative workload basis.

5.01.03 OTHER UNIT-LEVEL

The cost of all military, civilian, and contractor manpower that performs administrative, security, logistics, safety, engineering, and other mission support functions at the unit level. These costs include only the costs of manpower positions that exist to wholly or predominantly support the system whose costs are being estimated.

For systems that deploy, these costs include:

The costs of manpower positions that routinely deploy to support the system. Some examples are:

a. Staff. Manpower required for unit command, administration, supervision, operations control, planning, scheduling, safety, quality control of crew training and operational proficiency, etc. This may also include:

b. Staff in a parent organization above the unit level where appropriate (i.e., staff is primarily dedicated to the system).
c. Security. Manpower required for system security. Duties may include:
d. System-level entry control, close and distant boundary support, and security alert operations (does not include base level access control unless the entire facility exists solely to support the weapon system).
e. Logistics. Manpower required for logistics support. Functions may include:
f. Supply, transportation, inventory control, fuel handling, etc.
g. Ordnance Support. Includes:
h. Manpower providing munitions handling, weapons assembly, etc.
i. Excludes any ordnance support manpower included in element 1.2 (unit-level maintenance).
j. Other Support. Manpower required to provide system-specific fixed and mobile communications, information, intelligence, photo interpretation, and other special mission support (Note: manpower associated with operations or maintenance of simulators or training devices are captured in element 4.7).

For cases in which unit-level individuals support more than one system, manpower costs should be allocated among the systems on a relative workload basis.

5.02 UNIT OPERATIONS

The cost of unit operating material (e.g., fuel and training material), unit support services, and unit travel. This excludes material for maintenance and repair.

5.02.01 OPERATING MATERIAL

Summary element of all Operating Material funded efforts.

5.02.01.01 ENERGY

The costs of FUEL, PETROLEUM, OIL AND LUBRICANTS [POL], ELECTRICITY, propulsion fuel, and fuel additives used by systems in performing their normal peacetime missions. For fuel purchased from the Defense Logistics Agency (DLA), these costs include a surcharge for DLA overhead and operating expenses (transportation, storage, and inventory management). These costs may also include the cost of field-generated electricity and commercial electricity necessary to support the operation of a system.

5.02.01.02 TRAINING MUNITIONS AND EXPENDABLE STORES

The costs of the unit-level consumption of training munitions, rockets, missiles, and expendable stores in the course of normal peacetime training missions for the system being estimated. This includes:

a. The cost of live and inert ammunition, bombs, rockets, training missiles, sonobuoys, and pyrotechnics expended in training and non-combat firings such as firepower demonstrations.

b. Other expendable stores such as chaff, flares, fuel tanks, travel pods, and other items that lose their identity in use and may be dropped from stock record accounts when issued or used.

5.02.01.03 OTHER OPERATIONAL MATERIAL

The costs of operating materiel other than energy, training munitions, or expendable stores. The costs identified must be related to the system whose O&S requirements are being assessed. Illustrative examples include computer supplies, paper, diskettes, ribbons, charts, maps, and administrative supplies used for housekeeping and health and safety.

5.02.02 SUPPORT SERVICES

The costs of support services purchased at the unit level specifically to support the system. These services may vary greatly from one unit to another. They may include but are not limited to:

a. FSRs that support non-maintenance activities (such as training, data collection, and IT support) that are not accounted for in cost element 1.3 (Other Unit-Level Manpower).
b. Unreimbursed food services, rations, postal services (postage/box rental), or laundry services.
c. Lease or rental of administrative, computational, or support equipment or software.
d. Lease costs of special facilities or land (e.g., for the storage of warheads and missiles).
e. Unit-funded service contracts for administrative, computational, or support equipment.
f. Communications services (e.g., data/voice links, dedicated lines, microwave channels), port services, and other unit-funded utilities not part of base operating support costs.

5.02.03 TEMPORARY DUTY

For system specific personnel, costs of TAD/TDY pay and allowances costs, including unit personnel travel for training, administrative, or regularly scheduled training away from the unit's permanent operating location that are associated with a unit's concept of operations and support.

TAD/TDY costs include military and commercial transportation charges, rental costs for passenger vehicles, mileage allowances, and subsistence expenses (e.g., per diem allowances and incidental travel expenses).

Excludes temporary duty associated with contingencies or wartime operations.

5.02.04 TRANSPORTATION

The costs of transportation funded by the unit for the system being estimated. Typically includes the transportation costs for moving equipment, personnel, and supplies to and from training areas, remote operating sites, or test ranges.

This excludes the transportation costs inherent in cost elements 4.02.01.01 (Energy), 4.03.01 (Consumable Materials and Repair Parts), and 4.03.02 (Depot Level Reparables)

Transportation costs for these elements are reflected in surcharges of various Defense Working Capital Funds (DWCFs) and normally would not be estimated separately. The DWCF is a reimbursable arrangement where logistics providers (such as maintenance depots) sell goods or services to customers (operating forces such as squadrons or brigades), and prices are set for these transactions based on a full cost (direct labor, direct material, and overhead) recovery principle of transportation funded by the unit.

5.03 MAINTENANCE

The cost of all system maintenance other than maintenance manpower assigned to operating units. This consists of organic and contractor maintenance, to include labor and materials.

5.03.01 CONSUMABLE MATERIALS AND REPAIR PARTS

This element captures the cost the operating unit incurs for consumable materials and repair parts used to operate and maintain the primary system at the unit level. Consumable materials refers to materials consumed in the maintenance or support of the primary system; examples include coolants and deicing fluids. Repair parts refers to items used to in the repair of the primary system; examples include transistors, capacitors, gaskets, and filters. The cost includes the costs of goods sold, as well as transportation, storage, inventory management and overhead reflected in the DWCF surcharge.

