



# **COST ANALYSIS GUIDEBOOK (CAG)**

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## **Executive Summary**

### **Cost and Analysis Mission:**

It is Marine Corps Systems Command's (MCSC) mission to serve as the Department of the Navy's (DON) systems command for Marine Corps ground weapon and information technology (IT) system programs in order to equip and sustain Marine forces with full-spectrum, current and future expeditionary and crisis response capabilities. The Cost and Analysis Community (C&AC), also referred to as the Operations Research/Systems Analysis (ORSA) Community, serves as the Commander's agent for cost and analytical support of USMC programs at MCSC as well as at Program Executive Offices (PEOs) while adhering to Department of Defense (DOD) and DON directives and instructions.

### **Cost Analysis Guidebook (CAG):**

The C&AC performs five major capability groups with Cost Analysis (CA) at the core of each. The focus of the Cost Analysis Guidebook (CAG) is CA. The CAG describes the cost analysis procedures, best practices, and processes necessary to perform the cost and analysis mission. This CAG provides an overview for cost and operations research analysts, program office members and decision makers, financial managers, Marine Corps or other government stakeholders, and those who have a need to know because of their interface roles. It does not describe every activity, method, or approach to cost analysis required to aid cost and analytical support for programs within MCSC/PEO.

The content provided herein acknowledges and aligns with existing higher level policy, guidance, and regulations. The basis of the guidebook leverages DOD and DON directives and instructions. The CAG also utilizes tools and techniques from other Military Services and non-DOD cost organizations, as well as governmental /commercial cost products and knowledge. It amplifies different and unique items which may be specific to the Marine Corps and incorporates standardized practices where applicable while maintaining compliance with higher level policy. This CAG is a living document and should be reviewed and/or updated periodically.

## **CHAPTER 1 INTRODUCTION**

DOD policy on cost estimating and analysis is primarily implemented throughout the DON via Secretary of the Navy Instructions (SECNAVINSTs) 5000.2 and 5223.2. The DON cost estimating community, guided by the current versions of both SECNAVINSTs 5000.2 and 5223.2, consists of a number of Navy and Marine Corps offices that perform cost estimating and analyses tasks to meet various organizational, financial, and contractual requirements. This CAG communicates cost estimating processes and best practices to the Cost and Analysis (C&A) Community at Marine Corps Systems Command (MCSC) and Program Executive Offices (PEOs).

This CAG is intended to be both instructive on topics and useful as a reference for the C&AC. It is also intended to be helpful to program management (PM) teams (e.g., Program Managers [PMs]/Tier 0 IPT Leads, Product Managers [PdMs]/Tier 1 Leads, engineers, logisticians, budget participants, etc.) as it explains how cost estimates are developed at MCSC/PEOs and the specific roles each member performs in cost estimating. The information included in this guidebook provides MCSC/PEO guidance on estimating to facilitate the development of weapons, IT, and non-standard training systems cost estimates that are timely, accurate, consistent, well communicated, and defensible. If there is a conflict between policies, procedures, definitions, and practices described within the CAG and higher level guidance, then the highest level guidance takes precedence.

### **1.0 PURPOSE.**

The CAG serves as a tool for those tasked with conducting cost analyses for MCSC and PEO LS. By serving as a ready reference resource on cost analysis processes, methods, techniques, structures, and definitions, this guidebook provides a comprehensive overview of the methods and procedures essential to the preparation of cost-related products. This CAG defines and communicates the standard processes used in the C&AC. The objectives of the guidebook are to:

- Provide an overview of the cost and analysis environment.
- Provide a detailed review of the importance of cost analysis in MCSC/PEOs.
- Describe the cost analysis processes used in MCSC/PEOs, providing enough information to teach a new analyst, inform someone who is not an analyst, or refresh the memory of an experienced analyst.
- Build knowledge into the processes by incorporating lessons learned, best practices, and tips throughout the document.
- Approach broad cost and analysis topics through general concept discussions, processes, and techniques that can be applied to many USMC estimating environments and provide sources for further information on cost estimating support applications and analysis techniques, such as software cost estimating and inflation.
- Promulgate it as the primary reference for all cost analysis needs at MCSC/PEO.
- Inform those outside the C&AC and its customers about its products and processes.

## **1.1 SCOPE.**

Cost analysis is a critical element of the decision support provided to the Milestone Decision Authority (MDA) of an acquisition program, the In-Service Authority (ISA) of a fielded system, and the PM/PdM of either. The process inherent to cost analysis is the most appropriate method available for the decision maker to assess the costs of alternatives on the basis of past, current, and projected future costs, benefits, and risks/uncertainties. The tasks detailed within are meant to provide enough information to perform an estimate along with resources for further information for readers unfamiliar with the discipline of cost estimating. This guidebook will also serve to show best practices for cost estimating in other types of analyses such as Business Case Analyses (BCAs), Economic Analyses (EAs), Earned Value Management (EVM), schedule analysis, as well as Analyses of Alternatives (AoAs).

## 1.2 COST ANALYSIS AND COST ESTIMATING.

Cost analysis is both a science and an art. It is a science in that the analyst can apply known mathematical formulas and techniques in a cost model. It is an art in that the analyst must gain an understanding of the program so that the main cost drivers of a program can be determined. Therefore, the cost analyst must have the capability to apply proven scientific and mathematical principles to a cost estimate while determining the most important areas affecting cost.

### 1.2.1 COST ANALYSIS.

Cost analysis is a generic term used to describe the analytic work performed to support opinions, conclusions, and recommendations related to past, present, and future costs. Cost analysis involves collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to understand cost relationships. Cost analysis is key to those analytic products such as: Life Cycle Cost Estimates (LCCEs), also known as Program Office Estimates (POEs), which are equivalent to Total Ownership Cost (TOC) (further explained in section 2.0.2), USMC Component Cost Estimates (CCE) and Will Cost Estimates; AoAs; Independent Cost Estimates (ICEs); EAs; BCAs; trade-studies and other forms of cost-benefit analyses.

Cost analysis does have limitations: analysts develop cost estimating methodologies with an imperfect understanding of technical merits. The applicability of historical data is also subject to interpretation. Because of future uncertainties, there are limitations in determining the degree to which reality varies from the plan. Realistically, the cost analysis process cannot:

- Be applied with a checklist approach, but rather must be tailored to the program.
- Produce results that are better quality than the input data.
- Predict political impacts.
- Substitute for sound judgment, management, or control.
- Make the final decisions.

Despite these limitations, cost analysis is a powerful tool. Rigorous and systematic analysis leads to a better understanding of a problem. It improves management insight into resource allocation problems. However, because the future is uncertain, the best estimates will differ from reality.

### **1.2.2 COST ESTIMATING.**

Cost estimating is the application of CA to predict the likely level of financial resources required to accomplish future work (at a prescribed level of performance, the required capability/specification, and with a given schedule). Cost estimates are used to:

- Support decisions on program viability, resource requirements, and budget requests,
- Support contracting (i.e., cost proposal evaluation and IGCE support),
- Compare funding levels to determine affordability,
- Inform of trade-space explorations in an effort to improve performance, address schedule constraints, or reduce risks/uncertainties,
- Provide credible and auditable values in support of milestone reviews during the acquisition process,
- Support the Planning, Programming, Budgeting, and Execution System (PPBES) process (This includes formulating and documenting USMC LCCEs and USMC Component Cost Positions (CCPs) on programs within the Program Objective Memorandum (POM) and the Budget Estimate Submission (BES) processes).

### **1.3 DECISION SUPPORT SYSTEM (DSS).**

The following subsections describe some of the major arenas that are supported by cost analysis. Obtaining Congressional approval and funding is only one achievement of three major processes involved in acquiring systems for a MCSC/PEO program. These three essential DSS (further information on these systems can be found in Chapter 1 of the Defense Acquisition Guidebook (DAG)) are:

- Requirements analysis as promulgated by the Joint Capabilities Integration and Development System (JCIDS),

- Defense Acquisition System as defined in DOD 5000.02, and
- Resource allocation as supported by the DOD PPBES process.

#### **1.3.1 JOINT CAPABILITIES INTEGRATION DEVELOPMENT SYSTEM (JCIDS).**

The JCIDS process produces information for decision-makers on projected mission needs. The needs identified are defined initially in broad operational terms in an Initial Capabilities Document (ICD) and are progressively translated into specific performance requirements in a Capabilities Development Document (CDD) and Capabilities Production Document (CPD). Further information on JCIDS can be found within the JCIDS Manual at: <https://acc.dau.mil/CommunityBrowser.aspx?id=530429>

*Note: A Defense Business System (DBS) is an information system, other than a National Security System, operated by, for, or on behalf of the DoD, including financial systems, management information systems, financial data feeder systems, and the information technology and cyber security infrastructure used to support business activities, such as contracting, pay and personnel management systems, some logistics systems, financial planning and budgeting, installations management, and human resource management. DBSs generally do not employ JCIDS procedures for the development and validation of capability requirements documents; however DoDI 5000.02 provides additional policy applicable to the acquisition of defense business systems that are expected to have a life-cycle cost in excess of \$1 million. It is intended to be used in conjunction with the procedures in the core instruction, with statutorily specified governance, and distinctive documentation as noted in the DoDI 5000.02.*

#### **1.3.2 ACQUISITION MANAGEMENT SYSTEM.**

The Acquisition Management System provides for a streamlined acquisition management structure and an event-driven process that links key milestone decisions to actual accomplishments. DOD 5000.01 and 5000.02 establish DOD acquisition policy. Cost estimating and analysis are implemented throughout the DON via SECNAVINSTs 5000.2 and 5223.2. Refer to SECNAVINST 5000.2 for the Defense Acquisition Management Framework.

For information regarding Acquisition Category (ACAT) level descriptions, decision authority, and cost related statutory/regulatory information see Appendix A.

### **1.3.3 PLANNING, PROGRAMMING, BUDGETING, AND EXECUTION SYSTEM (PPBES).**

The federal budget process drives the operation of federal programs and agencies. It involves multiple stakeholders, each working towards the fulfillment of the vision for government set forth by the Executive Office of the President. The planning and analysis that constitutes the first phase of the PPBES process is the foundation for the formulation of the President's Budget. To support the federal budgeting process effectively and to comply with the requirements for receiving federal/program funds, continuous, accurate, and forward-focused investment planning and analysis is required. As a current year budget is being executed, the next year's budget must be formulated and planned.

PPBES is DOD's resource allocation system for making informed, affordability assessments and resource allocation decisions on acquisition programs. This process examines military capabilities in a horizontal manner and relies on the Future Years Defense Plan (FYDP) to plan funding in the short term based upon long-term consequences.

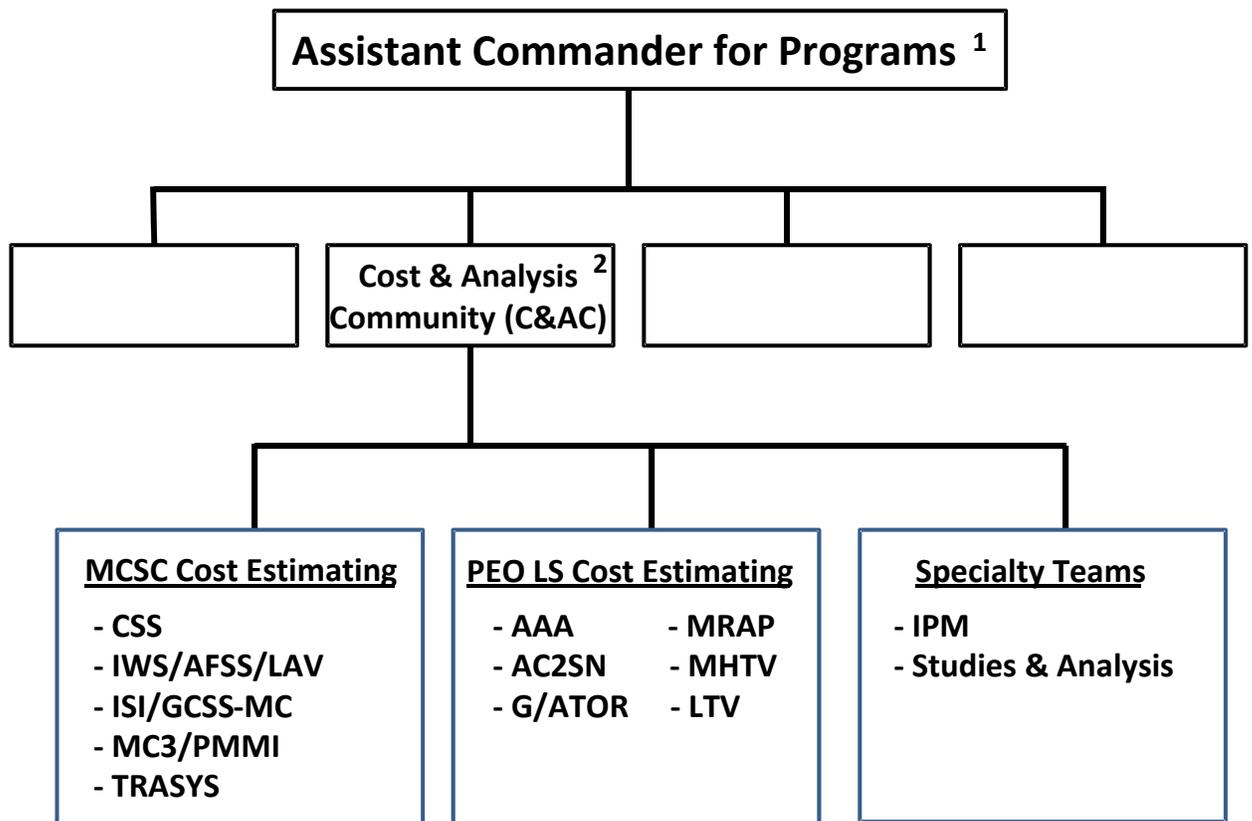
### **1.4 MARINE CORPS SYSTEMS COMMAND (MCSC), COST AND ANALYSIS COMMUNITY (C&AC).**

The primary function of analysts within the C&AC is to provide cost and analysis for MCSC and PEO(LS) programs. The many participants, their responsibilities, and the coordination among their functions, form the framework and environment of C&AC. This framework including participants, cost analysis deliverables, and cost estimating in the program life cycle, is described within this CAG.

#### **1.4.1 C&AC ORGANIZATION.**

The C&A Community (C&AC) is made up of the C&A Branch (C&AB) and the PEO LS Cost Team. The C&AB is located under the Assis-

tant Commander for Programs (AC PROG) within MCSC and is the MCSC authority in the field of cost analysis. The entire C&AC resides within the PM Competency. Through competency alignment, the C&AC advises the Commander MCSC (COMMARCORSYSCOM) and PEO LS on the historical, current, and emerging trends in all elements of USMC cost estimating and cost analysis. It is important to note that the community works for the COM-MARCORSYSCOM/PEO LS acting as an independent agent that provides cost products to PM Offices (PMOs) (formerly known as Product Groups (PGs)), PEO(s), and PMs/PdMs. The Community is organized into analytical teams in direct cost support of the PMs/PdMs and PEOs as well as conducting analysis for AoAs, BCAs, EVM, scheduling products, and Independent Government Cost Estimates (IGCEs). The C&A organizational overview is presented in Figure 1.1 below.



Notes:

(1): The Assistant Commander for Programs also serves as the PM Competency Director.

(2): The C&A is led by the C&A Branch Head, who also serves as the ORSA Community Lead.

Figure 1.0 C&A Organizational Overview

#### **1.4.2 ROLES AND RESPONSIBILITIES.**

The C&AC conducts and oversees the development of cost estimates for MCSC/PEO weapon, IT, and non-standard training systems programs. Through its processes, the C&AC core function delivers USMC Program Office Estimates (also known as LCCEs) to satisfy the "Will-Cost" estimate, whereas PMs/PdMs perform the "Should-Cost" (discussed later in this guidebook). There are many participants in the cost analysis process at MCSC/PEO. From the cost estimator to the end user, each participant plays an important role. This section provides an overview of key persons or groups participating in the cost analysis process along with a description of their related roles and responsibilities.

*Note: Only NCCA develops Component Cost Estimates (CCE) and Component Cost Positions (CCP).*

##### **1.4.2.1 Stakeholder (PMO, PEO, PdM, etc.) expectations:**

- Fund the development of required C&A products,
- Provide required documentation, including (but not limited to): Acquisition Strategy / Acquisition Plan (AS/AP), Cost Analysis Requirements Description (CARD), Life Cycle Sustainment Plan (LCSP),
- Provide timely support to the C&A Study Director and the analysis team, including access to data, technical experts, and program office staff,
- Provide timely and actionable comments on draft C&A products submitted for review,
- Promulgate C&A products produced for them as appropriate.

##### **1.4.2.2 The Assistant Commander, Programs:**

- Exercises staff cognizance over the C&AC,
- Provides staff resources as required to standing and overarching integrated product teams (IPTs),
- Provides staff resources as required to lead or execute analyses for which AC PROG has accepted responsibility,
- Represents products for which AC PROG has accepted responsibility and/or provide assessments of products produced by others to senior leadership.

#### **1.4.2.3 C&AC Branch Head/ORSA Community Lead (and Deputy):**

- Exercises staff cognizance over the tasking, training, and development of C&AC personnel and products referenced in this guidebook,
- Approves MCSC/PEO LS cost analysis policy, tools, processes, and procedures,
- Assigns resources as required to standing/overarching IPTs,
- Assigns resources as required to C&AC Teams,
- Represents products for which C&AC has accepted responsibility and/or provide assessments of products developed by others to senior leadership,
- Approves cost-related products and presides over internal Technical Review Boards (TRBs) and Cost Review Boards (CRBs) (C&AC processes are further discussed in Chapter 3),
- Ensures a repository for finished C&AC products,
- Performs as the MARCORSYSCOM Cost Director to include representing USMC on senior-level stakeholder groups (e.g., DON Cost Estimating Stakeholders' Group).

#### **1.4.2.4 Cost & Analysis Team Leader:**

- Oversees/reviews analytical efforts/products of team members,
- Approves cost-related products and presides over internal TRBs and CRBs as delegated by the C&AC Branch Head (C&AC processes are further discussed in Chapter 3),
- Attends technical and/or cost reviews for programs under the team leader's cognizance,
- Attends technical and/or cost reviews for programs under other teams' cognizance in a subject matter expert(SME) role, as available,
- Works together with other C&A Team Leaders to develop MCSC/PEO LS cost analysis policy and standardized cost tools, processes, and procedures,
- Ensures C&AC products are developed according to MCSC policy, processes, and procedures (to include compliance with those for DOD and DON),
- Informs higher management of status of team members and efforts,
- Communicates changes in policy, processes, procedures and any other team-related information to the team members,

- Works in coordination with team member supervisors (if applicable); conducts technical training for the team.
- Serve as central point of contact to the PdM/APMs of assigned PMOs, Direct Report PM (DRPM), PEO, etc. as well as to external agencies for programs under cognizance,
- Coordinates with other MCSC branches and/or other external agencies in order to ensure C&A products/outputs are properly portrayed (e.g., Assessments for Milestone Assessment Teams (MATs), Acquisition Program Baselines (APBs), Probability of Program Success (PoPS) Assessments, HQMC Affordability Analysis (AA), etc.),
- Performs duties and responsibilities of a C&AC analyst (described below) when required.

#### **1.4.2.5 Analyst:**

The following duties revolve around the analyst's area of expertise (specific items may also be elaborated upon within Chapters 3 and 4):

- Serves as the lead analyst for analytical products that are prepared "organically" (i.e., in-house without external support),
- Provides technical oversight as study director for C&AC products that are prepared using contractor services,
- Supports other functional areas (contracts, finance, etc.) by providing data and other information as appropriate (independent estimates of cost and schedule, draft products, etc.),
- Supports and defends all C&A products to the stakeholder and/or decision-makers and ensures that the stakeholder is able to properly convey those products to higher authorities.