5.03.02 DEPOT LEVEL REPARABLES

The DLR element captures the cost the operating unit incurs for DLR items used to maintain the primary system at the unit level. The cost includes direct labor and material for item repairs, attrition, as well as transportation, storage, inventory management, and overhead reflected in the DWCF surcharge.

5.03.03 INTERMEDIATE MAINTENANCE

The costs of labor, material, and any other costs expended at intermediate maintenance locations (such as Navy afloat or ashore Intermediate Maintenance Activities) in support of the primary system (EXTERNAL TO UNIT-LEVEL). This cost element excludes any manpower or material costs that are considered unit-level as described earlier (traditional Army support concepts does not include I-level maintenance).

5.03.03.01 INTERMEDIATE-LEVEL CONSUMABLE MATERIALS AND REPAIR PARTS

This element captures the costs for consumable materials and repair parts used at intermediate maintenance locations in support of the primary system.

5.03.03.02 INTERMEDIATE-LEVEL GOVERNMENT LABOR

This element captures the costs of military and government civilian manpower that performs intermediate-level maintenance on the primary system. For cases in which individuals maintain more than one system, manpower costs should be allocated on a relative workload basis.

5.03.03.03 INTERMEDIATE-LEVEL CONTRACTOR MAINTENANCE

The costs for labor, material, and overhead incurred by contractors providing intermediate-level maintenance services.

5.03.03.04 OTHER INTERMEDIATE-LEVEL MAINTENANCE

Any other intermediate-level maintenance costs not otherwise accounted for. If this cost element is used, the cost estimate documentation should describe the nature of the costs being presented.

5.03.04 DEPOT MAINTENANCE

Depot maintenance is the cost of labor, materiel, and overhead incurred in performing major overhauls or any other depot-level maintenance on a system or any of its major end items (e.g., aircraft engines) at centralized repair depots, contractor repair facilities, or onsite by depot teams.

Some overhaul activities occur at time intervals ranging from several months to several years. For primary systems (e.g., aircraft, tracked vehicles, ships), these costs should be included in the estimate for the years in which they are expected to occur, accompanied by documentation on the cost per event and the time interval between overhaul events.

Costs of major end items that have different overhaul cycles (i.e., structural subsystems such as hull, frame, or airframe; power subsystems such as engines or drive train; and electronic/mechanical subsystems such as fire control system, armaments, guidance, or command and control equipment) should be estimated and identified separately within this element. In some cases, the interval between end item overhauls may be expressed in terms of system operating hours (and not calendar time).

5.03.05 OTHER MAINTENANCE

This element is used to capture any other system specific maintenance costs not otherwise accounted for. If this cost element is used, the cost estimate documentation should describe the nature of the costs being presented. For example, this element may include transportation costs associated with periodic overhauls not funded by the unit (element 2.4) and not reflected in a DWCF surcharge.

5.04 SUSTAINING SUPPORT

The cost of system support activities that are provided by organizations other than the system's operating units.

5.04.01 SYSTEM SPECIFIC TRAINING

The cost of system-specific specialty training activities for individuals who need to be replaced due to attrition and normal rotation. Training costs should include the costs of instructors, training support personnel, as well as all the costs of trainees, per diem, and travel directly associated with the training. These three elements below capture costs for training individuals prior to their first assignment in a system operating unit. For individuals already assigned to a system operating unit, any expenses for the travel of individuals from operational units to training assignment, and return, are included in element 5.02.03 (Temporary Duty). The costs of maintenance or periodic refresh of the training equipment or devices is accounted for in element 5.04.07.

Note: This element includes the costs of recurring training activities, however, the costs of initial training equipment and training course materials are regarded as investment costs, not as O&S costs.

5.04.01.01 SYSTEM SPECIFIC OPERATOR TRAINING

The costs for training conducted in units designated as primary training sites for individuals to become proficient in specific system knowledge. This includes units such as Air Force wings assigned a primary mission of weapon-specific aircrew training, Navy air readiness training units, Navy Afloat Training Groups, and the Army Armor Center. These costs do not include skill training not related to a specific system, such as undergraduate aviation training. Training of a more general nature is captured in element 5.06.03.02 (General Skill Training).

5.04.01.02 SYSTEM SPECIFIC MAINTENANCE TRAINING

The costs of advanced system-specific training associated with maintenance functions in units designated as primary training facilities.

5.04.01.03 SYSTEM SPECIFIC OTHER SUPPORT TRAINING

The costs of advanced system-specific training associated with other support functions in units designated as primary training facilities.

5.04.02 SUPPORT EQUIPMENT REPLACEMENT AND REPAIR

The costs incurred to replace or repair support equipment associated with the primary system or its major subsystems at all levels of maintenance. The support equipment (e.g., tools and test sets) may be peculiar to the system or it may be common to a number of systems, in which case the costs must be allocated among the respective systems. In some cases, replacement of organic depot support equipment of a general nature may be included in the overhead costs associated with DLRs or depot maintenance.

Note: This element includes replacement and repair of equipment, however, the cost of initial support equipment procurement is regarded as an investment cost, not as an O&S cost.

5.04.03 SUSTAINING/SYSTEMS ENGINEERING

Costs reported in this element capture the government and contractor sustaining engineering to ensure the continuing viable operation of the system in the deployed environment. Most of the sustaining engineering effort will be a continuation of the earlier systems engineering effort that took place during program development and production. Sustaining engineering activities may be resident in the system program office organization, and/or they may be resident in external organizations. Examples of sustaining engineering activities might include: aircraft structural integrity monitoring or corrosion monitoring; planning and control of technical program efforts; continuing system requirements definition; safety and human systems integration engineering; obsolescence engineering; configuration management; and continuing specialty engineering, such as R&M Engineering. Specific modifications to hardware or software are included in element 5.0 (Continuing System Improvements). Sustaining engineering costs provided through a system support contract should be identified separately from costs associated with organic sources, if possible.

5.04.04 PROGRAM MANAGEMENT

This element includes government and contractor costs for management activities associated with the administrative, business, and financial management of the program. Program management activities are, in most cases, a continuation of those performed during development or production. Program management activities may be resident in the system program office organization, and/or they may be resident in external organizations. Program management provided through a support contract should be identified separately from program management provided by organic sources, if possible.

5.04.05 INFORMATION SYSTEMS

This element consists of the costs associated with ancillary automated systems hardware and software which directly supports the system, such as mission planning systems. This excludes costs of modifications and upgrades for the embedded hardware and software associated with the primary system.

5.04.05.01 TECH REFRESH

This element captures the costs of periodic replacement of workstations, computers, and peripherals.

5.04.05.02 LICENSE FEES

This element captures the costs of software licenses, whether program-wide, unit-wide, or seat-based.

5.4.5.3 MAINTENANCE

This element captures the costs of maintenance and support for the ancillary automated systems.

5.04.06 DATA AND TECHNICAL PUBLICATIONS

The costs associated with maintaining and updating deliverable data and technical publications and manuals concerning the operation, maintenance (at all levels of maintenance—organizational, intermediate, and depot), and support of the system.

Note: This element addresses only data and publications maintenance. The cost of developing the data and publications is normally regarded as an investment cost, not as an O&S cost.

5.04.07 SIMULATOR OPERATIONS AND REPAIR

The costs to operate and repair simulators and other training devices for the primary system or its major subsystems. This consists of the costs of labor, materiel, and overhead for simulator operations and repair. This also includes the cost of periodic simulator hardware and software replacement.

5.04.08 OTHER SUSTAINING SUPPORT

The costs of any significant sustaining support not otherwise accounted for. This cost element may be used to identify expenses such as those listed below, if they apply to the system for which the estimate is being made:

a. Test and evaluation in support of deployed systems, such as range costs, test support, data reduction, and test reporting.
b. Air, sea, and land support not funded by the unit and provided by other activities to verify the proper operation of an electronic communication, sensor, or other similar system.
c. Centrally provided technical assistance, such as Help Desks, that provide DoD-wide or Service-wide support.
d. Communication services (e.g., data/voice links, dedicated lines, microwave channels), hardware, and software leases purchased on a DoD-wide or Service-wide basis for direct system-specific support of a system. Note that communications services purchased at the unit-level are contained in element 5.02.02 (Support Services).
e. Centrally funded purchases for transportation of system materiel (end items and secondary items) not otherwise accounted for in the cost element structure. Note that costs of unit-funded purchases of transportation are contained in element 5.02.04 (Transportation), and that costs of any transportation reflected in DWCF surcharges are contained in elements 5.02.01.01 (Energy), 5.03.01 (Consumable Materials and Repair Parts), 5.03.02 (Depot Level Reparables), and 5.03.04 (Depot Maintenance).
f. Any government/contractor software center (e.g., Software Integration Laboratory (SIL)) ongoing facilities and license costs required by the system. Excludes any costs accounted for in element 5.05.02 (Software Maintenance).

5.05 CONTINUING SYSTEM IMPROVEMENTS

The cost of system hardware and software modifications.

5.05.01 HARDWARE MODIFICATIONS

The cost of development, procurement, and installation of modification kits. Modification kits will consist of both kits of equipment to be installed (Group B) and kits for provisions such as cables, brackets, or other interface devices (Group A). May also include costs associated with the modifications for support equipment, training equipment, technical publications/data, and initial spares and repair parts (consistent with the approved modification content). This element may also include minor software costs associated with the modifications that are not considered software maintenance. This cost element only includes those modifications needed to achieve acceptable safety levels, overcome mission capability deficiencies, improve reliability, or reduce maintenance costs. It excludes modifications undertaken to provide additional operational capability not called for in the original system design or performance specifications; such modifications costs are treated as modernization (and not O&S) costs, as most of these modifications will be considered ACAT programs in their own right.

5.05.02 SOFTWARE MAINTENANCE

This element includes the O&S efforts associated with software maintenance. Efforts include software specific SE/PM not included in 5.04.03 or 5.04.04.

5.05.02.01 SOFTWARE CHANGE PRODUCT

This element includes:

a. Efforts associated with defining, allocating, generating, integrating, and testing software changes for an operational software product or system.
b. Efforts associated with changing code to address defects, enhancements and IAVAs, as well as effort associated with integration baseline and test, Airworthiness/Safety/Networthiness certification, and Independent Verification and Validation for the software.

5.05.02.02 SUSTAINING/SYSTEMS ENGINEERING

This element includes:

a. Efforts associated with software specific sustaining engineering activities such as studies/investigations for SW specific issues.
b. Sustaining Engineering does not include any effort or cost for either maintenance (corrections) or capability enhancements; these are included in the release data. User support should not include Field Software Engineering, nor data in other sub-categories.

5.05.02.03 LICENSES

This element includes the costs of Commercial-Off-The-Shelf (COTS) software licenses.