## CHAPTER 2 COST ESTIMATING IN THE C&AC, MCSC

### 2.0 COST ESTIMATING OVERVIEW.

LCCEs are one of the most common products of cost analysis. A standardized LCCE documentation format is provided in Appendix B that ensures a comprehensive and complete cost estimate report. SECNAVINST 5223.2 requires formal LCCEs for each Milestone. Additional reasons to conduct an LCCE include POM Initiative Development, cost breaches, critical change and gate review validations. Costs associated with DODI 5000.02 life cycle phases and appropriations must be addressed within each estimate. The life cycle cost categories associated with specific program phases are:

- Research and Development costs, associated with the Materiel Solution Analysis phase, Technology Development phase, and Engineering and Manufacturing Development phase,
- Investment costs, associated with the Production and Deployment phase,
- Operations and Support costs, associated with the Operations and Support (O&S) phase, and
- Disposal costs after initiation of system phase out or retirement.

These are further described below and are based on guidance within the DAG, DON Total Ownership Cost (TOC) Guidebook, and Office of the Secretary of Defense (OSD) CAPE Operating and Support Cost-Estimating Guide as well as illustrated in Figure 2.0 (greater detail can be found in those references).

- Research and Development Costs include development costs incurred from the beginning of the Materiel Solution Analysis phase through the end of the Engineering and Manufacturing Development phase, and potentially into low-rate initial production (LRIP). Typically this includes costs of concept refinement trade studies and advanced technology development; system design and integration; development, fabrication, assembly, and test of hardware and software for prototypes and/or engineering development models; system test and evaluation; system engineering and PM; peculiar and common support equipment, peculiar training equipment/initial training, technical publications/data, and initial spares

and repair parts associated with prototypes and/or engineering development models.

- Investment Costs include production and deployment costs incurred from the beginning of LRIP through completion of deployment. Typically this includes costs associated with producing and deploying the primary hardware and software: system engineering and PM; peculiar and common support equipment, peculiar training equipment/initial training, technical publications/data, and initial spares and repair parts associated with production assets; interim contractor support that is regarded as part of the system production and is included in the scope of the acquisition program baseline; and military construction and operations and maintenance associated with system site activation.
- O&S Costs include sustainment costs incurred from the initial system deployment through the end of system operations. It includes all costs of operating, maintaining, and supporting a fielded system. Specifically, this consists of the costs (organic and contractor) of personnel, equipment, supplies, software, and services associated with operating, modifying, maintaining, supplying, training, and supporting a system in the DOD inventory. It may include interim contractor support when it is outside the scope of the production program and the acquisition program baseline.  
O&S costs include costs directly and indirectly attributable to the system (i.e., costs that would not occur if the system did not exist), regardless of funding source or management control. Directly attributable costs refer to the resources immediately associated with the system or its operating unit. Indirectly attributable costs refer to the resources that provide indirect support to the system's manpower or facilities (e.g., pay and allowances for a unit-level maintenance technician would be treated as a direct cost, but the cost of medical support for the same technician would be an indirect cost).
- Disposal Costs include costs associated with demilitarization and disposal of a military system at the end of its useful life. These costs in some cases represent only a small fraction of a system's life-cycle cost. However, it is important to consider demilitarization and disposal early in the life-cycle of a system because these costs can be significant, depending on the characteristics of the system.

Costs associated with demilitarization and disposal may include disassembly, materials processing, decontamination, hardware, collection/storage/disposal of hazardous materials and/or waste, safety precautions, and transportation of the system to and from the disposal site. Systems may be given credit in the cost estimate for resource recovery and recycling considerations.

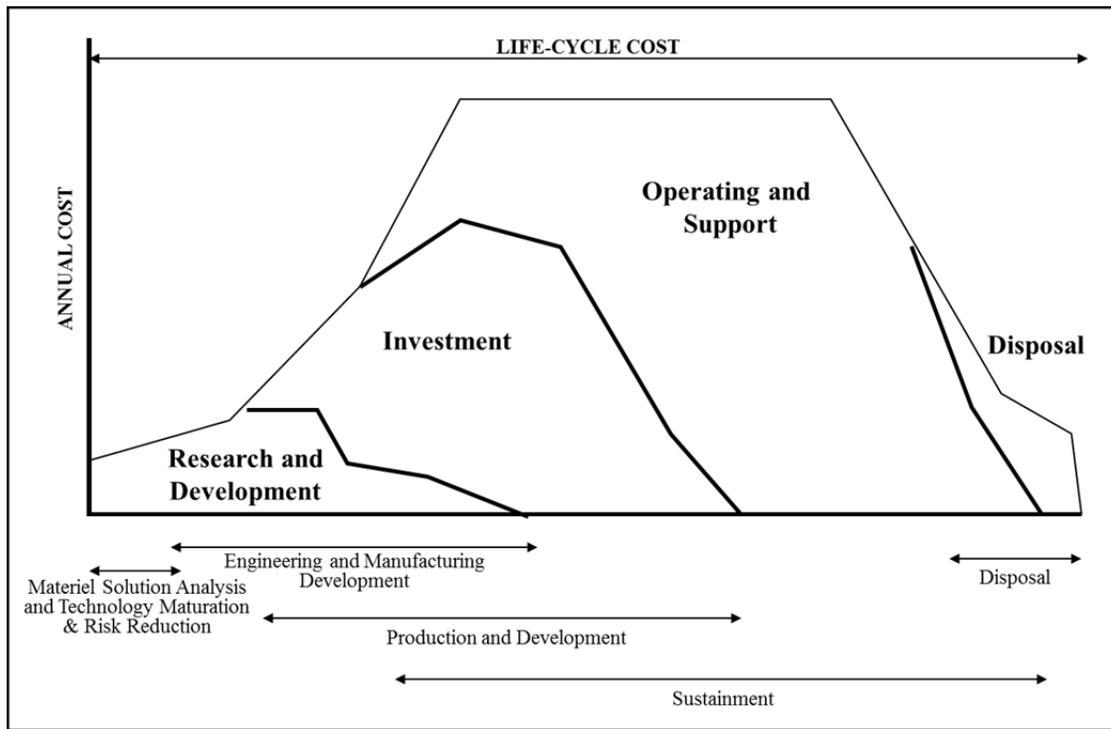


Figure 2.0 System Life Cycle

### 2.0.1 POLICIES, INSTRUCTIONS, AND DIRECTIVES.

In December 2008, SECNAVINST 5223.2 expanded the roles and responsibilities of the DON SYSCOM cost organizations and PMs/PdMs. Consequently, the C&AC grew in response to the increased demand and has developed processes for implementing the SECNAVINST 5223.2. The local MCSC Order 5223.2 establishes the CAG as the MCSC and PEO(LS) guidance regarding cost analysis. All MCSC and PEO LS ACAT programs, Abbreviated Acquisition Programs (AAP), and pre-ACAT efforts shall comply with the processes and policies established by the CAG and its references. The CAG provides best practices, processes, and procedures for cost analysis, studies, and other analyses. It also aligns

with Competency Aligned Organization (CAO) principles.

Additionally, the C&AC serves as the Command's authority for developing processes for the CARD and LCCE. While the CARD is a PM responsibility, the C&AC reviews and accepts the CARD for LCCE development. Therefore, early coordination in CARD development (and final review) with the C&AC ensures its sufficiency to serve as a basis for a LCCE. In-depth discussion on the processes for the CARD and LCCE are found in Chapter 3. Below is the C&AC LCCE support flowchart to aid in determining when a LCCE is needed and what is required to initiate that LCCE support from the C&AC.

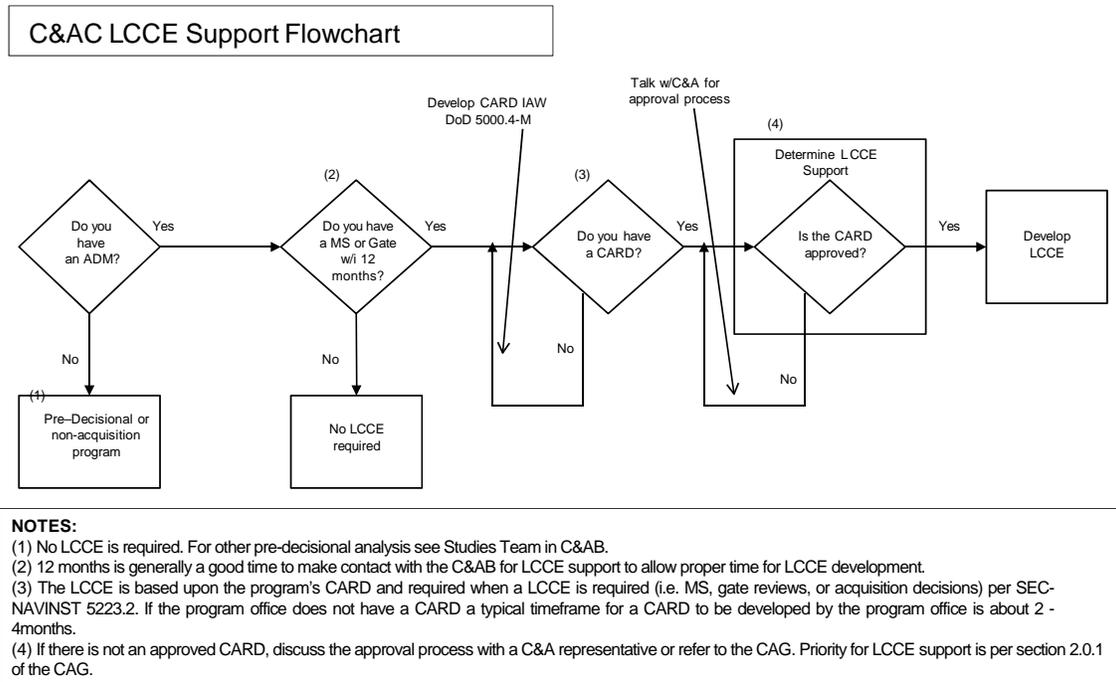


Figure 2.1 C&AC LCCE Support Flowchart

Additionally, the following list specifies the priorities for LCCE and cost support in general (these priorities are adjustable dependent on visibility, special interest, breaches, and resource availability):

- 1) ACAT I-IV programs and those seeking that designation (in that order).
  - a. coming up on a milestone decision (i.e., MS A, B, C, FRP).

- b. coming up on a gate decision (i.e., MDD, 1-6, and other like decisions).
- 2) AAPs and those seeking that designation
  - a. coming up on a milestone decision (i.e., MS A, B, C, FRP)
  - b. coming up on a gate decision (i.e., MDD, 1-6, and other like decisions).
- 3) If the program involves a Procurement Decision Authority, Authority to Participate (ATP) or other like situations, the cost support will be treated at the ACAT level commensurate with the Marine Corps' portion of the overall program.
- 4) Other support as resources allow (e.g., APB, POPS, excursions, source selections, etc.).

\* *Other types of cost and analytical support are available, as well (Chapter 4 has additional information for these areas).*

#### **2.0.2 TYPES OF COST ESTIMATES.**

**LCCE /POE/ WILL COST ESTIMATE.** The terms most commonly used within this Guidebook to indicate the C&A approved cost estimate are LCCE and POE. The terms LCCE, POE, PLCCE, and Will Cost Estimate are interchangeable terms. A LCCE consists of research and development costs, investment costs, operating and support costs, and disposal costs over the entire life cycle. These costs include not only the direct costs of the acquisition program, but also the indirect costs that would be logically attributed to the program. In this way, all costs that are logically attributed to the program are included, regardless of funding source or management control.

Additionally, through the DON TOC Guidebook, the DON has set forth guidance regarding the DON definition for the TOC. The DON TOC Guidebook directs the use of the life cycle cost definition and categories as the DON definition for TOC (which was previously introduced in section 2.0 of this document). This applies to Navy and Marine Corps Program Executive Officers, Program Managers, Direct Reporting Program Managers and their supporting resource sponsors and Systems Commands.

An LCCE provides a comprehensive and structured estimate of all resources necessary to develop, produce, operate and support, and dispose of a system during its complete life cycle. To avoid the question of early-on costs belonging to a specific program, a C&A LCCE includes costs starting at program initiation and extending through O&S and disposal. The LCCE is not limited to the budget controlled by the Program Manager. Cost estimators prepare an LCCE by translating the technical and design parameter characteristics and schedules into cost estimates using established cost estimating methodologies.

To conform to SECNAVINST 5223.2 and 5000.2, all MCSC and PEO LS LCCEs are based on a CARD. CARDS are developed by the PM, validated by independent technical and programmatic authority, and reviewed and accepted by the C&AC. The LCCE can be prepared by the C&AC, support contractor, or other authorized organization under C&AC direction. The C&AC oversees all LCCEs to ensure that all relevant cost elements are addressed and to verify the methodologies used in its development. The C&AC is the final approver of the LCCE. The standard modeling tool utilized by the C&AC to develop the cost model is the Automated Cost Estimating (ACE) module of the Automated Cost Estimating Integrated Tools (ACEIT) suite. In some cases, MS Excel may be used to develop the cost model with sufficient justification and the approval of the C&A Branch Head at the model's initiation. In addition, C&AC assists the PM/PdM in explaining or defending the estimate as necessary. The cost estimating process for C&AC is detailed in Chapter 3 of this guidebook.

**USMC COMPONENT COST POSITION.** DoD components establish a DoD component-level cost position (CCP) for their Major Defense Acquisition Programs (MDAPs) at milestone reviews. To support DoD's full funding policy for acquisition programs, as well as specific statutory certifications and regulatory requirements, the DoD component is expected to fully fund the program to this cost position in the current President's Budget (PB)/Future Years Defense Program (FYDP), or commit to full funding of the cost position in the next PB/FYDP, with identification of specific offsets to address any funding shortfalls that may exist in the current FYDP. For specific details on the CCP process here at MCSC and the PEO LS, see the information within Chapter 3.

**PROGRAM OFFICE ESTIMATE (POE).** A cost estimate developed by the PMO or by a government cost estimating organization on behalf of the PMO.

**SHOULD COST ESTIMATE.** Per the DAU glossary, the should cost estimate is an attempt to drive productivity improvement during contract negotiation and program execution by scrutinizing every element of program cost, assessing whether each element can be reduced relative to the year before, challenging learning curves, dissecting overheads and indirect costs, and targeting cost reduction with profit incentive.

The current MCSC Guide to Should Cost Management implements Should Cost policy and procedure at MCSC. The PM is responsible for developing the Should Cost initiative. However, in those cases where the C&AC has developed the LCCE, they can assist in should cost analysis (see MCSC Guide to Should Cost Management for specific details). In general, the guide details how to accomplish the three principal actions required of program managers from higher level directives. First, programs must perform should cost analysis to justify each element of program cost against the will cost. Secondly, program managers must use this analysis through all phases of program execution to drive productivity improvement into their programs. Thirdly, programs must report on how they are improving year by year or meeting other relevant benchmarks for value.

**INDEPENDENT COST ASSESSMENT (ICA).** An Independent Cost Assess-

ment (or Independent Assessment (IA)) consists of a review of various analytical products to evaluate program costing completeness, methodology, accuracy, and risk/uncertainty.

The Naval Center for Cost Analysis (NCCA) performs an ICA of the LCCEs for all ACAT ID or IAM programs. NCCA will additionally assess estimates for ACAT II programs as directed by the Assistant Secretary of the Navy (Financial Management and Comptroller) (ASN (FM&C)).

Assessments will include an independent evaluation of risk and uncertainty and provide increased visibility and understanding of major program costs and potential for cost growth. The IA will review cost processes and key assumptions to ensure cost estimates are consistent with all cost policy and guidance frameworks. Methodologies will be reviewed to ensure the most appropriate methodologies are selected, leading to an accurate and unbiased estimate.

Depending on the outcome of a C&AC assessment, the C&AC may elect to perform an ICE on any of these programs, as well as for any other MCSC program determined by C&A Branch Head to be of special interest. To ensure consistency across the organization and provide documentation crosschecks, the Department of the Navy Independent Cost Assessment Manual (NCCA's web references: <https://www.ncca.navy.mil/references.cfm>) provides a series of phased checklists that defines expectations for completed products. The C&AC SharePoint site provides several other valuable tools for analysts under the "Quick Start Guide".

**INDEPENDENT COST ESTIMATE (ICE).** For MDAPs and MAISs, the ICE serves as a comparison to the LCCE to assist in determining the fairness and reasonableness of an estimate. The Office of the Secretary of Defense, Cost Assessment and Program Evaluation (OSD CAPE) is responsible for producing the ICE for ACAT ID/IAM programs (and NCCA performs an ICA for ACAT ID/IAM programs). When an ICE or ICA is performed by NCCA, a reconciliation of the LCCE and ICE/ICA is conducted to formulate a DON CCP.

## 2.1 COST ESTIMATING METHODOLOGIES.

The generally accepted methodologies for estimating costs are analogy, parametric, engineering, and actuals. The cost analyst may find it useful to use one or more of these methodologies within one single cost estimate. Rarely will the cost analyst use exclusively one cost estimating method for an entire LCCE. The individual cost elements within a LCCE will likely require different cost estimating methods depending on the amount of known information. Generally speaking, the cost analyst may find that the best approach, given the known information, will be a hybrid methodology. This hybrid methodology will contain aspects of more than one of the aforementioned four general methodologies.

### 2.1.1 TYPES

The figure below depicts typically how the different CE methodologies are used across the life cycle phases.

## Cost Estimating Methods Appropriate to Acquisition Phases

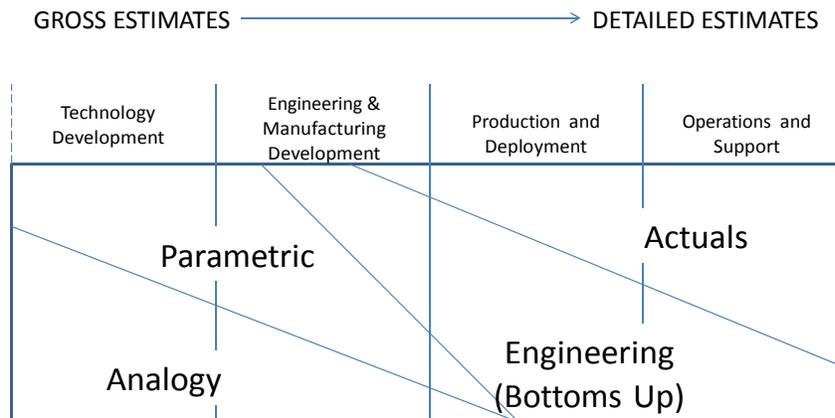


Figure 2.2 Cost Estimating Methods

**ANALOGY**. The Analogy method compares a new or proposed system with a similar historical system, for which there is available cost and technical data. It takes into consideration that most new programs evolve from existing programs to some degree. An analogy uses actual costs from a similar system with adjustments to account for the differences between the new system of interest and the historical system. A cost estimator typically uses this method early in the acquisition process, such as the Pre-Milestone A and Milestone A phases of a system. This is early in the life of a potential acquisition program when there may be a limited number of actual data points for the program of interest, and the cost estimator may be dealing with changing requirements and technology. To use the analogy, the historical and new systems should have a strong similarity.

There are two major advantages of using the analogy method. First, if an analogy is strong, the estimate will be more defensible. Second, the method tends to be a relatively fast and inexpensive way of estimating program costs and can be done with relatively little technical detail about the new system. However, there are also disadvantages associated with using the analogy method. The analyst must assume that historical data for the analogous system is accurate. Also, data adjustments made to compensate for differences among the systems will introduce uncertainty. Care should be taken to normalize the values from various sources for variations in areas such as technical characteristics, manufacturing processes, years of occurrence (inflation), etc.

**PARAMETRIC**. The parametric method of cost estimating is the use of historical cost data and statistical techniques to predict future costs. The implicit assumption of parametric cost estimating is that the same forces that affected cost in the past will affect cost in the future. The goal of parametric estimating is to create a statistically valid cost estimating relationship (CER) using historical data. A critical consideration in parametric cost estimating is the similarity of the systems in the underlying database, both to each other and to the system which is being estimated. A good parametric data set must have a significant number of normalized data points, be timely and accurate, and contain the latest available data.