5.05.02.04 CYBERSECURITY

This element includes:

a. Efforts associated with activities such as software Cybersecurity and Information Assurance Vulnerability Management (IAVM).
b. Cybersecurity, formerly Information Assurance (IA), and the Risk Management Framework (RMF) for DoD Information Technology, formerly DoD Information Assurance Certification and Accreditation (C&A) Process (DIACAP), are processes that verify the software system against externally defined domain performance criteria.

5.05.02.05 SOFTWARE PROGRAM MANAGEMENT

This element includes:

a. Efforts associated with system specific software maintenance project and technical management associated with system specific license management for procurement and renewal of software licenses for operational software.
b. License management activities include managing licenses for the maintenance facility as well as deployed systems.

5.05.02.06 FACILITIES

This element includes efforts associated with establishing and operating software maintenance related development including development assets/workstations, integration, and test facilities, as well as support equipment and tools. Only report hours that are direct charge to the Government.

5.05.02.07 FIELD SOFTWARE ENGINEERING

This element includes efforts associated with the on-site support of a deployed software product or system in its operational environment. FSE duties include on-site technical assistance, problem troubleshooting, software installation, operational assistance, and on-site training.

5.05.02.08 FOLLOW-ON USER TRAINING

This element includes efforts associated with follow-on user training. This includes new release training/periodic training events driven by a software change.

5.06 INDIRECT SUPPORT

The installation and personnel support costs that cannot be identified directly to the units and personnel that operate and support the system being analyzed, but can be logically attributed to the system and its associated manpower. These costs are often allocated on a per capita or other basis, and are more relevant

in situations in which total DOD manpower would change significantly or when installations are affected (expanded, opened, closed) due to the new system.

5.06.01 INSTALLATION SUPPORT

The costs of services funded and provided by the host installation that support the day-to-day operations of the system's force unit. Excludes the costs of personnel support services purchased by the unit that are reflected in element 4.02.02 (Support Services)

5.06.01.01 BASE OPERATIONS SUPPORT

The costs of services for functions such as base physical security, base administration, maintenance of installation equipment, base transportation, and other base and personnel support services.

5.06.01.02 BASE COMMUNICATIONS

The costs of local communication services provided by the host installation. May be combined with 4.06.01.01 (Base Operations Support) if it cannot be identified separately.

5.06.01.03 FACILITIES SUPPORT

The costs of facilities sustainment, restoration, and modernization (formerly known as real property maintenance).

5.06.02 PERSONNEL SUPPORT

The costs for the management, acquisition, initial training, and quality of life programs necessary to maintain a quality force.

5.06.02.01 PERSONNEL ADMINISTRATION

The costs of programs that acquire and administer the DoD workforce.

5.06.02.01.01 PERSONNEL MANAGEMENT

The costs of programs to administer the DoD military and civilian workforce. Major activities include reassigning on-board personnel and managing end strength and occupational skills to the levels needed.

5.06.02.01.02 ACQUISITION OF NEW PERSONNEL

The costs for recruiting, examining, and processing individuals into the military service as well as advertising in support of recruiting activities.

5.06.02.01.03 PERSONNEL NOT AVAILABLE FOR DUTY

The costs for military personnel placed in the personnel holding account because they are not available for assignment to a unit for medical or disciplinary reasons, or are about to be discharged (TRANSIENTS, PRISONERS, PATIENTS, STUDENTS). Includes military personnel not assigned to a unit because they are in transit to the next permanent duty station, schooling, or other training.

5.06.02.02 PERSONNEL BENEFITS

The costs for operation and maintenance of family housing, dependent and family support programs, and DoD commissaries and exchanges.

5.06.02.02.01 FAMILY HOUSING

The operating and maintenance costs of dwelling units, community facilities, roads, driveways, walkways, and utilities for use by family housing occupants.

5.06.02.02.02 DEPENDENT SUPPORT PROGRAMS

The costs of child development centers, youth development programs, family centers, family advocacy programs, counter-drug demand reduction programs, and other similar programs necessary to support the families of service members. Includes the education of dependents of federal employees in overseas assignments and for eligible dependents of federal employees residing on federal property where an appropriate public education is unavailable in the nearby community. These education costs are primarily funded by the DoD Education Activity (DoDEA).

5.06.02.02.03 COMMISSARIES AND EXCHANGES

The appropriated costs of employee salaries and other expenses at defense commissaries. These costs are primarily funded by the Defense Commissary Agency (DeCA).

5.06.02.03 MEDICAL SUPPORT

The costs for medical care for active duty personnel and their dependents. Includes provisions for in-house patient care in regional defense facilities, station hospitals, medical clinics and dental facilities, as well as care in non-defense facilities. This also includes costs for private-sector care such as TRICARE or other

similar activities. Medical care is funded by a combination of the military departments and the Defense Health Program. The active-duty composite rates described earlier also provide an acceleration factor to account for the costs of medical support.

5.06.03 GENERAL TRAINING AND EDUCATION

The costs for institutional or schoolhouse training and education not associated with a specific weapon or other system.

5.060.3.01 RECRUIT AND INITIAL OFFICER TRAINING

The costs of programs that provide basic military training and indoctrination to enlisted recruits, and of programs that provide basic military training and indoctrination to officer candidates (through college commissioning programs, officer candidate/training schools, and the three service academies).

5.06.03.02 GENERAL SKILL TRAINING

The costs of programs that teach (1) entry-level job skills after completion of initial military training, and (2) intermediate and advanced job skills later in the career.

5.06.03.03 PROFESSIONAL MILITARY EDUCATION

The costs of programs that provide (1) professional military education at each level of career progression, and (2) advanced academic degrees needed for work in specific organizations and tasks.

6.0 DEMILITARIZATION

Summary element of all demilitarization efforts. This element includes manpower authorizations, peculiar and support equipment, necessary facilities, and associated costs specifically identifiable to end-item demilitarization activities.

Appendix 5 Prior ACES to CAPE O&M Crosswalk

Prior to the use of the ACES found in Appendix 4, analysts needed to convert the ACES to the CAPE O&M Structure. The following table details the conversion.

Army Cost Element Structure for O&M and MILPERS
Unit Level Manpower (1.0)
4.01 Crew
4.02 Maint (MTOE)
4.03 Sys Spec. Supt
4.04 Sys Eng/Prog Mgmt
4.05 Replacement Personnel
Unit Operations (2.0)
5.05 Petroleum, Oil, & Lubricants (POL)
5.11 Training (Ammo/Missiles Only)*
5.02 System Specific Base Operations
5.07 Transportation
Maintenance (3.0)
5.01 Field Maint Civ Labor
5.03 Replen Depot-Level Reparables (Spares)
5.04 Replenishment Consumables (Repair Parts)
5.0611 Overhaul
5.063 Supply Depot Support
5.064 Industrial Readiness
5.065 SSTS
5.066 Demilitarization
Sustaining Support (4.0)
5.11 Training (Ammo/Missiles Excluded)*
5.10 Sys Eng/Prog Mgmt
5.09 System Test & Eval, Operational
5.062 Integ Mat'l Mgmt

Continuing System Improvements - SW Main (5.0)
5.08 Software
5.0612 HW Improvements
Indirect Support (6.0)
5.12 Other O&M

On 13 October 2015, the following memo updated the 2013 Army CES to CAPE O&S Structure:

13 Oct 2015

AMSTA-MSP-V

MEMORANDUM FOR ALL COST ANALYSTS – AMSTA-MSP-V

SUBJECT: Official Guidance on the crosswalk of the Army's Cost Element Structure (CES) for Operating and Support (O&S) costs to the Office of the Secretary of Defense's Cost Assessment &Program Evaluation (CAPE) CES for O&S costs.

1. Reference:
   a. Department of the Army Cost Analysis Manual, US Army CEAC, May 2002.
   b. Operating and Support Cost-Estimating Guide, OSD CAPE, March 2014.

2. This office policy is established to assist cost analysts in the crosswalk of the Army's CES for O&S costs to the CAPE CES for O&S costs.

3. The attached chart shows the crosswalk between the Army CES (reference 1(a)) and the CAPE CES for O&S (reference 1(b)). Some items on the Army CES had to be broken out further to better align with the CAPE CES. Examples include Field Maint Civilian Labor, Transportation, Training, and any TDY costs for personnel. If the cost cannot be separated, the cost can be allocated to one CAPE CES but it must be annotated as to what it includes.

4. POC for this policy is Ms. Mary Gross, AMSTA-MSP-V.

David Holm

DAVID A. HOLM
Director, Cost and Systems Analysis

1 Attachment

CF:
SFAE-CSS
SFAE-GCS
SFAE-CBD
SFAE-Soldier
SOSE&I
AMSTA-LC

16 Sep 2015

Army Cost Element Structure for O&S cells (Procurement, O&M, and MILPERS)