There are several advantages to parametric cost estimating. The estimate can usually be conducted quickly, if data is readily available, and is easily replicated. Estimating by parametric is less risky than estimating by analogy because the CER is based upon more than a single data point. There are also disadvantages associated with using the parametric methodology. The parametric method requires a base of historical cost, technical, programmatic, and performance data that must be consistent and reliable. Extrapolations that involve new systems become increasingly inappropriate as they depart further from the technology that existed at the time the sample systems were procured. Additionally, changes in the production process and types of material used for seemingly similar products may significantly influence cost. Care should be taken to ensure that the parametric method is applied correctly and with the same intent as that for which it was developed.

**ENGINEERING.** The engineering method of cost estimating is a "bottoms up" approach which details costs associated with each part of the acquisition item. In contrast, analogous and parametric techniques estimate acquisition costs in a "top down" manner. Engineering estimates are the most detailed and expensive approach to cost estimating. This method involves examination of individual elements at the lowest level of identifiable work and separate calculations for system engineering, material, labor, direct and overhead costs, as well as profit associated with each discrete element. Estimates for individual elements are usually derived from historical quotes, databases, previous prices, and when adjusted accordingly, can also be used to define the interrelationships of Life Cycle Cost (LCC) elements inherent in a particular acquisition program.

There are advantages of using the engineering method. The estimator has the ability to determine exactly what the estimate includes and whether anything was overlooked. It entails a unique application to the specific program and manufacturer. It gives good insight into major cost contributors. It also provides an easy transfer of results to other programs.

There are several disadvantages of the engineering method. It can be expensive to implement and it is time consuming. It is

not flexible enough to answer what-if questions or conduct what-if drills. New estimates must be built for each alternative. The product specification must be well known and stable. All product and process changes must be reflected in the estimate. Small errors can grow into larger errors during the summation. Some elements can be omitted by accident.

**ACTUALS.** The projection of actuals technique is appropriate when estimating a re-procurement of a system or when shifting from LRIP to full production or later in the production line. This technique may not be appropriate earlier in the production line when the depth of reported actuals may not support the estimate. Extrapolation from data on previous procurements of the same system may be useful. Since this technique begins with actual cost data, it is normally one of the most accurate. However, changes in areas such as manufacturing/assembly methods or quantity must be considered. This is especially true if the earlier buy was a prototype version or LRIP quantity.

**EXPERT OPINION.** To complement the other methodologies, expert opinion can be used. This relies on the subjective judgment of "experts" and is used exclusively when data is insufficient (or inadequate) to use analogy, parametric, or engineering methods. When a major change in either engineering or manufacturing state-of-the-art is involved; "experts" are particularly useful. "Expert" opinion is subject to bias and becomes less reliable as system complexity increases and the number of "experts" decreases. This subjective method can be used as a good check on the reasonableness of an estimate developed using another methodology, or as a means of assessing the uncertainty or risk of a cost element. The assumptions provided to or by the experts should be documented in the Ground Rules and Assumptions.

There are several advantages of using an expert's or experts' opinion(s). Once experts are assembled, it takes minimal time and is easy to implement. An expert may give a different perspective or identify facts not previously considered, leading to a better understanding of the program. It can help in cross-checking for CERs that require data significantly beyond the date range. It can be blended with other estimation techniques within the same Work Breakdown Structure (WBS) element. It can

be applied in all acquisition phases. However, there are some disadvantages associated with the expert opinion method. It lacks objectivity and is not very accurate or valid as a primary estimating method. There is a risk that one expert will dominate group discussion or that experts disagree with each other. Due to its subjectivity and lack of supporting documentation, expert opinion should be used sparingly and preferably only as a sanity check or for determining risk bounds.

## **2.2 COMMONLY USED COST ESTIMATING TERMS.**

### **2.2.1 SUNK COSTS.**

Sunk costs, also known as "actuals to date", are all past expenditures or irrevocably committed funds related to a given cost estimate. Typically, they are expressed as the costs incurred prior to the fiscal year (FY) in which the cost estimate is completed and after the program has been officially initiated. Analysts can express sunk costs in either current or constant dollars, but the type of dollars must be explicitly stated. Normally, analysts should not use sunk costs in alternatives for decision making as they reflect previous choices rather than current choices. Sunk costs are an important basis for estimating future trends and are required when documenting the program life cycle cost. In life cycle cost estimating, cost analysts must identify all sunk costs, should attempt to identify them by the lowest possible cost element and be mindful of how their cost estimating methodologies may account for estimating a portion of costs that are already sunk. Since a program continues to execute its budget while the LCCE is being developed, it is recommended that the cost estimator defines as a key ground rule what FY cutoff date at the end of the FY will be used to establish sunk costs. Additional information with regards to sunk costs for the Acquisition Program Baseline (APB) can be found in Chapter 5.

### **2.2.2 INCREMENTAL COSTS.**

When comparing alternatives, the analyst should present only the future cost or "incremental cost" of each alternative. These are those increments of cost that will be incurred as the result of choosing one or another of the alternatives availa-

ble. They may be looked upon as "consequential costs" since they are the consequences of the decision makers' current choice.

### **2.2.3 NON-PROGRAM OFFICE FUNDED COSTS.**

Non-program office funded costs are those costs that exist because the program exists but are not funded by the program office. In accordance with the policy of including attributable costs in the LCCE regardless of funding source, these costs should be reflected in the program's cost estimate. On the other hand, if the specific costs would exist even if the program did not, they are not considered costs of the program. For example, if an IT system requires specific hardware, and another program pays for that hardware, the hardware costs should still be reflected in the system's cost estimate (as non-program office funded costs). However, if an IT system uses an enterprise software license, in that if the program did not exist the cost of the enterprise license would not change, then this software license cost should not be part of the system's cost estimate.

### **2.2.4 MANPOWER.**

For acquisition programs, manpower costs cover the personnel (military, civilian, and contractor) required to design, procure, operate, maintain, support, and train for full operational deployment of the system. The costs should only cover personnel while they perform a preponderance of their duties specific to the program under consideration. For instance, in cases where the end item exists to serve the Marine in general (e.g., Personal Protective Equipment or individual weapons), operator costs should not be reflected in the estimate (with possible exceptions for specific end item maintenance, training, or qualification).

When considering total life cycle costs of a program, all manpower costs specifically associated with that program should be included regardless of funding source (refer above for details on Non-Program office funded costs). When comparing alternatives, manpower costs may be excluded when they do not vary

among the alternatives. In any case, how manpower is addressed should be clearly noted.

In accordance with DoD 7041.04, the cost analyst should report full costs of military and civilian manpower (i.e., not just salaries). Manpower cost estimates normally address costs to the DoD; however, in certain cases, analysts may be asked to report full manpower costs to the Federal Government. DoD 7041.04 addresses the business rules for each of these cases as well as contractor support. Additional detail for O&S specific manpower can also be found in the OSD Operating and Support Cost Estimating Guide.

#### **2.2.5 AMMUNITION.**

Ammunition can be broken down into several classifications, and care is required when costing. Ammunition required for testing, both destructive and performance, during system development is always included. War reserve ammunition and training ammunition are quite different and should have separate cost elements. In general, war reserve ammunition is only applicable to new munitions and is procured during the investment phase whereas training ammunition is included for all annual training and qualification requirements applicable to the system under investigation in the operations and support phase. In cases where the crew is dedicated to the system, tanks for example, the cost of small arms ammunition associated with rifle and pistol qualification is included in the other operations costs during the operations and support phase. O&S activities for ammunition itself are rather unique as the major issue is that a lot size must be created sufficient to be tested throughout the intended life cycle. Additionally, the production line has to be kept live sufficiently long enough to meet the operational service life needs of the ordnance that uses that ammunition.

#### **2.2.6 PHASE-OUT AND DISPOSAL COSTS.**

Disposal includes salvage values and disposal costs incurred during a phase-out period.

Disposal costs are considered a separate category of total

life-cycle cost. They typically represent only a small fraction of a system's total life-cycle cost. These costs are particularly important when systems requiring detoxification or long-term waste storage, such as the disposition of nuclear assets, solid-fuel propellants, and hazardous material. Where applicable, salvage values and disposal costs incurred during the phase-out period should be listed in a separate category of the estimate, labeled "Disposal."

### 2.2.7 LEARNING CURVES.

Learning curves, sometimes referred to as improvement curves or progress functions, are based on the concept that resources required to produce each additional unit decline as the total number of units produced increases. The learning curve concept is used primarily for uninterrupted manufacturing and assembly tasks with multiple units, which are highly repetitive and labor intensive. The cost estimator should be knowledgeable of the acquisition plan when preparing estimates and must exercise judgment to determine whether learning curve theory applies. If it does, appropriate consideration must be given to selection and application of proper learning rates for both man-hours and material dollars.

The theory states that each time the total quantity of units built doubles, the man-hours or recurring costs are reduced by a constant percentage. This may be expressed as unit theory or cumulative average theory. In any case, the application can be expressed as a mathematical function to a power and this function is linear on logarithmic scales. A common unit learning expression is  $y_x = ax^b$  where:

- $y_x$  is the man-hours or recurring costs of unit  $x$ ,
- $a$  is the man-hours or recurring costs of the first unit (also denoted as  $T_1$ )
- $x$  is the unit number
- $b$  is the logarithm (base 10 or natural) of the slope divided by the same logarithm type of 2.

### **2.2.8 COST DRIVERS/COST CARRIERS.**

The analyst should focus the majority of their cost estimating effort on those cost elements that are major drivers of the cost (defined as cost drivers) and/or those cost elements that contribute the most to the overall cost of the system (defined as cost carriers). Cost Carriers are easily identified by sorting the elements by cost which should then be provided to the PM for Should Cost Analysis. Key cost drivers should be identified to determine the cost impact of changes in performance characteristics, reliability, maintainability, and operating tempo. Each potential change should be tested independently.

Focusing on the cost drivers is especially important when conducting cost/benefit analyses such as Analysis of Alternatives (AoA) and Business Case Analysis (BCA). As many of these studies look at immature technology, a high fidelity cost estimate is not possible. Instead, the cost analysis should focus on the cost elements that will drive significant differences between the various alternatives.

### **2.2.9 TIME PHASING THE ESTIMATE.**

Time phasing an estimate is the act of spreading the estimate dollars based on program requirements by each fiscal year of the program. Often a model is developed that permits the modification of phase and major milestone dates linked to WBS and Cost Element Structure (CES) elements, permitting sensitivity analysis and "what-if" drills to be rapidly and efficiently conducted. The effect of time phasing is magnified by the inflation factors that convert the Base Year estimate into the then year values used to compare with PPBES preparation and execution documents (see Escalation and Inflation section below). This can be done using many techniques, including beta curves, Rayleigh curves, historical spreads, engineering judgment, and budget constraints.

*Note: The CES is the entire structure used for the cost estimate, which should be based on an official WBS and other authorized sources (e.g., OSD O&S Cost Estimating Guide)*

### 2.2.10 INFLATION.

All cost estimates should reflect the annual change in relative prices (inflation), the rate at which dollars are expended over time (outlays), and be expressed in both base year (BY) and then year (TY) dollars. This can be accurately accomplished by applying the appropriate inflation indices, using the Joint Inflation Calculator (JIC), published by NCCA at <https://www.ncca.navy.mil> and included in ACEIT. This tool is updated annually using The Office of the Under Secretary of Defense Comptroller's (OUSDC) "Inflation Guidance" in support of the PB for that year. Some of OUSDC's Inflation Guidance most commonly used indices and outlay rates are: procurement, research and development, construction, operations and maintenance, military personnel non-pay, fuel, and medical. These indices and outlay rates are used to calculate raw and weighted factors for each defense appropriation. Raw and weighted factors will be discussed in more detail later in this section.

Prior to any adjustment for inflation or outlays can occur, the analyst must select a BY for the cost estimate or analysis. The "OSD Inflation Handbook", defines the BY as "a specific year used as a benchmark in measuring financial or economic data." In other words the BY is the economic base for dollar amounts in an estimate and the starting point for the application of inflation factors. In addition to selecting a BY, the analyst must also determine which appropriation is funding the cost or WBS element (see Section 2.2.11). Once both the BY and appropriations are known, the analyst may begin applying the appropriate factors from the JIC to express the estimate in both BY dollars and TY dollars.

Constant year (CY) dollars are associated with a BY and reflects the dollar "purchasing power" for that year. Alternatively stated, CY dollars are BY dollars held "constant" for one or multiple years. BY and CY dollars are often used interchangeably. Raw factors, derived from the inflation indices are used to inflate or deflate dollars from one BY or CY to another (Table 2.0). TY dollars in addition to reflecting the "purchasing power" for a given year, take into account the way the DoD expends money. TY dollars are synonymous with budget and cur-

rent year dollars. All budget submissions should be expressed in TY dollars. Weighted factors, derived from both the inflation indices and outlay rates, are used to escalate or de-escalate from a BY or CY dollars to TY dollars (Table 2.0).

Raw Indices	Weighted Indices
BY or CY to BY or CY	BY to TY
	TY to BY

Table 2.0 Index Conversions

The following example illustrates the differences between BY, CY, and TY dollars. Assume for our example that a Program Office needs to budget/plan for the procurement of 10 laptop computers per year for FY2015 through 2019. In FY 2014, the Program Office used Procurement Marine Corps funds to purchase laptop computers at a unit price of \$658.00 in TY2014 \$. For our example, we will select FY2015 as our BY. Step 1 - Convert TY2014 \$658.00 to BY2014 dollars by using the PMC BY2014, FY2014 weighted factor. Step 2 - Convert BY2014\$ to BY2015\$ by using the PMC BY2015/FY2014 Raw factor. Step 3 - Express the total estimate in constant year 2015\$ by multiplying the BY2015\$ by the quantity for each year, 2015 through 2019. Step 4 - Express the estimate in TY\$ by multiplying the CY\$ for each FY by the respective BY2015/FY2015 - FY2019 weighted factors. See Table 2.1 below:

<b>Step 1 - Convert unit cost of TY2014\$ 658.00 to BY2014 dollars</b>					
<b>TY2014\$</b>	<b>BY14/FY14 Weighted factor</b>				<b>BY2014\$</b>
658.00	1.0306				638.48
<b>Step 2 - Convert unit cost BY2014\$ to BY2015\$</b>					
<b>BY2014\$</b>	<b>PMC BY2015/FY2014 Raw factor</b>				<b>BY2015\$</b>
638.48	0.98328				649.34
<b>Step 3 - Express the total estimate in BY2015\$ by multiplying the BY2015\$ unit cost by the quantity for each year, 2015 through 2019</b>					
	<b>FY2015</b>	<b>FY2016</b>	<b>FY2017</b>	<b>FY2018</b>	<b>FY2019</b>
Quantity	10	10	10	10	10
<b>BY2015\$</b>	<b>6,493.36</b>	<b>6,493.36</b>	<b>6,493.36</b>	<b>6,493.36</b>	<b>6,493.36</b>
<b>Step 4 - Express the estimate in TY\$ by multiplying the CY\$ for each FY by the respective BY2015/FY2015 - FY2019 weighted indices.</b>					
	<b>FY2015</b>	<b>FY2016</b>	<b>FY2017</b>	<b>FY2018</b>	<b>FY2019</b>
<b>BY2015 Weighted Factors</b>	1.0328	1.0533	1.0744	1.0959	1.1178
<b>TY\$</b>	<b>6,706.15</b>	<b>6,839.44</b>	<b>6,976.23</b>	<b>7,115.76</b>	<b>7,258.07</b>

Table 2.1 Conversion Example

### 2.2.11 APPROPRIATION CATEGORIES.

An appropriation category is a major type category within the DOD budget, and a major category to which a cost is allocated. Appropriations represent separate and distinct spending and are supported by separate budget submissions that provide varying levels of detail about planned procurements and expenditures. For LCCEs or similar cost analyses the major appropriation categories are: (1) Research, Development, Test and Evaluation, (RDT&E); (2) Procurement; (3) Operations and Maintenance (O&M); (4) Military Personnel (MILPERS); and, (5) Military Construction (MILCON). The most commonly used appropriations used in the Marine Corps are discussed below. There are a number of other appropriations other than what is listed below and more information can be found at the NCCA's website:  
<https://www.ncca.navy.mil/>

#### **2.2.11.1 Research, Development, Test and Evaluation, Navy (RDT&E,N)**

The Research, Development, Test, and Evaluation, Navy (RDT&E, N) appropriation funds Marine Corps managed RDT&E efforts and activities, some Marine Corps data systems, and selected joint tactical communications programs. RDT&E, N also funds development efforts for weapons, non-standard training, and other hardware systems, as well as electronic communications and data systems. RDT&E, N is a multi-year appropriation with funds available for obligation for two years. It includes both expense and investment costs incurred in performing R&D such as:

- Exploratory Development/Advanced Technology Demonstration (efforts directed to solving specific military problems),
- Advanced Development (development of hardware prototypes for experimental or operational testing),
- Engineering and Manufacturing Development (developmental projects engineered for military use but not approved for procurement),
- Operational System Product Improvement (enhancements to fielded systems),
- Management and Support of R&D Installations and Activities,
- Costs for labor, materials, and time that are expended in the research, design, engineering, prototyping, and testing of concepts, ideas, methods, software, and hardware, and
- Investment costs in required tooling, diagnostic and test equipment and facilities required for the development effort.

#### **2.2.11.2 Procurement Marine Corps (PMC).**

The Procurement Marine Corps (PMC) appropriation funds the purchase, delivery and modification of end items or items that are centrally managed for management or control and is a multi-year appropriation that has an obligation life of three years managed by a "full funding" concept. Procurement includes all costs related to the production of a usable end item of military hardware, such as the basic unit to be fabricated, installed Government Furnished Equipment (GFE), armament, hardware/software subsystems, production testing, non-standard training systems, and any project management costs appropriately funded with PMC. Production costs directly associated with

the end item and frequently reflected in the procurement line include contract or in-house costs for non-recurring engineering, recurring engineering, engineering support to production, tooling, manufacturing, purchased equipment, quality control, engineering changes, warranties, First Destination Transportation (FDT), general and administrative charges, and profit/fee. First Article Testing (FAT) is also included, as are non-production support costs such as training equipment, publications, technical data, and Contractor Technical Services (CTS).

#### **2.2.11.3 Operations and Maintenance, Marine Corps (O&MMC).**

Operations and Maintenance, Marine Corps (O&MMC) is an annual appropriation that funds primarily day-to-day support of the operating forces, equipment, installation operations/maintenance, facility maintenance, some civilian pay, travel, and second destination transportation. Additionally, O&MMC outlays are used for training and education, petroleum products and consumable supplies, recruiting and advertising, base operations/support/communications, supply depot and inventory control operations, and the purchase of minor equipment.

#### **2.2.11.4 Operations and Maintenance, Marine Corps Reserve (O&MMCR).**

Operations and Maintenance, Marine Corps Reserve (O&MMCR) is an annual appropriation that funds the operations and maintenance of the Marine Corps Reserve, to include training, organization and administration, repair of facilities and equipment, travel and transportation, some civilian pay, and the contracting of services, supplies, and minor equipment. Many O&MMCR costs are similar in nature to the costs associated with the O&MMC appropriation. However, costs associated with depot-level overhaul, Service Life Extension Program (SLEP)/Inspect and Repair Only as Necessary (IROAN), etc. of end items that had been fielded to the Selective Reserve are accounted for with O&MMC funds as the association of a particular end item with the Selective Reserve is severed upon induction.

#### **2.2.11.5 Other Procurement Navy (OPN).**

Other Procurement Navy (OPN) is a three year appropriation which includes Navy funding for procurement/modernization of equipment not funded by other appropriations.

#### **2.2.11.6 Military Construction Navy (MCN).**

Military Construction Navy (MCN) is a five year appropriation that funds the acquisition, construction, installation, and equipping of permanent and temporary public works, naval installations and facilities for the Navy and Marine Corps. MCN dollars are requested, justified, appropriated, and managed by project and for specific projects. MCN includes the acquisition of land and construction of ranges, demolition, built-in equipment, and supporting facilities. There are some minor projects that are O&M funded as the Maintenance of Real Property.