OSD CAPE Cost Element Structure for O&S		2.11 Training Ammo/Missiles	2.13 Modifications	4.0 Military Personnel	4.01 Crew	4.02 Maintainers (MTOE)	4.03 System Specific Support	4.04 System Eng/Prog Mgmt	4.041 Proj Mgmt Admin (PM Mil)	4.042 Other	4.05 Replacement Personnel	4.051 Training	4.051a Training - Crew MOSs	4.051b Training - Maint MOSs	4.051c Training - Sys Spec Spt MOSs	4.052 Perm Change of Station	4.052a Perm Change of Station - Crew MOSs	4.052b Perm Change of Station - Maint MOSs	4.052c Perm Change of Station - Sys Spec Spt MOSs	4.06 Other Military Personnel	4.06a Other Military Personnel - AMCOS (Recruitment)	4.06b Other Military Personnel - AMCOS (MERHC)	4.06c Other Military Personnel - Misc*	5.0 Operating & Maintenance	5.01 Field Maint Civilian Labor	5.01a Field Maint Civilian Labor - Salaries for Unit Level Maintenance	5.01b Field Maint Civilian Labor - Salaries for Intermediate Level Maintenance	5.02 System Specific Base Operations	5.02a System Specific Base Operations - Service Contracts	5.02b System Specific Base Operations - Other	5.03 Replen Depot-Level Reparables (Spares)	5.04 Replenishment Consumables (Repair Part)	5.05 Petroleum, Oil & Lubricants (POL)	5.06 End-Item Supply & Maint	5.061 Overhaul	5.062 Integ Mat'l Mgmt	5.063 Supply Depot Support	5.064 Industrial Readiness	5.065 Demilitarization (not included in CAPE CES)	5.07 Transportation	5.07a Transportion - SDT for initial fielding	5.07b Transportion - SDT for overhaul	5.08 Software	5.09 System Test & Eval. Operational	5.10 Sys Eng/Prog Mgmt	5.101 Proj Mgmt Admin (PM Civ)	5.102 Other	5.11 Training	5.11a Training -Replacement Personnel	5.11a1 Training -Replacement Personnel - Crew MOSs	5.11a2 Training -Replacement Personnel - Maint MOSs	5.11a3 Training -Replacement Personnel - Sys spec Spt MOSs	5.11b Training - TADSS	5.12 Other O&M	5.12a Other O&M - AMCOS	5.12aa Other O&M - AMCOS (Recuritment)	5.12ab Other O&M - AMCOS (Moral/Welfare/Rec & DoDEA and Family Assistance)	5.12ac Other O&M - AMCOS (Discount Groceries)	5.12ad Other O&M - AMCOS (Medical/Health Care)	5.12ae Other O&M - AMCOS (Training)	5.12af Other O&M - AMCOS (College Fund)	5.12b Other O&M - Misc*
1.0	Unit-Level Manpower																																																													
1.1	Operations				X												X																																													
1.2	Unit-Level Maintenance					X												X								X																																				
1.3	Other Unit-Level						X												X																																											
2.0	Unit Operations																																																													
2.1	Operating Material																																																													
2.1.1	Energy - POL																																X																													
2.1.2	Training Munitions & Expendable Stores	X																																																												
2.1.3	Other Operational Material																																																													
2.2	Support Services																												X																																	
2.3	Temporary Duty																																													X	X															
2.4	Transportation																																								X																					
3.0	Maintenance																																																													
3.1	Consumable Materials and Repair Parts																															X																														
3.2	Depot-Level Reparables																														X																															
3.3	Intermediate Maintenance																																																													
3.3.1	Intermediate-Level Cons Material & Repair Parts																															X																														
3.3.2	Intermediate-Level Government Labor					X																				X	X																																			
3.3.3	Intermediate-Level Contractor Maintenance																									X	X																																			
3.3.4	Other Intermediate-Level Maintenance																									X	X																																			
3.4	Depot Maintenance																																		X	X	X	X				X																				
3.5	Other Maintenance																																																													
4.0	Sustaining Support																																																													
4.1	System Specific Training																																																													
4.1.1	System Specific Operator Training												X																																					X												
4.1.2	System Specific Maintenance Training													X																																					X											
4.1.3	System Specific Other Support Training														X																																					X										
4.2	Support Equipment Replacement & Repair																																																													
4.3	Sustainment/Systems Engineering																																																													
4.4	Program Management								X	X																																																				
4.5	Information Systems																																																													
4.5.1	Tech Refresh																																																													
4.5.2	License Fees																																																													
4.5.3	Maintenance																																																													
4.6	Data and Technical Publications																																																													
4.7	Simulator Operations and Repair																																																			X									
4.8	Other Sustaining Support																																											X																		
5.0	Continuing System Improvements																																																													
5.1	Hardware Modifications		X																																																											
5.2	Software Maintenance																																										X																			
6.0	Indirect Support																																																													
6.1	Installation Support																																																													
6.1.1	Base Operations Support																													X																																
6.1.2	Base Communications																													X																																
6.1.3	Facilities Support																													X																																
6.2	Personnel Support																																																													
6.2.1	Personnel Administration																																																													
6.2.1.1	Personnel Management																																																													
6.2.1.2	Acquisition of New Personnel																				X																																			X						
6.2.1.3	Personnel Not Available For Duty																																																													
6.2.2	Personnel Benefits																																																													
6.2.2.1	Family Housing																																																													
6.2.2.2	Dependent Support Programs																																																								X					
6.2.2.3	Commissaries and Exchanges																																																								X				
6.2.3	Medical Support																					X																																				X			
6.3	General Training & Education																																																													
6.3.1	Recruit and Initial Officer Training																																																											X		
6.3.2	General Skill Training																																																											X		
6.3.3	Professional Military Education																																																												X	

* Depending on the type of cost that is listed under the two Army "Other" cells, the crosswalk to the CAPE will vary.

On 3 June 2013, the following memo established an Army CES to CAPE CES crosswalk:

03 Jun 2013

AMSTA-CSB-V

MEMORANDUM FOR ALL COST ANALYSTS – AMSTA-CSB-V

SUBJECT: Official Guidance on the crosswalk of the Army's Cost Element Structure (CES) for Operating and Support (O&S) costs to the Office of the Secretary of Defense's Cost Assessment &Program Evaluation (CAPE) CES for O&S costs.

1. Reference.
   a. Department of the Army Cost Analysis Manual, US Army CEAC, May 2002.
   b. Operating and Support Cost-Estimating Guide, OSD CAPE, March 2012.

2. This office policy is established to assist cost analysts in the crosswalk of the Army's CES for O&S costs to the CAPE CES for O&S costs.

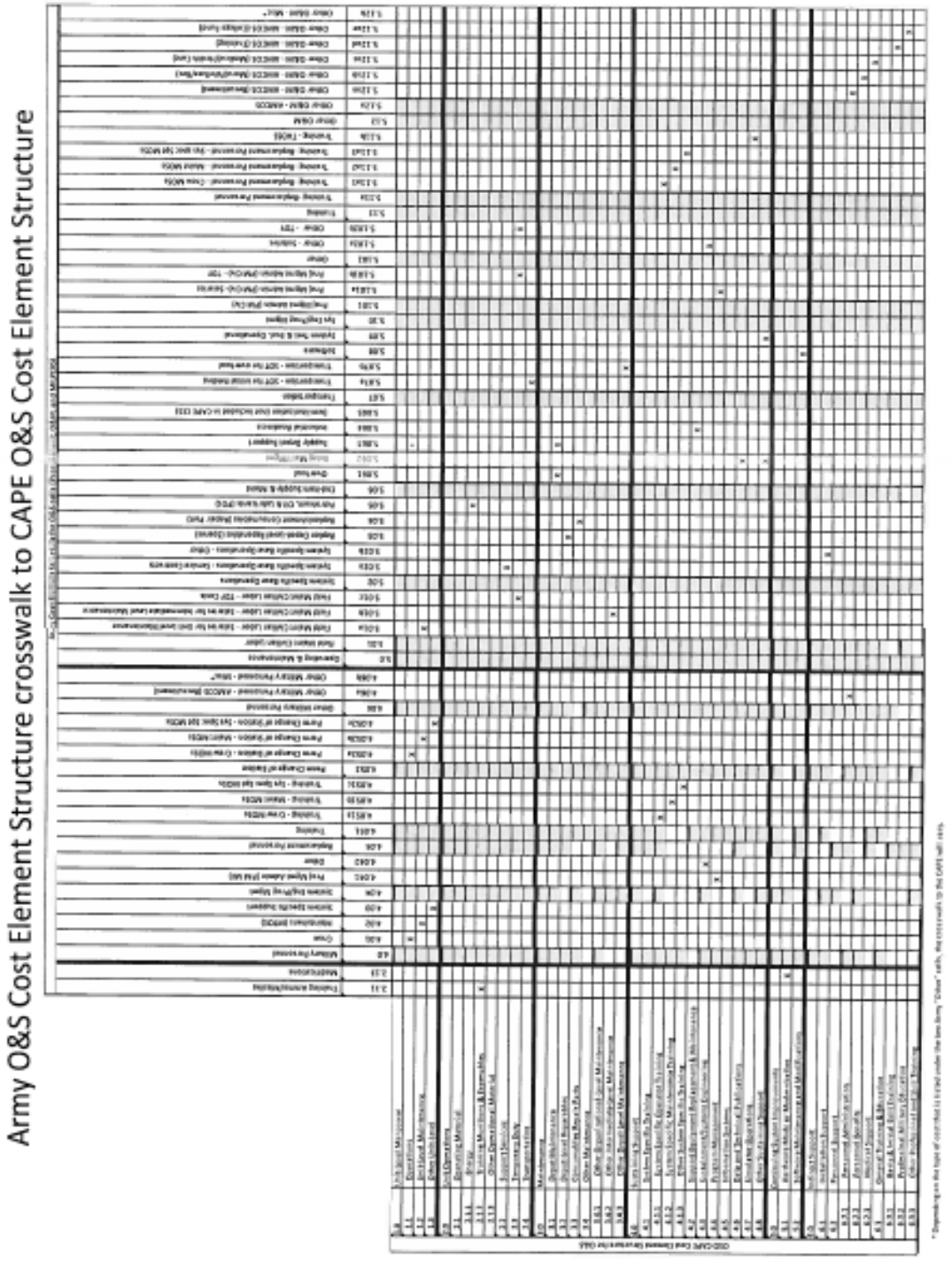
3. The attached chart shows the crosswalk between the Army CES (reference 1(a)) and the CAPE CES for O&S (reference 1(b)). Some items on the Army CES had to be broken out further to better align with the CAPE CES. Examples include Field Maint Civilian Labor, Transportation, Training, and any TDY costs for personnel. If the cost cannot be separated, the cost can be allocated to one CAPE CES but it must be annotated as to what it includes.