#### **2.2.11.7 Procurement of Ammunition, Navy and Marine Corps (PANMC).**

Procurement of Ammunition, Navy and Marine Corps provides funding for the construction, procurement, production, and modification of ammunition, and accessories thereof. This includes: specialized equipment and training devices; expansion of public and private plants, including ammunition facilities, authorized by section 2854 of title 10, United States Code, and the land necessary, for the foregoing purposes, and such lands and interests therein, may be acquired. Additional covered costs includes: any construction prosecuted prior to approval of title; the procurement and installation of equipment, appliances, and machine tools in public and private plants; reserve plant and Government and contractor-owned equipment layaway; and other expenses necessary for the foregoing purposes.

#### **2.2.12 GOVERNMENT FURNISHED EQUIPMENT/INFORMATION/MATERIAL/PROPERTY (GFE/I/M/P)**

Government Furnished Equipment (GFE) includes hardware/software that has been selected to be furnished by the government to a contractor or government activity (comparable government production/integration facility) for installation in, for use with, or in support of the system/equipment. GFE may be incorporated into or attached to an end item. It also may be consumed or expended in the performance of a contract. It includes, but is not limited to, raw and process materials, parts, components, assemblies, subassemblies, small tools and supplies.

Government Furnished Information (GFI) lists and describes data and information in the possession of, or acquired by, the government and made available to the contractor. For training development contracts, proponents will most commonly provide the contractor with GFI in the form of outputs from the in-house

performance of previous Systems Approach to Training (SAT) phases. For example, if a proponent decides to contract out the development of a training course, the proponent would provide the contractor with the analysis and design data as critical inputs to the development phase.

Government Furnished Material (GFM) is government material which may be incorporated into or attached to an end item to be delivered under a contract or which may be consumed in the performance of a contract. It includes, but is not limited to, raw and processed material, parts, components, assemblies, and small tools and supplies.

Government Furnished Property (GFP) is property (e.g., real and personal, including facilities, materiel, special tooling, special test equipment, and agency-peculiar property) in the possession of or directly acquired by the government and subsequently made available to the contractor. Types of GFP include facilities, utilities, equipment, and materials.

The fiscal year spread of GFE/I/M/P costs should be based on the system's delivery schedule. Occasionally, GFE/I/M/P may be delayed from the basic system's schedule if it is not needed for integration until later in the production process. Conversely, certain articles may be considered as Long Lead Items (LLI) to ensure that production of the system is not delayed.

### **2.2.13 SOFTWARE.**

Software (SW) continues to be a major cost driver in information, training, and weapon systems. Analysts should strive to create a defensible and auditable SW development estimate based on historical size and effort, and consequently schedules data from the current development, previous generations, and analogous programs. Simply entering source lines of code into a commercial off-the-shelf (COTS) product does not achieve this outcome.

For more information on SW Cost Estimation Techniques, the following sources are recommended:

- NCCA & AFCAA Software Development Cost Estimating Handbook Sept 2008 at <https://acc.dau.mil/adl/en-US/323892/file/46968/SW%20Cost%20Est%20Manual%20Vol%20I%20r>

[ev%2010.pdf](#)

- Software Development Cost Estimating Guidebook, Software Technology Support Center, 2010 at [http://www.stsc.hill.af.mil/consulting/sw\\_estimation/softwareguidebook2010.pdf](http://www.stsc.hill.af.mil/consulting/sw_estimation/softwareguidebook2010.pdf)

#### **2.2.14 ENGINEERING CHANGE PROPOSAL (ECP)/ MODIFICATION**

Per MCSC Acquisition Policy Letter 02-09, during the life-cycle of our weapons and information systems, it is often necessary to make changes to their configurations for various reasons. MCSC management procedures for making modifications to systems are based on whether the system to be modified is in development/production, or is out of production.

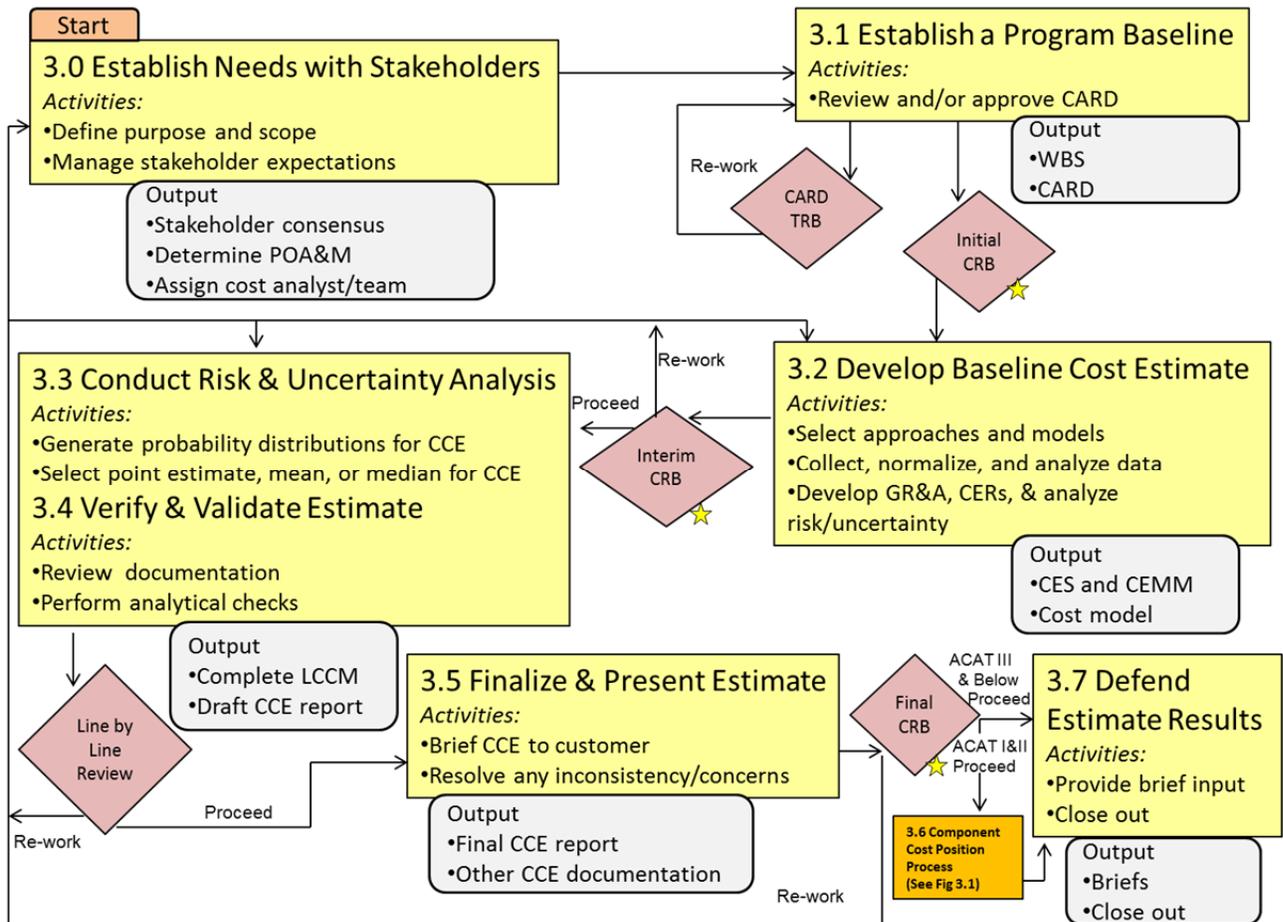
Systems in development or production are said to have an "active Acquisition Category (ACAT)"; that is, they have achieved less than 90% of total deliveries or expenditure or less than 90% of total program research and production costs. These costs should be captured in the LCCE and reflected in the APB.

Because MCSC manages the full life-cycle of weapons and IT systems, many modification efforts will be to out-of-production systems; that is, programs having achieved at least 90% of total deliveries and expenditure or at least 90% of total program research and production costs. These amendments have often referred to such modifications as Product Improvement Programs (PIPs), Engineering Change Proposals (ECPs), conversions, re-configurations, retrofits, refreshes, and various other terms. The Acquisition Policy Letter notes that all changes to out-of-production systems and items of equipment, including software changes and changes to information technology systems, are considered to be modifications.

Any modification that occurs out of production is likely to be designated as an Abbreviated Acquisition Program (AAP) at a minimum. Such post-fielding modifications will require a separate Cost Analysis Requirements Description (CARD) and LCCE per current SECNAVINSTs 5223.2 and 5000.2.

## CHAPTER 3 COST ESTIMATING PROCESS AT MCSC, C&AC

The C&AC adheres to the guidance within the Department of the Navy Cost Estimating Guide (DON CEG). This chapter is intended to follow a similar format while providing amplifying information regarding processes and practices within the C&AC at MCSC. The below graphic depicts C&AC cost estimation process, leveraging both the DON CEG and the Space and Naval Warfare Systems Command's (SPAWAR) 1.6 Cost Estimating Process (SPAWAR Instruction 7720.4). This process facilitates uniformity among cost estimates and ensures the cost estimate is defensible and executable.



★ Denotes potential NCCA participation in the review process (requires prior coordination/mutual agreement)

Figure 3.0 MCSC, C&AC Cost Estimating Process

This review process results in C&A approval of an estimate developed under the purview of the C&AC. This process consists of a series of reviews, where actions are taken to certify the sufficiency of the cost estimate. These reviews are described in greater detail throughout this chapter. Every LCCE (including updates) under the auspices of the C&AC will utilize this process. These reviews may be tailored dependent on Team Leader or C&AC Branch Head guidance, but all items within the reviews should be addressed. Reviews in addition to those described in Figure 3.0 are at the judgment of the cost analyst and/or team leader. Reviews can be initiated at any time prior to final delivery of the estimate. For those cost estimates which require liaison with NCCA or any other external agency (e.g., development of an ICE) there are steps in addition to the C&AC cost estimating process which require coordination and attention of the cost analyst. See Figure 3.1 for steps in developing Component Cost Position in conjunction with the C&AC cost estimating process.

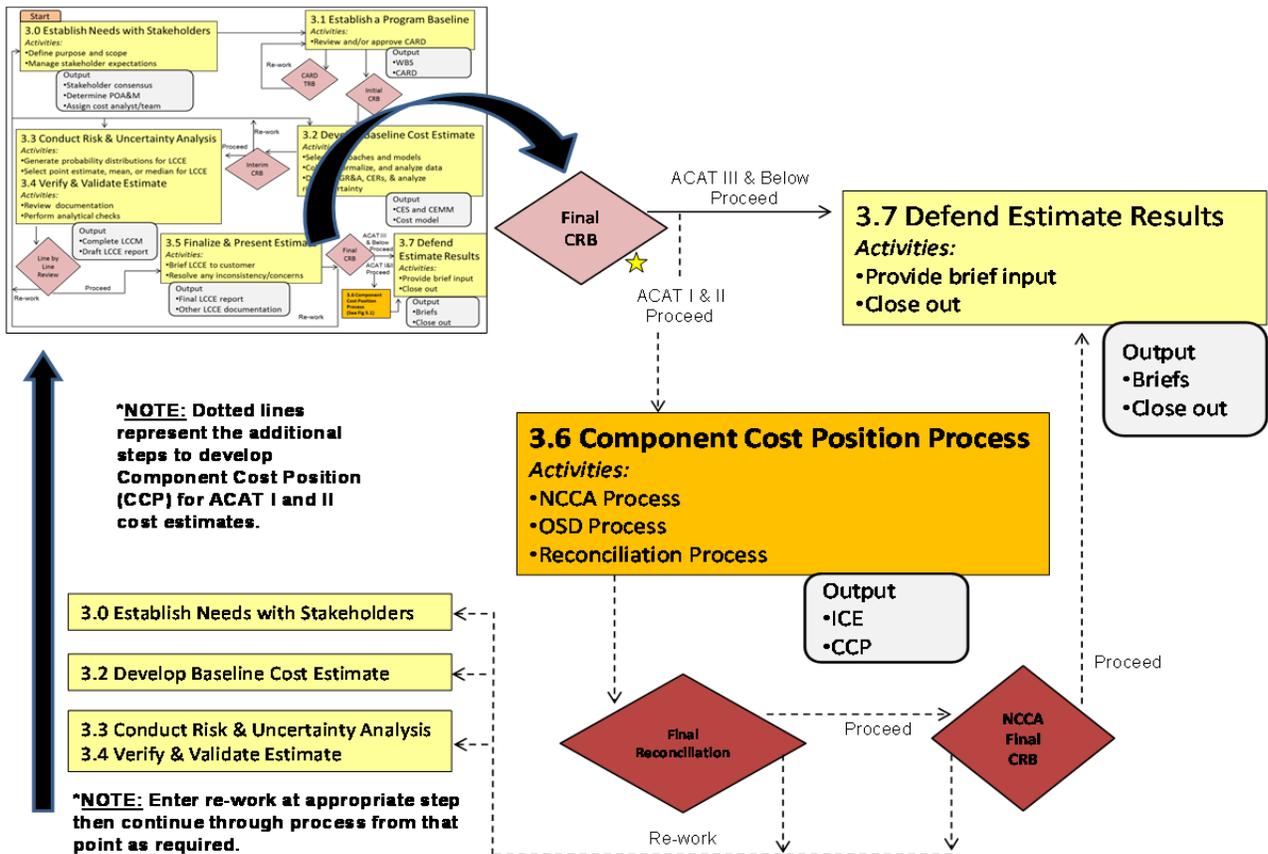


Figure 3.1 Component Cost Position Process

### **3.0 ESTABLISH NEEDS WITH STAKEHOLDERS.**

This first step identifies the purpose and scope of the cost support to determine resource requirements and supportability. Purposes can range from support of acquisition milestone reviews, gate reviews, program and budget formulation, analyses of alternatives, and special studies. The cost analyst/team must evaluate the request to determine the complexity, timeframe, and process steps that must be performed to develop the cost estimate. Defining the scope of the request will determine the degree of effort involved to formulate products that meet the needs of the customer(s).

If the decision is that a particular effort will be supported by the C&AC, the applicable cost team leader should consider current workload and work priorities and decide if internal or contracted resources are to be utilized in supporting the development of required deliverable(s). Defining and managing the expectations of stakeholders throughout the development of the cost estimate requires continuous communication with all stakeholders and customers of the products.

#### **3.0.1 DESCRIPTION/PURPOSE.**

It is important to identify the need for analysis and to determine the level of C&AC involvement. The need for cost analysis support can be identified through a variety of sources (program manager, C&AC analyst, AC PROG Assessments, etc.); however it is typically the program manager or project officer requesting support. The customer is usually looking for a LCCE to support programmatic decisions, but may also have broader ambition in terms of analytical support. It is important to meet with all stakeholders (program office, C&AC, etc.) and confirm the scope of the need, the decision to support, and the level of C&AC involvement. If it is determined during this meeting that C&AC does not need to be directly involved, that determination does not prohibit the customer from returning to C&AC at a later date if assistance is required.

It is useful at the beginning of the Sub-processes to determine

as much as possible what the final products will look like in paragraph 3.5 and anticipate what kinds of drills will likely be performed on the estimate. The structure of the estimate should be designed in such a way as to readily obtain cost subsets (Cost at desired CES levels, APUC, PAUC, Roll-away/Sail-Away/etc. cost, Budget Charts, PoPS Criteria, Selected Acquisition Reports (SAR) inputs, Contractor vs. Government splits, etc., Appropriation, etc.)

### **3.0.2 PRIMARY SUB-PROCESSES.**

The customer (program office representatives) meets with the appropriate C&A analyst/team to determine if C&A involvement is supportable or necessary. The participants in the meeting should consider all aspects of the program/initiative including the potential impact of the analysis on its execution. Key factors to consider include:

- ACAT level and MDA designation,
- Acquisition decision that cost analysis is to support,
- Program background and acquisition strategy,
- Available resources (personnel and funding),
- Available documentation (CARD, past LCCE, ICD, etc.),
- Program schedule (including key milestones),
- Type of analytical product(s) needed (LCCE, etc.),
- C&AC assessment and involvement,
- Other stakeholder involvement as appropriate,
- Policy requiring C&AC Support (i.e., SECNAVINST 5000.2, SECNAVINST 5223.2, etc.), and
- Schedule for deliverables (a typical cost estimate usually takes a minimum of 6-9 months to complete).

### **3.0.3 EXIT CRITERIA.**

If it is determined that particular cost support is to be undertaken by a C&AC team, the outcome of this step is an agreement between C&AC and stakeholders regarding the level of cost support and a plan of action and milestones (POA&M).

## **3.1 ESTABLISH A PROGRAM BASELINE.**

Understanding the program is key to the development of good estimates. This means understanding the program acquisition strategy, technical definition, characteristics, design features, technologies, and product support plan. The ideal place to start is a programmatic description of features pertinent to costing the system being developed, acquired, and sustained, all of which can be found in the CARD.

### **3.1.1 DESCRIPTION/PURPOSE.**

A CARD contains the most comprehensive set of data for use by the cost analyst. It defines and provides quantitative and qualitative descriptions of the program characteristics from which cost estimates will be derived. A well-constructed CARD helps reduce misunderstanding regarding program content by providing an official common reference of information. It is important that no estimated costs be included in the CARD so that it can be used as the common technical and programmatic baseline.

Analysts use CARDS to baseline life-cycle costs, including technical and programmatic risks/uncertainties. The cost analyst articulates potential cost growth due to changes in specification and development risk/uncertainty, among others, via sensitivity analyses and risk/uncertainty analyses. The CARD assists the analyst in identifying any area or issue that could have a major cost impact.

The Program Office is responsible for the development and preparation of the CARD, and its format and content are guided by DoDI 5000.73. SECNAVINST 5223.2 further tasks Program Managers with the following:

- Develop a CARD as a basis for estimating when a LCCE is required,
- Update the CARD annually,
- Obtain a review of the technical and programmatic requirements contained in the CARD from designated SYSCOM authorities before submitting the CARD to the appropriate cost organization,
- Obtain SYSCOM cost organization review and acceptance prior

to approval of the CARD.

### 3.1.2 PRIMARY SUB-PROCESSES.

This section describes the initial development of a CARD. The overall intent is to show program offices the rigor that should be involved in its creation and the reviews that should transpire leading to its approval. Table 3.0 describes the review and approval process of the CARD at MCSC/PEO(LS).

MCSC CARD Review and Approval Process				
MDA	USD (AT&L)	SECNAV or ASN (RDA)	COMMARSYSCOM or PEO (LS)	PMO
Acquisition Program	ID/IAM	IC/IAC/II	III/IV/AAP	III/IV/AAP
Submittor	PM	PM	PdM	PdM
Technical and Programmatic Review (minimum review by appropriate level engineer & logistician)	Competency Directors	Competency Directors	Competency Leads (e.g., APEOs or APMs)	Competency Leads (e.g., APEOs or APMs)
Cost & Analysis Review	Cost & Analysis Branch Head	Cost & Analysis Branch Head	Cost Team Leader	Cost Team Leader
Acceptance	Cost & Analysis Branch Head in coordination with OSD CAPE	Cost & Analysis Branch Head in coordination with NCCA	Cost & Analysis Branch Head	Cost & Analysis Branch Head
Approval	COMMARSYSCOM or PEO	COMMARSYSCOM or PEO	PM	PdM

Table 3.0 MCSC CARD Review & Approval Process

**Work Breakdown Structure (WBS).** Within the CARD a WBS is required and will be included for that particular system. MIL-STD-881 contains different WBSs for different commodities. In short, a WBS is an organized framework to break down a project into logical subdivisions or subprojects at lower levels of detail. It can be used as a PM tool that outlines the essential products that may be delivered to provide a suitable solution to a program need. The development and maintenance of a WBS is managed by a systems engineering process that designs a product-oriented family tree to organize, define, and graphically display all the work items or work packages to be done to accomplish the program's objectives. A well-structured WBS helps promote accountability by identifying work products that are independent of one another and those that have a parent child relationship. The WBS also serves as a valuable communication tool between systems engineering, PM, and other functional organizations because it presents a clear representation of what

needs to be accomplished and how the work will be done. For guidance on developing a program WBS, reference the most current version of the DOD MIL-STD-881.

**CARD Initial Draft**. When the CARD Initial Draft is complete and the Project Officer/Program team has reviewed the document it should be delivered to the C&A Cost Team/Analyst representing that particular program to review to ensure its proper format and content (using a comment resolution matrix (CRM) is a useful way to document the comments and track their progress). Once the CARD has been reviewed and comments from the program office have been incorporated, all parties involved should meet and discuss any comments. Depending on changes, additional revised drafts, meetings, and/or other reviews may be initiated. An IPR can be conducted as a status check (see Appendix C for brief template).

**Independent Technical Review (ITR)**. Once the CARD Draft has been updated and corrections incorporated, the CARD Final Draft is submitted to at least the product manager's engineer and logistician, as well as anyone else deemed necessary, for independent technical review (ITR). Depending on ACAT level, the CARD may need to go up to the Program Manager's or PEO's engineer and logistician vice the product manager's level. This ensures compliance with SECNAVINST 5223.2 in obtaining a review of technical and programmatic requirements from designated SYS-COM authorities. CARD signature page examples can be found in Appendix L.

Once complete with the ITR and comments incorporated, the CARD Final Draft is to be delivered to the C&A Cost Team/Analyst for review of the document. However, C&A prefers to review the CARD when it is an initial draft (to ensure format/content) and after the ITR when engineer and logistician comments have been vetted and incorporated. The CARD is updated by incorporating changes from the ITR and the C&A review.

**CARD Technical Review Board (TRB)**. A CARD Technical Review Board (TRB) should be held to formally accept and recommend approval of the CARD. The cost analyst should prepare a brief to other program stakeholders and C&AC representatives at a CARD TRB (refer to templates in Appendix C). The purposes of the CARD TRB are to ensure that the accuracy and completeness of the CARD are evaluated by all the appropriate stakeholders and the CARD is accepted by the C&A Branch Head or designated rep-

representative should attend the TRB (depending on the program's ACAT level).

### **3.1.3 EXIT CRITERIA.**

The end state is an accepted and approved CARD.

## **3.2 DEVELOP A BASELINE COST ESTIMATE.**

The CARD is the foundation for the formulation of the LCCE. As information is extracted from the CARD to develop the estimate, many items must be taken into consideration. To ensure consistency across the organization and provide documentation crosschecks, the Department of the Navy Independent Cost Assessment Manual (available on NCCA's web references <https://www.ncca.navy.mil/references.cfm>) provides a series of phased checklists that defines expectations for completed products. The C&AC SharePoint site provides several other valuable tools for analysts under the "Quickstart Guide". In order to develop a baseline cost estimate, an analyst should consider how the model will be developed, what Cost Element Structure (CES) will be needed, what ground rules and assumptions (GR&A) need to be made, what other information must be collected and analyzed, the cost estimating tools to be utilized, the creation of a Cost Element Methodology Matrix (CEMM), and the presenting and verification of initial findings through an Initial Cost Review Board (CRB). See Appendix F for an example of a CEMM.

### **3.2.1 DESCRIPTION/PURPOSE.**

In order to prepare for the Initial CRB and progress in developing the baseline cost estimate, the following iterative and often concurrent activities should be performed:

- Collect, validate, normalize, and analyze data for each cost element,
- Develop estimating approaches for each cost element,
- Develop cost estimating relationships (CERs) and assess risk/uncertainty for each cost element,
- Develop the model, and

- Run the model.

These activities are briefly discussed below. It is important to note that these activities must be continually refined throughout the development of the cost estimate. As each CRB or review is held, the Ground Rules and Assumptions (GR&A), methodologies, CERs, cost factors, etc. should be re-visited.

### **3.2.2 ENTRY CRITERIA.**

**Initial Cost Review Board (CRB).** Entrance to this step starts with conducting an Initial CRB. The C&AC analyst will coordinate the initial CRB, and attendees should include the cognizant cost team, program office team, and other appropriate stakeholders in order to review assumptions and methodologies for the estimate and model. At a minimum, the LCCE should be based on, a program baseline (e.g., draft CARD as determined by the Cost Team Leader). A brief should be prepared to facilitate and guide the initial CRB (refer to templates in Appendix D1).

### **3.2.3 PRIMARY SUB-PROCESSES.**

**Develop Estimating Approaches.** The first step starts with identifying the appropriate CES that should be selected and tailored to meet each programs' need and possible estimating methodologies for each element of the CES. Widely used references for CESs include MIL-STD-881 and the OSD Operating and Support Cost Estimating Guide. Appendix E displays the standardized CES format that is utilized at MCSC/PEO, C&AC. While each program may require some tailoring, Appendix E is a specific example of an Electronics system. The point is to emphasize a standardized format that can be utilized across all cost estimates at MCSC/PEO C&AC. CES elements may differ for each program as well as for each phase. However, each phase of the program's life cycle should be captured and evaluated. For each cost element, consider two or more estimating approaches which can be based on existing data, analogous studies, program office knowledge, and peer reviews. Summarizing these and other details in a CEMM (see template in Appendix F) is important as this becomes a record of various items presented in a logical flow throughout the development of the LCCE.

**Collect, Validate, Normalize, and Analyze Data.** Utilization of cost data is critical for quality analysis and defense of the estimate. The cost analyst/team should create a data collection plan. This plan should identify potential data sources, the actions required to capture cost and data; ensure all cost elements are covered; detail a schedule; and record/account for the refinement, validation, normalization, and further analysis of all data.

**Develop CERs and Analyze Risks/Uncertainty.** Many estimates use a combination of analogy, parametric and engineering build-up methodologies. There are many techniques to develop CERs (e.g., regression analysis, factors). The cost analyst should choose the appropriate techniques based on data availability and information as appropriate. Recording and explaining methodologies (e.g., CER rationale) is important in understanding the estimate. This should include data sources, equations and rationale. Analyzing risks and uncertainty is vital and should be done in conjunction with the development of the estimate (See section 3.3 - Conduct Risk/Uncertainty Analysis for further detail).

**Develop the Model.** The cost model must be developed in such a way that it meets requirements and customer needs. Therefore, the analyst/team must determine which modeling tool will best do so. The C&AC's standard tool to develop the cost model is the Automated Cost Estimating (ACE) tool (MS Excel may be utilized on a case-by-case basis with the approval of the C&A Branch Head prior to the model being developed). As the estimate's development progresses, the analyst must continuously verify and document information in the model, sources, and methodologies. This will ensure quality and allow other analysts to review and update the model as necessary.

**Run the Model.** Running (or calculating) the model to yield a baseline estimate, the point estimate (before executing risk and uncertainty analysis in the next step) is important in following the plan of action. These initial results will be refined for final delivery. This is also the likely point in

which an Interim CRB and model review is performed.

#### **3.2.4 EXIT CRITERIA.**

**Interim CRB & Life Cycle Cost Model (LCCM) Review.** At least one interim CRB including an LCCM review should be held at this point to evaluate estimate details. This review could include, but is not limited to, discussion on risk/uncertainty parameters/application, solicitation for additional information or guidance since the initial CRB, and discussion of challenges to the schedule or analysis. A brief should be prepared to facilitate the interim CRB (refer to templates in Appendix D2).

The end state to this step is to have progressed from executing the initial CRB to developing a model that culminates in an interim CRB including model review.

### **3.3 CONDUCT RISK/UNCERTAINTY ANALYSIS.**

The Government cost analysis community recognizes the need to capture the inherent uncertainty of acquisition programs into realistic cost estimates to support milestone decision processes. Programmatic, cost, schedule, and technical uncertainties are present from Material Solution Analysis through Operations and Sustainment. Many estimating processes have focused on producing a single, discrete dollar value that in turn becomes the budget. Realistically, estimating processes develop a range of likely values, with objective and quantifiable analysis of uncertainty intrinsically embedded. At MCSC, the standard tool for conducting risk and uncertainty analysis is the ACEIT suite. The ACEIT Joint Analysis of Cost and Schedule (JACS) add-in to Microsoft Project allows for risk-adjusted resourcing and scheduling as well. For more information on Uncertainty and Risk in cost estimating, refer to the Joint Cost Schedule Risk and Uncertainty Handbook at the following link: <https://www.ncca.navy.mil/tools/csruh/index.cfm>

#### **3.3.1 DESCRIPTION/PURPOSE.**

**The Requirement for Cost Risk and Uncertainty Analysis.**

Cost analysts work prodigiously to develop the best cost esti-

mate possible from the available information and within the parameters of the project's planned schedule. Subsequently, every assumption and variable driving the cost estimate represents only one point within a range of possible values. For this reason, a cost estimate of this type is called a "point estimate." Throughout data collection every attempt should be made to collect the entire range of possible values for use in uncertainty analysis.

### **The Difference Between Risk and Uncertainty.**

There is an important distinction between the terms risk and uncertainty, as stated in the GAO Cost Estimating and Assessment Guide.

- **Risk** is the probability of a loss or injury.
- **Uncertainty** is the indefiniteness about the outcome of a situation.

In a situation that includes favorable and unfavorable events, risk is the probability that an unfavorable event occurs. Uncertainty is defined in cost models for the purpose of estimating risk. In the context of a cost model, risk is the probability that a specific funding level will be exceeded.

### **3.3.2 ENTRY CRITERIA.**

An entrance criterion for this step is successful completion of an interim CRB. This is determined by the cost analyst/team once the briefing and LCCM have been reviewed and the way forward determined and/or updated.

### **3.3.3 PRIMARY SUB-PROCESSES.**

**Uncertainty to Be Captured.** Every program has many sources of uncertainty. The goal is to model the combined effect of all sources of uncertainty in order to assess the risk of exceeding a given budget. At a minimum, the model needs to capture the uncertainty of:

- All parametric CERs including factors and learning curve equations,

- All CER inputs, complexity factors for analogies, engineering judgment,
- Any other cost drivers (man-hours, head counts, rates, ratios, overhead, fee, etc.),
- The planned schedule (durations), and
- Applicable risk register events - both probability of occurrence and the consequence.

#### **Uncertainty That Could Be Captured.**

There are many other potential sources of cost estimate uncertainty. If defensible methods are available, the analyst should consider capturing the uncertainty of the following:

- Inflation,
- Acquisition strategies,
- Requirements creep,
- Significant change in the planned scope,
- Different contracting options/strategies,
- Congressional/Service actions (e.g., budget perturbations),
- Anything outside the project manager's control that will affect the project that can be modeled.

No standard, approved modeling methods are provided in this guidebook for determining these uncertainties. Inclusion of these uncertainties should be done with great care to reduce the likelihood of double counting or creating overly pessimistic assessments.

**Uncertainty That Should Not Be Captured.** Special consideration should be given to uncontrollable events that can impact the cost of a program. In most cases, these events should not be included in the uncertainty assessment. If at all, they could be the subject of a separate sensitivity analysis and discussion. Events such as natural disasters (e.g., hurricanes, earthquakes, etc.), industry collapses (e.g., bankruptcies, litigation, etc.), mission changing events (e.g. space shuttle disaster), and world events (e.g., September 11<sup>th</sup>) should generally be excluded from explicit uncertainty modeling.

#### **3.3.4 EXIT CRITERIA.**

The end state of this step is to have risk and uncertainty

analysis completed. This includes determining at what risk level the LCCE will be set at (e.g., mean, 50%, etc.). The determination is program-specific and based on the amount of risk the MDA is willing to accept. The resulting risk-adjusted LCCE will be used consistently in all program documents to include the APB, "Spruill chart", etc. This in turn helps prepare for verification and validation of the estimate via a thorough line-by-line review.

### **3.4 VERIFY AND VALIDATE THE COST ESTIMATE.**

With risk and uncertainty analysis completed, focus shifts to the development and delivery of the draft LCCE report as well as the preparation for a line-by-line review of the LCCM. Verifying and validating is the next step and involves quality control. Verification aids the estimate in regards to its credibility, accuracy, and its thorough documentation. Validation aids in ensuring that the estimate meets the C&AC and program office requirements. In short, verification focuses on quality and its compliance with DOD, DON, and USMC cost standards, while validation focuses on ensuring the proper estimate was completed for the parties involved.

#### **3.4.1 DESCRIPTION/PURPOSE.**

The draft LCCE report may have been in development prior to the incorporation of "risk and uncertainty"; however with those items completed, now a full draft report can be completed. The other focus in this step is the line-by-line review of the cost model. This review should be extensive and thorough; the analyst should perform a bottoms-up review of all cost elements and ensure all bases of estimates are logical and documented.

#### **3.4.2 ENTRY CRITERIA.**

The entrance to this step is the completion of risk and uncertainty analysis. The cost model at this point should be fully functional and thoroughly documented.

#### **3.4.3 PRIMARY SUB-PROCESSES.**

**Draft LCCE Report.** Once the draft LCCE report and associated LCCM have been fully developed and submitted, the responsible cost analyst must review the report and model thoroughly and annotate comments either in the documents themselves or through a CRM. Additionally, the report can be reviewed and comments

provided by the cost team leader and program stakeholders. The report should be based upon a CARD (if required) or similar documents and contain the necessary documentation from the cost model. The draft LCCE report should be delivered to stakeholders at least a week prior to the line-by-line review so its comments can be discussed and resolved by the parties involved and the report updated. A sample LCCE format is contained in Appendix B (this is the minimum criteria regarding what is to be included in the final LCCE report).

**Line-by-Line Review.** During this review, the cost analyst should explore and ensure that the data within the model is accurately analyzed and that it supports the GR&A and cost methodologies for each CES element. The analyst should ensure it encompasses four main areas:

- **Completeness:** Ensure the estimate covers all cost elements and that there is no double counting,
- **Accuracy:** Ensure that the cost model is mathematically correct,
- **Credibility:** Ensure that the estimate meets C&AC and program office requirements; that it utilizes sound principles and assumptions, that it meets all related DOD, DON, and USMC policies; and that it adequately assesses risk and uncertainty, and
- **Documentation:** Ensure that the estimate is completely documented in detail so that it could be replicated by another cost analyst unfamiliar with the program; and include: cost tables, data sources, basis of the estimate (e.g., formulas, etc.), methodology, and GR&A for both the point estimate and risk and uncertainty analysis.

The analyst also should evaluate the cumulative probability distributions as well as coefficient of variations (CVs) (defined as the mean divided by the standard deviation). Any significant variation in the probability distribution or unusually low or high CVs (in relation to DON standards also used in Probability of Program Success (PoPS) briefs) could indicate a flaw in the risk/uncertainty or estimating methodology and should be thoroughly explained and discussed. A detailed template on the line-by-line review is found in Appendix D3.

### 3.4.4 EXIT CRITERIA.

The exit criteria to this step are a successful completion of a Line-by-Line review of the cost model as well as a thorough review of the draft LCCE report and model. If there any issues, questions, or concerns identified during the Line-by-Line review, those items must be resolved prior to proceeding to the next step of finalizing and presenting the estimate.

### 3.5 FINALIZE AND PRESENT COST ESTIMATE.

The LCCE is not considered valid until the C&AB Head (or his designee) approves the report. It is important that the appropriate decision makers are briefed on how the LCCE was developed. A brief should be prepared with enough detail to show the estimate's completeness and quality. It should be easily understood for those unfamiliar with the estimate while being detailed enough to illustrate the major points to the estimate such as cost drivers. Table 3.1 describes the LCCE review and approval process at MCSC/PEO (LS).

MCSC LCCE Review and Approval Process				
MDA	USD (AT&L)	SECNAV or ASN (RDA)	COMMARCORSSYSCOM or PEO (LS)	PM
Acquisition Program Level	ID/IAM	IC/IAC/II	III/IV/AAP	III/IV/AAP
Submitter	Cost Analyst	Cost Analyst	Cost Analyst	Cost Analyst
Cost & Analysis Branch Re-	Cost Team Leader	Cost Team Leader	Cost Team Leader	Cost Team Leader
Endorsement	COMMARCORSSYSCOM or PEO (LS)	COMMARCORSSYSCOM or PEO (LS)	PM	PdM
Final Approval (designee as appropriate)	Cost & Analysis Branch Head in coordination with NCCA & OSD CAPE	Cost & Analysis Branch Head in coordination with NCCA	Cost & Analysis Branch Head	Cost & Analysis Branch Head

Table 3.1 MCSC LCCE Review & Approval Process

#### 3.5.1 DESCRIPTION/PURPOSE.

Steps in this process are to finish documentation within the report and model, then develop the final presentation(s). Documentation is important for re-enforcing the validity of the estimate and provides a basis for future changes to the program's estimate. Presenting the estimate through a final presentation or brief is vital in communicating the results of the LCCE to a variety of stakeholders. Briefs may need to be presented to

various stakeholders, and each brief will need to be tailored to its specific audience.

### **3.5.2 ENTRY CRITERIA.**

The entrance to this step is the successful completion of a line-by-line review of the cost model and review of the draft LCCE report. Any issues should have been resolved and preparation for the Final CRB has begun.

### **3.5.3 PRIMARY SUB-PROCESSES.**

**Final CRB.** The Final CRB is convened when all comments have been adjudicated and a briefing is prepared. At a minimum, the C&AB Head (or designee) will preside at the Final CRB and the cost analyst, cost team leader, and project officer will be present; however other program stakeholders are highly encouraged to attend such as the project officer and program manager. The composition of the Final CRB is dependent upon ACAT level and MDA of that program. The intent of the Final CRB is to gain the official approval of the cost estimate by the C&AB Head (or designee). The Final CRB should address the purpose and scope of the estimate/program review, estimate/program schedule, system description, ground rules & assumptions, estimating methodology summary, cost drivers, risk/uncertainty analysis, and additional items as determined by the C&AC analyst (see Appendix D4 for a detailed template on the Final CRB).

**Final LCCE Report.** Following the Final CRB, a final LCCE report should be completed and reviewed by the appropriate stakeholders to ensure there are no looming questions. The final LCCE report should be delivered to stakeholders at least a week prior to the Final CRB so any minor comments can be discussed and resolved by the parties involved. See Appendix B for details of the LCCE Report.

### **3.5.4 EXIT CRITERIA.**

The exit to this step is a successful completion of a Final CRB as well as a final approved LCCE report. If there are issues,

questions, or concerns at the Final CRB, those items must be resolved prior to finalizing the LCCE and soliciting signatures on the LCCE report. Since minor updates could occur while gaining signatures, an additional Final CRB will be at the recommendation of the cost team leader or C&AC Branch Head. It is permissible when refinements are administrative or minor in nature that those specific items are reviewed by the cost analyst and briefed to the appropriate stakeholders when complete without convening another CRB (i.e., considered Final CRB complete). You are ready to progress to the last step once the necessary Final CRB is complete and the LCCE report is signed and sent to the appropriate stakeholders.

### **3.6 COMPONENT COST POSITION.**

For more information, reference Section 5.1.

### **3.7 DEFEND COST ESTIMATE RESULTS.**

It is likely that the cost analyst will need to communicate and defend results of the LCCE through documentation and/or briefings. No matter the methods of media used, they need to convey the cost estimate's completeness and quality.

#### **3.7.1 DESCRIPTION/PURPOSE.**

Final steps are to communicate and defend the LCCE results as required to higher authorities such as MDA, other Services, or external agencies. The cost analyst should succinctly illustrate key points that support and communicate the results of the LCCE; this inherently aids in the defensibility of the estimate. It is good practice to document results that may be counter intuitive. Communicating results simply and clearly enables confidence in the appropriate methods and processes that were utilized in the estimate. As the concluding step, the cost analyst should take the necessary actions to close out the cost effort.

#### **3.7.2 ENTRY CRITERIA.**

The entrance to this step is the successful completion of the

Final CRB and a signed LCCE report. With the estimate completed, there will likely be a need for some supporting documentation and/or briefings in which the cost analyst input may be necessary to ensure the LCCE is properly portrayed and defended.

### **3.7.3 PRIMARY SUB-PROCESSES.**

**Defend results.** Once the Final CRB and LCCE report are successfully completed and approved the cost analyst should anticipate providing support at other echelons. This can be as simple as ensuring documents are correctly representative of the LCCE and is properly reflected in other documents such as an APB Section C, PoPS charts, MS decision presentations, etc. It may also include attendance in higher level meetings and briefings such as MS decisions. Whichever the case, the material used to convey the LCCE results must be appropriately reviewed to ensure its accuracy.

**Close out.** Project close out is important as the final step in performing a particular cost estimate and as part of the overall cost estimating process. Activities in this step include identifying lessons learned, documenting, and archiving the cost estimate.