4. POC for this policy is Ms. Mary Gross, AMSTA-CSB-V.

DAVID A. HOLM
Chief, Cost and Systems Analysis Office

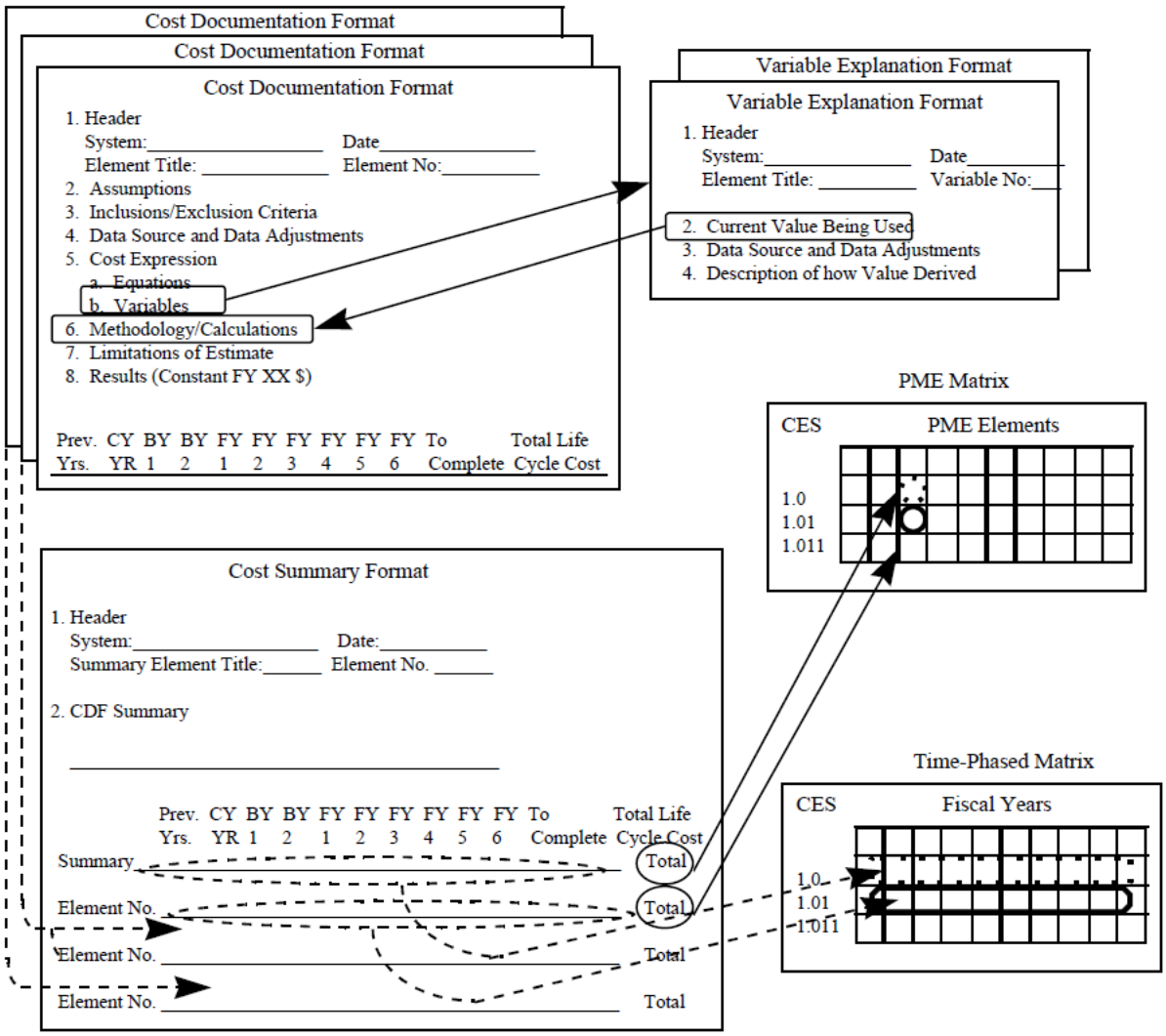
1 Attachement

CF:
SFAE-CSS
SFAE-GCS


Army O&S Cost Element Structure crosswalk to CAPE O&S Cost Element Structure

Appendix 6: Figures

Appendix 7: Example Documentation



Appendix 8: Economic Useful Life (EUL) Commodity Matrix-Guide to EUL Values for Cost Estimating

On 20 December 2019, the Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology) (ASA (ALT) provided a revision to their Economic Useful Life (EUL) Commodity Matrix-Guide to EUL Values for Cost Estimating. The current EUL recommendations are provided here:

Commodity Group	EUL Value	Rationale
Aircraft (Rotary or Fixed Wing)	17-25 Years	Recapitalization at 17-25 years to extend life or Replace due to Technical/Operational Obsolescence or structural integrity from fatigue issues
Tactical Wheeled Vehicles	30 Years	Recapitalization at 30 years to extend life or Replace due to Technical/Operational Obsolescence
Combat Vehicles (Tanks, APC, Self Propelled Artillery, **Ground Cpmbat Vehicles**	30 Years	Recapitalization at 30 years to extend life or Replace due to Technical/Operational Obsolescence
Engineering and Construction Equipment	15-40 Years	Dependent on condition and severity of usage and use of industry standards as the rationale to account for the difference in life for items depending on operating conditions. Reset or recapitalization can be used to extend life, to match the description in the General Equipment commodity area.
Communication Electronics and Sensors	8-15 Years	Technical refresh considered as needed. Non tactical Computers average replacement every five Years

Missiles - Tactical and Ballistic	10 Years	Can be extended (average of 17+ Years) through depot inspections to determine missile condition and Stockpile Reliability Program to determine missile condition.
Watercraft	40 Years	EUL supported by 3 Year scheduled oncondition cyclic maintenance. The Service Life Extension Program (SLEP) is the approach used to keep vessels operational beyond the original EUL.
Munitions - Conventional (not Missile)	20 Years	For Life cycle Cost estimating purposes EUL of 20 years is used. Conventional ammunition can be maintained -for long intervals. The useful life is heavily dependent upon storage conditions (especially temperature) and cyclical lot inspections, rather than upon estimation of item degradation.
Weapons (Individual and Crew Served) - Small Arms, Towed Artillery and Guns	25-5.0 Years	EUL value selected based on estimated rounds to be fired, intended weapon use (training, field unit or reserve) and durability-based on operational testing
Rail	65 Years	Rail freight cars built before July 1974 have a 40-year service life limit, but that may be extended to 50 years via an American Association of Railroads (AAR) Rule 88 Rebuild or via Extended Service Status (EXS) inspections and upgrades. Cars built later have a 50-year life limit. Although the Department of Transportation (DOT) considered introducing a mandatory retirement age for tank cars carrying crude oil, the most recent change to AAR Rule 88 allows railcar lives to be extended to 65 years by obtaining Increased Life Status (ILS).
General Equipment (Generators, MHE, Bridging Equip., **Pumps, Tanks and Shop Sets)**	17-25 Years	Recapitalization at 17-25 years to extend life or replace due to technical/operational obsolescence. Equipment usage/operating hours, repair frequency, down-time and reliability will impact EUL

Unmanned Ground Systems	5-10 Years	Due to a risk of obsolescence and diminishing manufacturing sources, a short EUL for robots of 5 or 10 years is recommended by the International Cost Estimating and Analysis Association.
Unmanned Air Systems	20 Years	EUL of 20 years for the UAS commodity group with the additional recommendation UAS EUL be revisited as additional data becomes available.
Other Robotic Equipment	N/A	Unable to identify any programs under this commodity group with fielded systems.
All Others (CBRNE, TMDE, etc)	7-20 Years	applicable value based on history, shelf-life, usage/operating hours, repair frequency, down time and equipment analysis

Appendix 9: Lessons Learned/White Papers