All final documents should be placed under the appropriate section of the C&AC SharePoint site, while working files should be removed and stored as required by the team leader. Final documents can also be stored in NCCA's library as required. A debrief among team members (covering such topics as methodology, data problems, insights for future work, et. al.) is advisable so all may benefit from the experience gained from each cost estimate. Changes to procedures, models, and sources of information may be applicable to other estimates and throughout the C&AC.

### **3.7.4 EXIT CRITERIA.**

The exit to this step is the successful defense of the LCCE, if required, to a variety of decision makers through documentation and/or briefings. Additionally, it is important as stated above

to properly ensure the cost effort has been closed out as required by C&AC, team leader, and/or contract requirements.

## **CHAPTER 4 OTHER ANALYSIS**

### **4.0 OTHER ANALYSIS.**

Shown below are types of analysis (other than cost), that can be conducted by the C&AC. In many instances, when a prospective sponsor asks what type of analysis is needed, one or more of the types listed below can be recommended.

When applicable, the cost piece of the following analyses should follow as closely as possible to the process defined in the previous sections. It is realized, however, that the systems defined in the analyses may be less defined or there may be multiple alternatives. Understanding that, the process can be tailored to meet the cost, schedule, or purpose of the individual study.

#### **4.0.1 MAJOR AUTOMATED INFORMATION SYSTEM (MAIS) ECONOMIC ANALYSES (EA).**

An EA is a systematic approach to determining the most efficient and cost-effective method of allocating resources to satisfy a program based on the identified assumptions and constraints. An EA evaluates the relative worth of different technical alternatives, design solutions, and/or acquisition strategies. This evaluation provides the means for identifying and documenting the costs and associated benefits of each feasible alternative in order to determine the most cost effective solution.

An EA takes on a specific role for AIS programs. The Clinger Cohen Act, USC Title 40 requires that all AIS programs, regardless of ACAT level, conduct an EA that includes a calculation of the return on investment (ROI) (for non-AIS programs an LCCE instead is required per the Clinger Cohen Act). Clinger Cohen Act is required for all acquisition programs at MS A, MS B, MS C, or Full-Rate Production (or Full Deployment) Decision Review (DR) (or Equivalent)). An AIS EA contains both an LCCE and Benefit Analysis (BA). Falling under the responsibility of the PM, an AIS BA describes both quantitative and qualitative benefits of the alternatives. The BA determines the best AIS program acquisition preferred alternative available to the Government. The best alternative will generally be the one that meets critical mission requirements at the lowest cost and/or provides

the most advantageous Return On Investment (ROI). At a minimum, the AIS EA must compare both the costs and benefits of the Status Quo scenario with Preferred Alternative. The costs associated with the Preferred Alternative are the same as the LCCE for the program's milestone documentation requirements.

#### **4.0.2 BUSINESS CASE ANALYSIS.**

Within the C&AC, a specialized group of analysts are responsible for conducting cost vs benefit types of analysis. Their focus is on conducting the types of analysis that will provide decision makers with various alternatives along with the related cost and benefits of those alternatives to best support the types of decisions that need to be made. To assist in this process, Figure 4.0 displays a simple method that, per the initial questions posed, will result in the recommended type of analysis.

A Business Case Analysis (BCA) is a comparative analysis that helps decision makers to develop more informed decisions by identifying the risk versus reward for alternative courses of action. A BCA combines strategic analysis with quantitative and qualitative cost/benefit/risk/uncertainty analysis to identify alternatives and present business, economic, risk/uncertainty, and technical arguments for selecting an alternative to achieve organizational or functional missions or goals. The fundamental building blocks of a BCA include cost estimates and analyses (life cycle or otherwise), benefits analyses, sensitivity analysis, and risk/uncertainty analyses relating to each alternative under consideration.

A BCA is often prepared to support decisions other than a milestone acquisition decision, such as baseline change requests, sole-source justifications and support strategy determination. According to SECNAVISNT 5223.2, the C&AC is responsible for overseeing development and review of cost estimates in support of business case analyses. The C&AC analysts may also assist the PM/PdM with structuring, conducting and/or reviewing the BCA. C&AC participation adds cost and analysis expertise as well as a level of independence to the analysis. The Product Support BCA is a structured methodology and document that aids decision making by identifying and comparing alternatives by examining the mission and business impacts (both financial and non-financial), risks, and sensitivities of various sustainment strategies. Specific and elaborating guidance for responsible personnel, Product Support Managers (PSMs), can be found in the

current USD, ATL Directive-Type Memorandum 10-015 - Requirements for Life Cycle Management and Product Support, PSM Guidebook, and DOD Product Support BCA Guidebook.

#### **4.0.3 ANALYSIS OF ALTERNATIVES (AOA).**

As an important element of the defense acquisition process, an Analysis of Alternatives (AoA) evaluates the performance, operational effectiveness, operational suitability, and life-cycle costs of alternative programs to meet mission capability. The AoA is initially conducted during the Concept Refinement phase of the Defense Acquisition Framework to refine the system concept contained in the Initial Capabilities Document (ICD) or other source requirement documents approved at the Concept Decision. The AoA is required to be updated at subsequent milestones. AoAs illuminate the risk, uncertainty, and the relative advantages and disadvantages of the alternatives being considered; show the sensitivity of each alternative to possible changes in key assumptions; and aid decision makers in judging whether any of the proposed alternatives offer sufficient operational and/or economic benefit. The Materiel Development Decision (MDD) initiates the AoA to explore various conceptual approaches with the goal of identifying the most affordable and cost-effective option of meeting the Initial Capabilities Document (ICD).

The C&AC plays a variety of roles in the AoA process. Per SECNAVISNT 5223.2, the C&AC is responsible for overseeing the development and review of cost estimates in support of an AoA. The C&AC also supplies the Secretariat of the USMC AoA IPT. In addition, the C&AC can serve as the study lead or work with other organizations (such as Operations Analysis Division (OAD), Naval Government Laboratories, etc.) to assist with the AoA. The C&AC could also provide analysts to support any piece of the analysis from cost, alternatives, Operations Research assistance or any others.

A more detailed description of an AoA, as well as a general process for conducting one, can be found on DAU's website at [https://acc.dau.mil/ILC\\_AOA](https://acc.dau.mil/ILC_AOA). An AoA quick reference guide can be found in Appendix G. Below is the C&AC AoA/BCA support flowchart to aid in determining requirements and support.

1. Are you early in the Life Cycle Process (Pre MS A, Pre MDD) and looking to inform requirements (CDD)?
2. Are you looking for a formal analysis that will help provide buy-in for your program?
3. Are you looking to determine how to best support your existing program?
4. Are you looking how to best upgrade an existing program?
5. Are you looking at financial, business, or other reasons for determining between multiple decision options?
6. Do you require an independent assessment of your analysis?
7. Are you looking for a material decision to fill an existing gap?

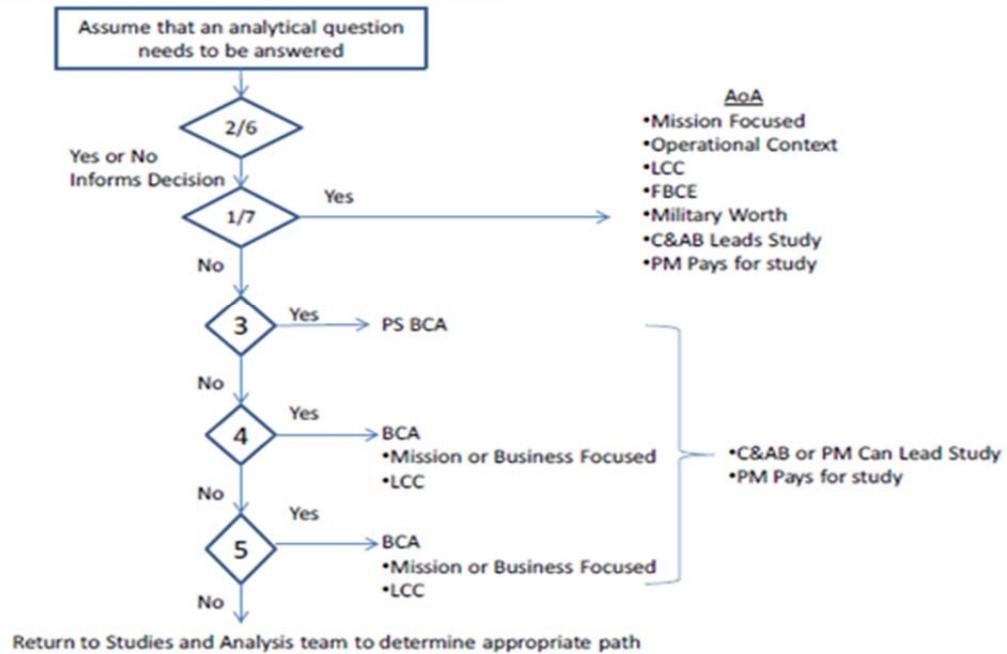


Figure 4.0 AoA/BCA Support Flowchart

\*FBCE = Fully Burdened Cost of Energy

#### 4.0.4 INTEGRATED PROGRAM MANAGEMENT (IPM).

Earned Value Management (EVM) is one of DoD's and industry's most powerful program planning and management tools. It is normally used in conjunction with cost plus and fixed-price incentive contracts. When "EVM" reporting is contractually required the contractor must submit an Integrated Program Management Report (IPMR)(DI-MGMT-81861), to report contract cost and schedule performance data. The term IPM is gradually replacing EVM and is used by MCSC and NAVAIR as it places the focus of the reporting on Program Management. In most cases the terms are interchangeable. Older documents use EVM, and more current publications are using IPM.

The purpose of IPM is to ensure sound planning and resourcing of all tasks required for contract performance. It promotes an environment where contract execution data is shared between project personnel and government oversight staff and in which emerging problems are identified, pinpointed, and acted upon as early as possible. IPM provides a disciplined, structured, objective, and quantitative method to integrate technical work scope, cost, and schedule objectives into a single cohesive contract baseline plan called a Performance Measurement Baseline (PMB) for tracking contract performance.

The PMB is a time-phased, resourced plan against which the accomplishment of authorized work is measured. The PMB is time phased in alignment with the Contract Integrated Master Schedule (C-IMS), with budget distributed in accordance with the contractor's accounting calendar for the authorized work scope including all control accounts and Summary Level Planning Packages (SLPPs). This is illustrated in Figure 4.1.

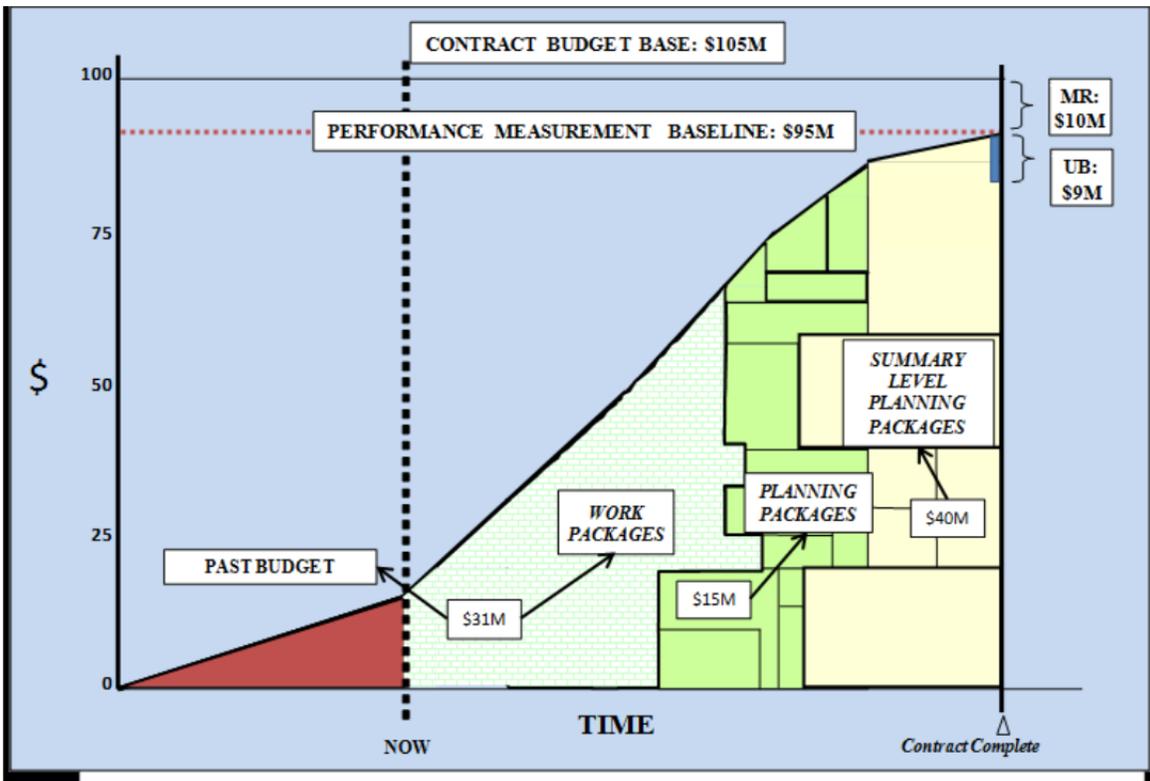


Figure 4.1: Example of PMB

IPM reporting requirements are determined by the criteria in DODI 5000.02, Table 8 "EVM Requirements". The MCSC Integrated Program Management Team (IPMT), under the C&AC, should be involved early in any programs which will have contracts with IPM reporting requirements. The team will assist with the writing of applicable CDRs and will also train the program offices in how to effectively use the performance data which will be generated by the contractor. An Integrated Baseline Review (IBR) is required within 180 calendar days of contract award or significant contract modification. The IPMT can also provide IBR training and will play a significant roll in the execution of the IBR.

Once IPM reporting is determined to be required, there are two primary skill sets that the IPMT will provide to Program Offices.

#### **4.0.4.1 EARNED VALUE ANALYSIS.**

The C&AC will provide Program Offices with Earned Value Analysis support where full IPM reporting is required. The EV Analyst focuses on Formats 1-5 of the IPMR and tracks cost performance of the contract. In cases where the IPMR has been tailored full time support may not be required, so the EV Analyst may also be supporting other programs. Likewise, as contracts mature usually a lower level of ongoing EV analysis is required. Regardless of the scope, the MCSC EV analyst shall remain involved with the program team until the contract has been closed out.

#### **4.0.4.2 SCHEDULE ANALYSIS.**

The C&AC will provide Program Offices with Schedule Analysis support when (almost) any level of IPM reporting is required. In cases where full IPM reporting is required, a C-IMS (Format 6) will always be one of the reports. In cases where the reports will be tailored, Format 6 should be a contract deliverable for all development, major modification and low rate initial production contracts. This is true even for Firm Fixed

Price contracts, where there is no utility in cost performance reporting and associated EV analysis. In all of these cases, a Schedule Analyst will be assigned to support the Program Office.

#### **4.0.4.3 SCHEDULING SUPPORT.**

In addition to Earned Value and Schedule Analysis support, the IPMT can also provide scheduling training to program offices, where there is a contractor IMS deliverable. This training supports the development of Integrated Government Schedules (i.e., a Government IMS), and significantly enhances the ability of the program office to stay in synch with the contractors that are building the required products. In some cases, scheduling support can also be provided.

Due to the current, limited size of the IPMT, priority is given to programs where IPM reporting and analysis is required. Other programs that required support are prioritized based on ACAT Level, location in the Acquisition Cycle, and level of schedule risk.

#### **4.0.5 INDEPENDENT GOVERNMENT COST ESTIMATES.**

An Independent Government Cost Estimate (IGCE) is required to substantiate all requests for contracting actions exceeding the simplified acquisition threshold (SAT), as specified in FAR 2.1. The IGCE establishes a realistic contract price for budget planning or other purposes. As outlined in Appendix A of the MCSC IGCE Guide, IGCEs should entail, at minimum, a review by the C&AC for all new non-commercial procurements with complex pricing arrangements, such as Cost Plus Fixed Fee (CPFF) or Cost Plus Incentive Fee (CPIF),<sup>2</sup> and anticipated values of more than \$5 million.

## **CHAPTER 5 EXTERNAL COORDINATION**

### **5.0 ANALYTICAL SERVICES.**

#### **5.0.1 C&A COMMUNITY ANALYSIS.**

When feasible, cost support will be performed internally by analysts within the C&AC. However, it is not always practical to execute cost support this way due to manning, priorities within the Command or Community, or timeline associated with the requested cost support. In those cases, sections 5.0.2 and 5.0.3 address other options to be pursued. Whichever option is chosen, there shall be direct involvement by C&AC analysts to ensure the proper rigor and the quality of products meets the requirements of the C&AC.

#### **5.0.2 GOVERNMENT LABORATORIES/FFRDC.**

Utilizing government laboratories provides an excellent opportunity to gain additional analysis expertise. The process to gain this expertise requires either direct interface with the individual laboratories or discussions with analysts who have an understanding of the capabilities of the individual labs. For the Naval Surface Warfare Centers (NSWC), a USMC interface at Dahlgren will find the proper expertise within the NSWCs. Similar assistance is available at the Space and Naval Warfare Systems Command (SPAWAR) and the Center for Naval Analysis (CNA), which is a Federally Funded Research and Development Center (FFRDC).

The process starts with the team lead or analyst contacting the various points of contact to provide a statement of work and negotiating deliverables and schedule, as well as the overall level of effort that will be required to conduct the work. This process should be conducted for multiple laboratories to promote competition and the ability to select the best capability at the best price.

When the analysis performer is selected, the negotiations should continue to ensure that specific deliverables, dates,

etc. are determined. The study director is now ready to begin the analysis.

### **5.0.3 CONTRACT SUPPORT.**

The C&AC has a contract vehicle in place for Operations Research and Systems Analysis (ORSA) capabilities. See your cost team leader for details.

## **5.1 COMPONENT COST POSITION (CCP).**

A Component Cost Position (CCP) is required for each Department of the Navy (DON) Acquisition Category (ACAT) ID, IC, IAM, IAC, and selected ACAT II programs. CCPs shall be established by NCAA (DASN C&E) for: all Milestone A, B, C, and full-rate production decisions; whenever an Acquisition Program Baseline (APB) is established or updated for the program; or when otherwise directed by OSD. CCPs shall be reviewed and updated for all non-Milestone acquisition Gate Reviews per appropriate streamlining from the process for Milestone-based CCPs.

### **5.1.1 DESCRIPTION/PURPOSE.**

Per the memorandum "DON Service Cost Positions" dated January 7, 2010, the Service Cost Position (now called Component Cost Position (CCP)) is the DON official life-cycle cost estimate of all resources and associated costs required to develop, produce, deploy, sustain, and dispose of a particular system. The CCP encompasses all past (or sunk), present, and future costs of the program regardless of appropriation or funding source. When OSD Cost Analysis and Program Evaluation (CAPE) is developing the ICE for ACAT ID and IAM programs, the CCP is presented by DASN (C&E) to OUSD (AT&L). In these cases, the CCP represents the reconciliation of the LCCE and NCCA's ICA. The CCP is then compared to the CAPE's ICE to support the milestone decision review and development of the approved budget.

The SYSCOM CARD and LCCE processes are designed such that they may overlap the CCP process. Initiation of the CCP process occurs typically 7 months prior to the acquisition milestone/gate review and includes a kickoff meeting. Delivery of the draft CARD may occur simultaneously or soon thereafter. Therefore,

after the MCSC LCCE is approved by the C&AB Head or designee, further coordination is required to arrive at the CCP. The reconciliation process will also likely overlap and extend some of the events in the C&A process.

#### **5.1.2 ENTRY CRITERIA.**

The entrance to this step is the approved MCSC LCCE.

#### **5.1.3 PRIMARY SUB-PROCESSES.**

For ACAT ID programs, the NCCA will participate in the SYSCOM review process and collaborate with the MCSC to independently assess the MCSC LCCE (i.e., perform an Independent Cost Assessment (ICA)). The schedule for the reviews will be established by mutual agreement between the MCSC and NCCA.

For ACAT IC and IAC programs, in addition to the MCSC LCCE, NCCA will develop an Independent Cost Estimate (ICE). The DON CRB reconciles the ICE and MCSC LCCE to establish a CCP. An initial DON CRB will be held with key stakeholders to present an overview of the program and review the technical and programmatic baseline as described in the CARD. Subsequently, CARD comments from all stakeholders will be adjudicated and the CARD will be finalized.

Further interaction between MCSC and NCCA will occur throughout the CCP development and reconciliation process.

At the Final DON CRB, MCSC will present their approved LCCE. NCCA in turn will present their independent assessment or ICE/CCA results. The Final CRB will review all presented information needed to establish the program CCP.

#### **5.1.4 EXIT CRITERIA.**

The output is the CCP, which is summarized in a memo signed by DASN C&E.

## **5.2 AFFORDABILITY ASSESSMENT.**

For more information, reference the current MAG.

## **5.3 ACQUISITION REPORTS.**

### **5.3.1 SELECTED ACQUISITION REPORT (SAR).**

In accordance with 10 U.S.C. 2432, the Secretary of Defense will submit a SAR to Congress for all MDAPs. The program manager will use the Defense Acquisition Management Information Retrieval (DAMIR) application to prepare the SAR. The SAR reports the status of total program cost, schedule, and performance, as well as program unit cost and unit cost breach information. Each SAR will include a full life-cycle cost analysis for the reporting program, each of its evolutionary increments, as available, and for its antecedent program, if applicable.

The SAR for the quarter ending December 31 is the annual SAR. The program manager will submit the annual SAR within 60 days after the President transmits the following fiscal year's budget to Congress. Annual SARs will reflect the President's Budget and supporting documentation. The annual SAR is mandatory for all ACAT I programs.

The program manager will submit quarterly exception SARs for the quarters ending March 31, June 30, and September 30 not later than 45 days after the quarter ends and will report the current estimate of the program for cost, schedule, and performance. Quarterly SARs are reported on an exception basis, as follows:

- The current estimate exceeds the Program Acquisition Unit Cost (PAUC) objective or the Average Procurement Unit Cost (APUC) objective of the currently approved APB in base-year dollars by 15 percent or more,
- The current estimate includes a 6-month or greater delay, for any schedule parameter, that occurred since the current estimate reported in the previous SAR,
- Milestone B or Milestone C approval occurs within the report-

able quarter.

### **5.3.2 MAJOR AUTOMATED INFORMATION SYSTEM (MAIS) ANNUAL REPORT (MAR).**

The Secretary of Defense is required to submit a MAR for all MAIS programs to Congress not later than 45 days after the President submits the budget, per Chapter 144A of title 10 United States Code. The MAR is a justification of cost, schedule, and performance for funds requested in the President's budget. Like the SAR, the MAR is prepared using the DAMIR tool.

In addition to the aforementioned annual report, the Program Manager is required to submit a written MAIS Quarterly Report (MQR) to a DoD Official, reporting any variance from the cost, schedule, and performance as baselined in the MAR. The Senior Official must review the Program Manager's quarterly report and determine whether a Significant or Critical Change has occurred. If a Significant Change has occurred, the Senior Official must notify Congress within 45 days after receiving the PM's report. If a Critical Change has occurred, the Senior Official must conduct an evaluation of the program and submit a report and certification to Congress within 60 days of receiving the PM's report.

A Significant Change occurs if: there is a delay in schedule of more than six months, but less than a year; an estimated program development cost or full life-cycle cost for the program has increased by at least 15 percent, but less than 25 percent; or a significant, adverse change in the expected performance exists. A Critical Change occurs if: there is a failure to achieve a full deployment decision within five years; a delay in schedule exists of one year or more; an estimated program development cost or total life-cycle cost of the program has increased by 25 percent or more; or, a change exists in the expected performance that will undermine the ability of the system to perform the functions anticipated in the original baseline.

### **5.3.3 DEFENSE ACQUISITION EXECUTIVE SUMMARY (DAES).**

The DAES information is designed to provide early-warning reporting to USD(AT&L). The information describes actual program problems, warns of potential program problems, and describes mitigating actions taken or planned. The program manager may obtain permission from USD(AT&L) to tailor DAES content. At a minimum, the DAES must report program assessments, unit costs (10 U.S.C. 2433), and current estimates of current APB parameters. It should also report the status of exit criteria and include a budget chart and a cost/KPP Performance/Tech Readiness/APB Unit cost quad chart.

DAES reporting must present total costs and quantities for all years as projected through the end of the acquisition of the program. In keeping with the concept of total program reporting, the DAES should present best estimates for costs beyond the FYDP, if the FYDP does not otherwise identify those costs. (Then total program concept refers to system acquisition activities from Program Initiation through Production and Deployment.)

The Office of USD(AT&L), the Offices of DOD Component Acquisition Executives (CAEs), Chief Information Officers (CIOs), Program Executive Officers, and the program office should each establish DAES focal points.

### **5.4 COST AND SOFTWARE DATA REPORTING (CSDR)/DEFENSE COST AND RESOURCE CENTER (DCARC).**

Cost and Software Data Reporting (CSDR) is the primary means by which the DOD collects data on the costs that contractors incur on major DOD programs. CSDRs provide the right visibility and consistency needed to develop credible cost estimates. CSDR reporting and processing requirements are determined by ACAT program category and the value of individual contracts and subcontracts within the program. Programs are classified according to estimated dollar values for RDT&E, production, annual acquisition and life-cycle costs.

There are two fundamental components of the CSDR system: Contractor Cost Data Reporting (CCDR) and Software Resources Data Reporting (SRDR). The first component, CCDR, is applicable to government stakeholders who develop data collection plans in the form of DD 2794 CSDR Plans that are applicable to firms engaged in the development and/or production of ACAT I/IA programs. The second component, the SRDR, is a contract data deliverable that formalizes the reporting of software metric data. It is designed to record both the expectations and actual results of new software development or upgrades. Regardless of contract type, this applies to all major contracts and subcontracts for contractors developing/producing software elements within ACAT I and IA programs and pre-MDAP and pre-MAIS programs subsequent to Milestone A approval for any software development element with a projected software effort greater than \$20M (then-year dollars).

The DCARC, formerly known as the Contractor Cost Data Report (CCDR) Project Office (CCDR-PO), was established in 1998 to assist in the re-engineering of the CCDR process. The DCARC is part of OSD CAPE organization within OSD. The primary roles of the DCARC is to collect current and historical MDAP and MAIS cost and software resource data in a joint service environment and make those data available for use by authorized government analysts to estimate the cost of ongoing and future government programs, particularly DOD weapon systems.

The CSDR process may be described as a series of events, each designed to bring the right documents to the right organizations at the right time in order to ensure that industry provides data to the DCARC that is consistent with their DCARC-approved CSDR plans. Although CSDR is required for some programs, it may be appropriate to negotiate the reports into the design, development, production, etc. contracts so that future cost estimates can use such data.

Additional information can be found at the DCARC website <http://dcarc.cape.osd.mil>.

## **5.5 PROGRAM OBJECTIVE MEMORANDUM (POM) PROCESS.**

For more information, reference the current MCSC Acquisition Guidebook (MAG).

## **5.6 LCCE COST OUTPUTS.**

### **5.6.1 ACQUISITION PROGRAM BASELINE (APB).**

The Acquisition Program Baseline (APB) is a statutory document for MDAP programs and a regulatory document for ACAT II, III, and IV programs for MS B/C and FRP DR or FDDR. An APB is prepared by a PM and submitted as a stand-alone part of the milestone documentation package. In defense systems acquisition the term "base-line" is defined as "a quantity or quality" used as a starting point for subsequent efforts and progress measurement. Baselines provide important and complementary impacts on controlling an acquisition program. An APB has three parameters - cost, schedule, and performance and in turn two components for each parameter - an objective and a threshold. Objective denotes the desired requirements and threshold denotes the minimum acceptable requirements. Objectives and thresholds are determined differently for cost, schedule, and performance. Regarding cost, objective values for each appropriation are dependent on what is reasonable for the program. The objective value is a risk adjusted point estimate as determined in 3.3.4. Traditionally, threshold values for each appropriation are 10% higher than the objective. However, the MDA is the final authority to set acquisition program thresholds.

Section C of the APB is directly linked to the program's LCCE and includes all appropriations to include MPMC, RMPC, MILCON, PANMC, etc., and should not be used to determine ACAT level. Sunk costs should be included in the APB section C to the extent that they are within the defined acquisition period (described below) for calculations of APUC and PAUC. These sunk costs should be captured from "program initiation" (normally MS B). Furthermore, program initiation should be defined within the Acquisition Decision Memorandum (ADM). Appendix H is a template for showing costs in the APB section C derived from guid-

ance from the Defense Acquisition Guidebook (DAG). Further information on the APB can be found in the DAG Chapter 3 (sections 3.1 and 3.7 for life cycle costs description), Chapter 10 (APB guidance), the MAG, and the current versions of DODI 5000.02 and SECNAVINST 5000.2.

To further aid in defining terms used within the APB and LCCE, there are standardized terms per DOD 5000.4-M: development cost; flyaway cost; weapon system cost; procurement cost; program acquisition cost; O&S cost; and life-cycle cost as depicted in Figure 5.0. This standardization of terminology provides a uniform and consistent frame of reference for identifying what is included or excluded from each cost term, and how each cost term relates to WBS elements, budget appropriations, and life-cycle cost categories. These terms also establish a basic definitional structure for understanding DOD acquisition program costs when used in fiscal guidance, POMs, Program Decision Memorandums, budget submissions, and Selected Acquisition Reports (SARS).

# Life Cycle Cost Composition

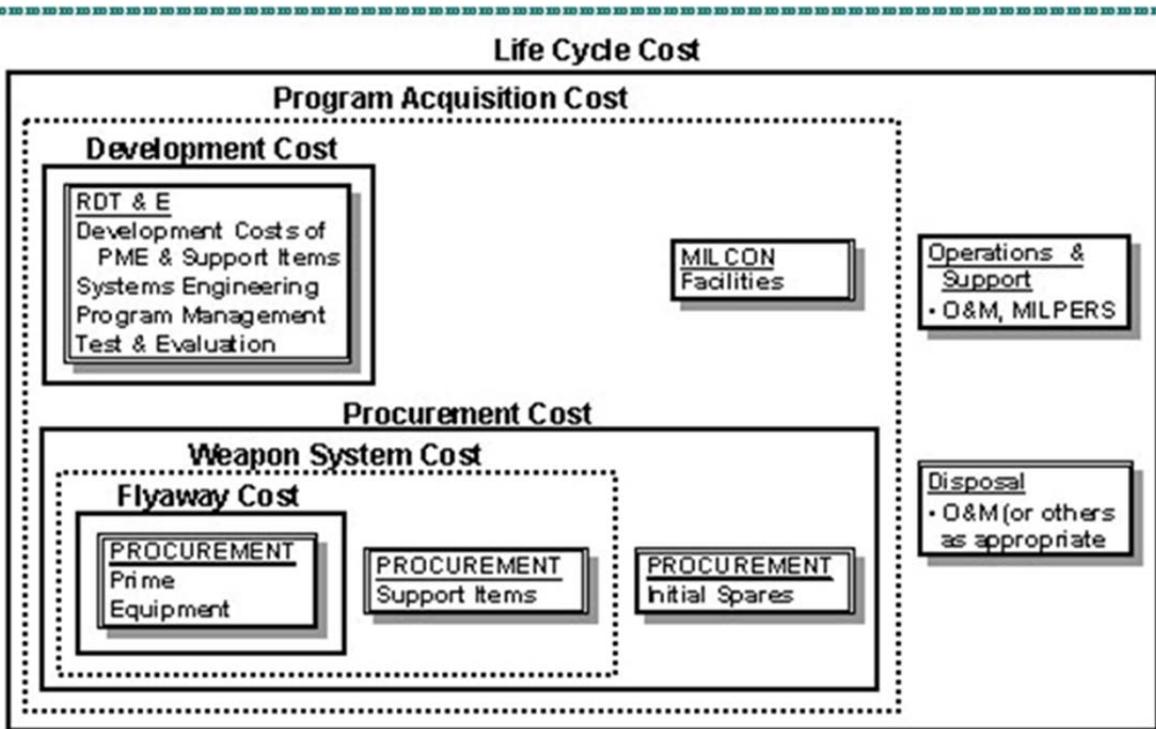


Figure 5.0 Life Cycle Cost Composition

**Development Cost.** Cost of all research and development-related activities, contract and in-house, necessary to design and test the system. It includes a number of WBS elements, including Prime Mission Equipment, Support Equipment, Training, etc. Prototypes and test articles are included in this cost category.

**Flyaway Cost (Rollaway, Sailaway, etc.).** Cost of procuring prime mission equipment (e.g., an aircraft, ship, tank, etc.). Figure 5.0 shows that this term includes the WBS elements of Prime Mission Equipment, System Engineering/PM, System Test and Evaluation, Warranties, Engineering Changes, etc.

**Weapon System Cost.** It is the procurement counterpart of Development Cost in that it contains the same WBS elements as Development Cost. Weapon System Cost consists of the Flyaway Cost plus procurement of support items.

**Procurement Cost.** It includes Weapon System Cost plus the procurement of initial spares.

**Program Acquisition Cost.** It consists of all costs associated with developing, procuring, and housing a weapon system. This is the complete cost of acquiring a weapon system - ready to operate.

**Operations and Support Costs.** This category includes all costs for personnel, equipment, and supplies associated with operating, modifying, maintaining, and supporting a weapon system in the DOD inventory. This includes all direct and indirect costs. These costs do not include any of the development costs, procurement costs or any other part of the program acquisition costs for the weapon system, nor do they include any disposal costs for the weapon system.

**Life-Cycle Cost.** As shown in Figure 5.0, it is the sum of Program Acquisition Cost, Operations and Support Cost, and Disposal Cost for a system.

### **5.6.2 C&A COMMUNITY LCCE - BUDGET COMPARISON CHART.**

A chart often required for a program's budget and planning is a budget comparison chart. These charts emphasize a program's budgetary controls for the prior and current budget years and FYDP in comparison to the program funded portions of the LCCE while also showing the LCCE as a whole. The current OSD template and instructions are at:

<https://ebiz.acq.osd.mil/DABSchedule/default.aspx>. Per SEC-NAVINST 5223.2, all acquisition programs will have a LCCE completed by the Systems Command (SYSCOM) in support of milestone reviews. For ACAT I programs, NCCA and the SYSCOM will collaborate on the NCCA Independent Cost Estimate (ICE) or NCCA Independent Cost Assessment (ICA) to develop a Component Cost Position (CCP). The CCP should be shown for those programs. For programs not requiring a CCP, use the SYSCOM cost organization LCCE for the "Required" numbers. Further guidance on populating this chart is in the MAG and Naval PoPS Guidebook.

### **5.6.3 CUMULATIVE DISTRIBUTION FUNCTION (CDF) (S CURVES).**

The Cumulative Distribution Function (CDF) is a mathematical, S-shaped curve derived from the risk/uncertainty analysis that, for any given value, identifies the probability that the observed value will be less than or equal to the given value (the term S-curve is used synonymously with CDF). The S-curve provides decision-makers with an estimate of the probability that a program's ultimate cost will be at or below some given value - current funding for example.

When generating the S-curve, the analyst should generate curves for each appropriation, but not include sunk cost. However, sunk cost must still be justified.

#### **5.6.3.1 Coefficient of Variation (CV).**

Modeling uncertainty is an iterative process that requires objective examination of the individual results in a unit-less and consistent manner. The CV of a distribution, defined as the ratio of the standard deviation to the mean, is a relative measure of dispersion because it expresses the standard deviation as a percentage of the mean. Higher values (i.e., CVs greater than 0.35) describe a wider dispersion and thus resulting in a flatter S-curve indicative of high-risk programs

and/or unusually broad distributions. Smaller values (i.e., CVs less than 0.15) describe very optimistic ranges or a lack of correlation resulting in the steeper S-curves indicative of programs with low to moderate risks/uncertainties. These rules-of-thumb, however, are commodity dependent and a function of where the program is in the acquisition life-cycle. The aforementioned values and other details are delineated in the Joint Cost Schedule Risk and Uncertainty Handbook at the following link: <https://www.ncca.navy.mil/tools/csruh/index.cfm>

Note: The Naval PoPS Guidebook further delineates appropriate CV ranges depending on where a program is in its life-cycle.

#### **5.6.4 ACAT LEVEL DETERMINATION SUPPORT.**

A member of the C&AC can provide guidance regarding calculation of weapon systems and IT systems in accordance with established ACAT criteria. APB Section C should not be used for ACAT level determination (See Appendix H).

## APPENDICES

### Appendix A Acquisition Information

#### Appendix A1 DoDI 5000.02 Criteria for ACAT/AAP Designation

Description and Decision Authority for ACAT I-IV / AAP Programs		
Acquisition Category (ACAT)	Reason for ACAT/AAP Designation	Decision Authority
ACAT I	<ul style="list-style-type: none"> <li>MDAP (10 U.S.C. 2430 (Reference (n)))                             <ul style="list-style-type: none"> <li>Dollar value for all increments of the program: estimated by the DAE to require an eventual total expenditure for research, development, and test and evaluation (RDT&amp;E) of more than \$480 million in Fiscal Year (FY) 2014 constant dollars or, for procurement, of more than \$2.79 billion in FY 2014 constant dollars</li> <li>MDA designation</li> <li>MDA designation as special interest<sup>1</sup></li> </ul> </li> </ul>	ACAT ID: DAE or as delegated ACAT IC: Head of the DoD Component or, if delegated, the CAE (not further delegable)
ACAT IA <sup>2,3</sup>	<ul style="list-style-type: none"> <li>MAIS (10 U.S.C. 2445a (Reference(n))): A DoD acquisition program for an Automated Information System<sup>4</sup> (AIS) (either as a product or a service<sup>5</sup>) that is either:                             <ul style="list-style-type: none"> <li>Designated by the MDA as a MAIS program; or</li> <li>Estimated to exceed:                                     <ul style="list-style-type: none"> <li>\$40 million in FY 2014 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, and deployment, and incurred in any single fiscal year; or</li> <li>\$165 million in FY 2014 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, and deployment, and incurred from the beginning of the Materiel Solution Analysis Phase through deployment at all sites; or</li> <li>\$520 million in FY 2014 constant dollars for all expenditures, for all increments, regardless of the appropriation or fund source, directly related to the AIS definition, design, development, deployment, operations and maintenance, and incurred from the beginning of the Materiel Solution Analysis Phase through sustainment for the estimated useful life of the system.</li> </ul> </li> <li>MDA designation as special interest<sup>1</sup></li> </ul> </li> </ul>	ACAT IAM: DAE or as delegated ACAT IAC: Head of the DoD Component or, if delegated, the CAE (not further delegable)
ACAT II	<ul style="list-style-type: none"> <li>Does not meet criteria for ACAT I or IA</li> <li>Major system (10 U.S.C. 2302d (Reference (n)))                             <ul style="list-style-type: none"> <li>Dollar value: estimated by the DoD Component Head to require an eventual total expenditure for RDT&amp;E of more than \$185 million in FY 2014 constant dollars, or for procurement of more than \$835 million in FY 2014 constant dollars</li> <li>MDA designation<sup>5</sup> (10 U.S.C. 2302 (Reference (n)))</li> </ul> </li> </ul>	CAE or the individual designated by the CAE <sup>6</sup>
ACAT III	<ul style="list-style-type: none"> <li>Does not meet criteria for ACAT II or above</li> <li>An AIS program that is not a MAIS program</li> </ul>	Designated by the CAE <sup>6</sup>
ACAT IV T	<ul style="list-style-type: none"> <li>Does not meet the criteria for ACAT III or above</li> <li>Requires operational test and evaluation</li> <li>Weapon system programs:                             <ul style="list-style-type: none"> <li>RDT&amp;E total expenditure ≤ \$140 million in FY 2014 constant dollars, or</li> <li>Procurement total expenditure ≤ \$660 million in FY 2014 constant dollars</li> </ul> </li> <li>IT system programs:                             <ul style="list-style-type: none"> <li>Program costs/year &lt; \$15 million, or</li> <li>Total program costs &lt; \$30 million, or</li> <li>Total life-cycle costs ≤ \$378 million in FY 2014 constant dollars</li> </ul> </li> </ul>	Cognizant PEO, SYSCOM commander, DRPM, or designated flag officer, SES official, or PM. ASN (RD&A), or designee, for programs not assigned to a PEO, SYSCOM, or DRPM.
ACAT IV M	<ul style="list-style-type: none"> <li>Does not meet the criteria for ACAT III or above</li> <li>Does not require operational test and evaluation as concurred with by OTA</li> <li>Weapon system programs:                             <ul style="list-style-type: none"> <li>RDT&amp;E total expenditure ≥ \$10 million ≤ \$140 million in FY 2014 constant dollars, or</li> <li>Procurement expenditure ≥ \$25 million/year, ≥ \$50 million total ≤ \$660 million total in FY 2014 constant dollars</li> <li>Not applicable to IT system programs</li> </ul> </li> </ul>	Cognizant PEO, SYSCOM commander, DRPM, or designated flag officer, SES official, or PM. ASN (RD&A), or designee, for programs not assigned to a PEO, SYSCOM, or DRPM.
AAP	<ul style="list-style-type: none"> <li>Does not meet the criteria for ACAT IV or above</li> <li>Does not require operational test and evaluation as concurred with in writing by OTA</li> <li>Weapon system programs:                             <ul style="list-style-type: none"> <li>Development total expenditure &lt; \$10 million, and</li> <li>Production or services expenditure &lt; \$25 million/year, &lt; \$50 million total</li> </ul> </li> <li>IT system programs:                             <ul style="list-style-type: none"> <li>Program costs/year &lt; \$15 million, and</li> <li>Total program costs &lt; \$30 million</li> </ul> </li> </ul>	Cognizant PEO, SYSCOM commander, DRPM, or designated flag officer, SES official, or PM. ASN (RD&A), or designee, for programs not assigned to a PEO, SYSCOM, or DRPM.

1. The Special Interest designation is typically based on one or more of the following factors: technological complexity; congressional interest; a large commitment of resources; or the program is critical to the achievement of a capability or set of capabilities, part of a system of systems, or a joint program. Programs that already meet the MDAP and MAIS thresholds cannot be designated as Special Interest.

2. When a MAIS program also meets the definition of an MDAP, the DAE will be the MDA unless delegated to a DoD Component or other official. The DAE will designate the program as either a MAIS or an MDAP, and the Program Manager will manage the program consistent with the designation.
3. The MDA (either the DAE or, if delegated, the DoD Chief Information Officer (CIO) or another designee) will designate MAIS programs as ACAT IAM or ACAT IAC. MAIS programs will not be designated as ACAT II.
4. AIS: A system of computer hardware, computer software, data or telecommunications that performs functions such as collecting, processing, storing, transmitting, and displaying information. Excluded are computer resources, both hardware and software, that are an integral part of a weapon or weapon system; used for highly sensitive classified programs (as determined by the Secretary of Defense); used for other highly sensitive information technology (IT) programs (as determined by the DoD CIO); or determined by the DAE or designee to be better overseen as a non-AIS program (e.g., a program with a low ratio of RDT&E funding to total program acquisition costs or that requires significant hardware development).
5. Acquisitions of services that satisfy or are expected to satisfy the definition of a MAIS in 10 U.S.C. 2445c, Reference (n), will comply with this instruction. All other acquisitions of services will comply with Enclosure 9 of DoD Instruction 5000.02 (Reference (b)).
6. As delegated by the Secretary of Defense or Secretary of the Military Department.

Appendix A2 DODI 5000.02 & SECNAVINST 5000.2 Statutory/Regulatory

Cost Related Excerpts

Statutory Information

Directive	Information Required	When Required / Applicability	ACAT	Prepared By	Approved By
FROM DOD 5000.02	Analysis of Alternatives (AoA)	MS A / MS B (updated as necessary) / MS C (updated as necessary)	All		
	Acquisition Program Baseline (APB)	MS B / MS C (updated, as necessary) / Full-Rate Production DR (or Full Deployment DR)	MDAP & MAIS		
	Economic Analysis	MS A (may be combined with AoA) / MS B (or equivalent) / Full Deployment DR (or equivalent)	MAIS		
FROM SECNAVINST 5000.2E	Analysis of Alternatives (AoA)	MS A / MS B (update as necessary) / MS C (update as necessary) / Full Deployment DR (for AIS)	All	Indep Activity Analysis Director	CAE/CNO/CMC (ID/IAM)
	Acquisition Program Baseline (APB)	MS B (update as necessary) / MS C (update as necessary) / Full-Rate Production DR (or Full Deployment DR)	I	PM	MDA
	Economic Analysis	MS A (may be combined with AoA) / MS B (or equivalent) / Full Deployment DR (or equivalent)	IA	SYSCOM Cost Director	PM

Regulatory Information

Directive	Information Required	When Required / Applicability	ACAT	Prepared By	Approved By
FROM DOD 5000.02	Affordability Analysis	MS B / MS C	All		
	Analysis of Alternatives (AoA)	MS A / MS B (updated as necessary) / MS C (updated as necessary) / Full Deployment DR (for AIS)	All		
	AoA Study Guidance	Materiel Development Decision (updated as necessary)	All		
	AoA Study Plan	Immediately following the Materiel Development	All		
	Acquisition Program Baseline (APB)	Decision consistent with MDA Direction (updated as APB MS B / MS C (updated, as necessary) / Full-Rate			
	Cost Analysis Requirements Description (CARD)	Production DR (or Full Deployment DR) For MDAPs: MS B / MS C / Full-Rate Production DR For MAISs: Any time an Economic Analysis is required (by statute or MDA)	MDAP & MAIS		
FROM SECNAVINST 5000.2E	Affordability Analysis	MS B / MS C	All	CNO/CMC	CNO/CMC
	Analysis of Alternatives (AoA)	MS A / MS B (updated as necessary) / MS C (updated as necessary)	I, II, III, IV (non-IT & non-NSS)	Indep Activity Analysis Director	CAE/CNO/CMC (ID) MDA/CNO/CMC (IC/II/III/IV)
	AoA Study Guidance	Materiel Development Decision (updated as necessary)	All	APE (ID/IAM) CNO/CMC (IC/IAC/II/III/IV)	CAPE (ID/IAM) MDA/CNO/CMC (IC/IAC/II/III/IV)
	AoA Study Plan	Immediately following the Materiel Development Decision consistent with MDA Direction (updated as necessary)	All	Indep Activity Analysis Director	CAPE (ID/IAM) MDA/CNO/CMC (IC/IAC/II/III/IV)
	Acquisition Program Baseline (APB)	MS B / MS C / Full-Rate Production DR (or Full Deployment DR)	IA, II, III, IV	MDA Staff	MDA
	CARD,	For MDAPs: MS A / MS B / MS C / FRP DR For MAISs: MS A / MS B / Full Deployment DR (required when an EA is required) *(CARD shall be prepared by PM whenever an LCCE is required, and updated annually.) **(Note: The CARD is reviewed and accepted by the MCSC cost director for all ACAT programs)	All	PM	SYSCOM Cost Director
Program Life-Cycle Cost Estimates ("Program Life Cycle Estimates" and "Program Office Estimates" are synonymous)	MS A / MS B / MS C / FRP DR (Full Deployment DR)	All	SYSCOM Cost Director	SYSCOM Cost Director	
Service Cost Position ("Service Cost Position" and "Component Cost Position" are synonymous)	MS A / MS B / MS C / FRP DR (Full Deployment DR)	I/IA, select II	NCCA/ PM/ SYSCOM Cost Director	DASN (C&E)	

Appendix B LCCE Report Format



**NAME OF PROGRAM**  
**LIFE CYCLE COST ESTIMATE**

**For**

**Decision Event**

**Month Year**

**MARINE CORPS SYSTEMS COMMAND**

**QUANTICO, VA 22134**

Distribution authorized to U.S. Government Agencies only. Other requests for this document shall be referred to Cost and Analysis Branch, Marine Corps Systems Command.

**“THIS IS A SAMPLE FORMAT FOR AN LCCE REPORT AND THOSE ITEMS WITHIN SHOULD BE ADDRESSED (IT IS NOT ALL INCLUSIVE, EVERY ITEM IS NOT LISTED AND MORE CAN BE INCLUDED)”**

LIFE CYCLE COST ESTIMATE

Coordination/Approval

**(This page changes dependent on ACAT level. For guidance, see the Cost Study Director)**

**Submitted by:**

_____	_____
NAME (Signer's name in all capital letters)	Date
Cost & Analysis Study Director or Program Executive Officer Lead Analyst	

**Reviewed by:**

_____	_____
NAME	Date
Cost & Analysis Team Leader	

**Endorsed by:**

_____	_____
NAME	Date
Program Manager XXXXXX	

**Approved by:**

_____	_____
NAME	Date
Cost & Analysis Branch Head	

**“This Table of Contents example will differ as the Cost Element Structure (CES) for the program changes; it will contain at a minimum Executive Summary, these 6 sections, A-E appendices, list of tables/figures.”**

## **Appendix B LCCE Report Format**

<b>EXECUTIVE SUMMARY</b>	<b>XX</b>
<b>INTRODUCTION</b>	<b>XX</b>
1.1    PURPOSE AND SCOPE	<b>XX</b>
1.2    ESTIMATING TEAM	<b>XX</b>
1.3    BACKGROUND	<b>XX</b>
1.4    SYSTEM DESCRIPTION GROUND RULES AND ASSUMPTIONS	<b>XX</b>
1.5    GROUND RULES	<b>XX</b>
1.5.2    ASSUMPTIONS	<b>XX</b>
<b>ESTIMATING METHOD AND DATA BY WBS/COST ELEMENT</b>	<b>XX</b>
<b>(BODY)</b>	<b>XX</b>
2.1    WBS/COST ELEMENT NAME	<b>XX</b>
2.1.1    WBS DEFINITION	<b>XX</b>
2.1.2    RESULTS	<b>XX</b>
2.1.3    ASSUMPTIONS	<b>XX</b>
2.1.4    ESTIMATES METHODOLOGY	<b>XX</b>
2.1.6    PHASING METHODOLOGY	<b>XX</b>
INFLATION	<b>XX</b>
<b>RISK AND UNCERTAINTY ANALYSIS</b>	<b>XX</b>
3.1    RISK OUTPUTS	<b>XX</b>
<b>COMPARISONS TO PREVIOUS ESTIMATES</b>	<b>XX</b>
<b>EXCURSIONS</b>	<b>XX</b>
<b>SUMMARY</b>	<b>XX</b>
<b>APPENDIX B ACRONYMS</b>	<b>XX</b>
<b>APPENDIX B APB SECTION C INPUTS</b>	<b>XX</b>

## EXECUTIVE SUMMARY

The executive summary should be a narrative format summarizing the important results and conclusions from the estimate. The summary should include a top level then-year (TY) dollar cost risk and uncertainty adjusted point estimate by year by appropriation in one table.

**Table ES - 1: LCCE Summary by Risk Adjusted Appropriation without Sunk Costs**

Appropriation	BY11 \$K		TY \$K	
	LCCE w/ Sunk	LCCE w/o Sunk	LCCE w/ Sunk	LCCE w/o Sunk
RDT&EN				
PMC				
MPMC				
OMMC				
<b>Total</b>				

**Table ES - 2: LCCE by Risk Adjusted Appropriation with Sunk Costs (TY \$K)**

Appropriation	Total	Prior	2011	2012	2013	2014	2015	2016	2017	To Comp
<b>Total</b>										
RDT&EN										
PMC										
MPMC										
OMMC										

## INTRODUCTION

### 1.1 PURPOSE AND SCOPE

The intended use determines the purpose of a cost estimate, and its purpose determines its scope and detail. This section of the documentation should provide the intended use, purpose, scope, and level of detail.

## **1.2 ESTIMATING TEAM**

Provide the name, title, organization, and contract information if applicable in this section. Do not include any personally identifiable information (PII).

## **1.3 BACKGROUND**

The background section should provide the reader with a good overview of what has happened with the program as it has evolved over time prior to the estimate. The background should discuss previous milestone and/or gate reviews, their associated estimates, and what occurred in those reviews. A good background will give the reader a better understanding of what has occurred in the program and why.

## **1.4 SYSTEM DESCRIPTION**

The System Description includes the program's acquisition plan and technical description, including contract type, major subsystems, performance parameters, and support requirements. Reference excerpts from key program documents that underlie estimate inputs, such as the Acquisition Strategy and Cost Analysis Requirements Description (CARD) or "CARD-like" document.

## **1.5 GROUND RULES AND ASSUMPTIONS**

Although often grouped together, there is a subtle difference between ground rules and assumptions. In this section of the documentation, these ground rules and assumptions should be for the overall estimate and general in nature. More specific ground rules assumptions should be included in the appropriate WBS section.

### **1.5.1 GROUND RULES**

Ground rules consist of a given set of instructions (e.g., "OSD inflation as of 30 January 2011 will be used."). The program's Work Breakdown Structure (WBS) or Cost Element Structure (CES) and the estimate base year are ground rules. These can be numbered or simply listed.

### **1.5.2 ASSUMPTIONS**

Assumptions are unknowns filled-in with data that may affect the outcome of the estimate (e.g., "Inflation beyond 2012 will be 2% per year"). The program schedule, including milestone events as well as when systems are procured, delivered, and fielded, is an assumption and should be captured. The use of tables or charts helps to convey the message. Assumptions might also include participating agency support, government versus contractor furnished equipment, and contractor rates, relationships, and profit/fee.

## **ESTIMATING METHOD AND DATA BY WBS/COST ELEMENT (BODY)**

### **WBS/Cost Element Name**

Each WBS or CES element should be listed here. This section will be the longest section in your documentation, as it details the inputs, formulas, and outputs for each element in your estimate. Present this section in total constant year and non-risk and uncertainty adjusted then-year dollars, as it is simply a depiction of your costing method.

#### **2.1.1 WBS DEFINITION**

Analysts are expected to use a WBS consistent with the appropriate MIL-STD-881 appendix for the commodity being estimated, expanded as necessary to the level of estimation. Include the WBS/Cost Element name as well as a clear definition as to what the cost element means and includes. Include the work scope of the effort. The WBS should be broken out by program phase with the appropriation clearly noted.

#### **2.1.2 RESULTS**

Provide a table of the total cost of the WBS element in constant year and then-year dollars. The estimates in this table are not risk and uncertainty adjusted. The analyst should take care to build the table into the cost models in order to efficiently and effectively build the documentation.

#### **2.1.3 ASSUMPTIONS**

Provide specific assumptions applicable to the specific WBS element.

#### **2.1.4 ESTIMATING METHODOLOGY**

The estimating methodology should be fully explained. The methods described should include the selected approach, any crosschecks developed, and risk and uncertainty considerations. Make sure to include sunk costs identified separately. Document the sources for all inputs and data. Raw data, whether copies of contractor information or from a database, used for estimating should be included. An appendix to the estimate can include this information, but reference such appendices here so the reader can find them. If referencing other spreadsheets, reports, or documents, please include file name and location in references. The methodology should be summarized in equation format, allowing for exact replication of estimate from inputs. Any CER and its derivation should be fully explained along with descriptive statistics explaining the error of the estimate, upper and lower limits of data. The data set should be included. Any external CERs used should include the documented analysis, be clearly referenced, "and/or" be placed in the NCCA Library. Each input to the estimating equation in the analysis should be fully explained. The source of the variable should be disclosed along with the date of the information and reference to the CARD or CARD-like document.

### 2.1.5 PHASING METHODOLOGY

The phasing methodology should be fully explained. Sources for inputs in deciding the phasing methodology should be listed as well. The intent here is to describe the basic phasing methodology to see that it makes sense and is in line with the schedule and other time-sensitive events.

### 2.1.6 INFLATION

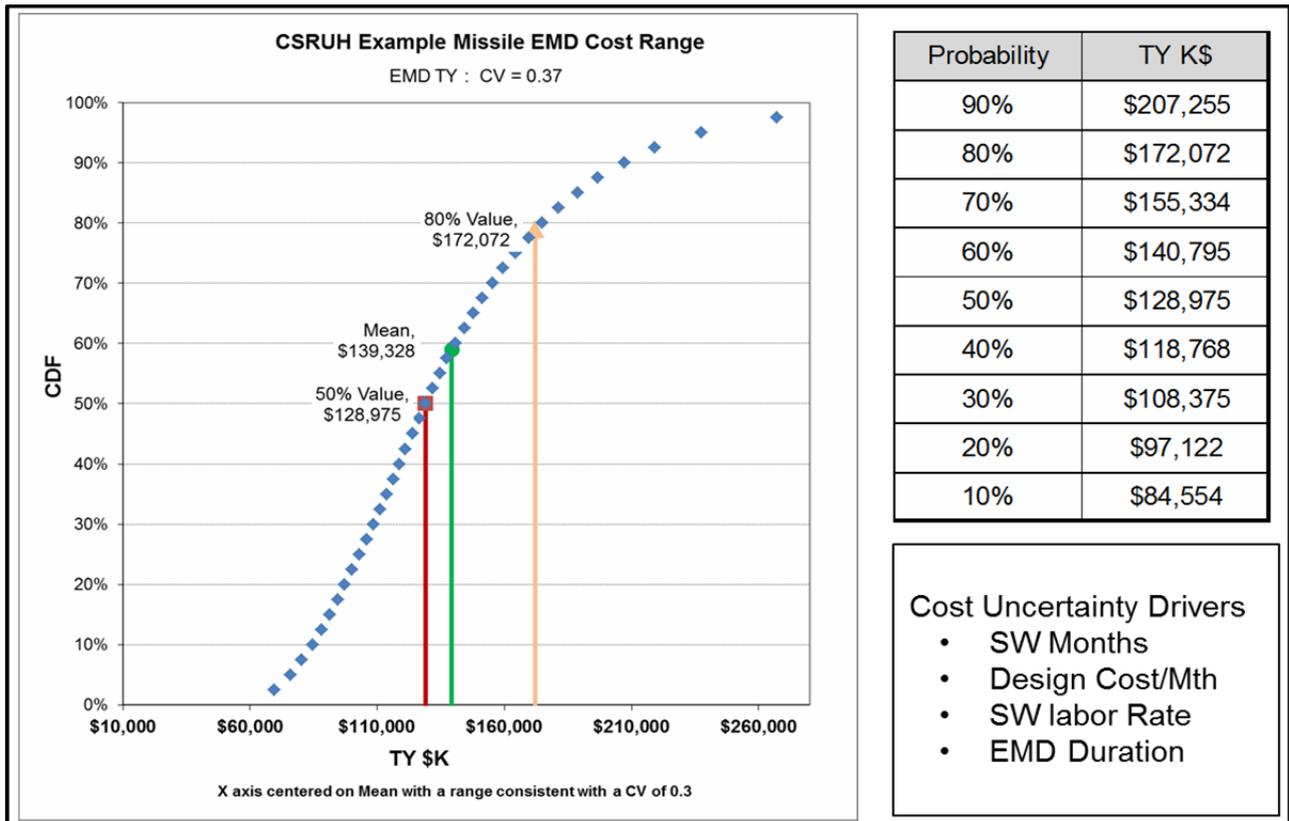
Note the inflation index used to convert the estimate for this element to then-year dollars.

## RISK AND UNCERTAINTY ANALYSIS

### 3.1 Risk Outputs

Reporting to senior leadership does not typically require the type of detailed charts shown to colleagues or technical management. Presenting the risk story to senior leadership or to a review agency requires presentation of the S-curve as shown in **Figure 4-8**.

In the upper left is the S-curve with markers for individual points of interest such as the mean, the 80% or a particular scenario. To the right of that is a decile table showing each 10% increment of probability and its corresponding value. On the S-curve chart is the CV to convey the estimate's dispersion and the number of iterations. At the bottom right is a list of the major drivers of risk in the model. How sunk costs are depicted is up to the cost analyst and team leader. Optionally, parameters for the low and high scenario may be shown. This is to give context to the overall curve in words and parameters that the decision maker can understand. This chart must be repeated for each phase or appropriation on which uncertainty analysis was performed. PoPs guidance shows S-curve costs in TY\$. For an on-going program this S-curve is the to-go cost, but the sunk cost needs to be shown on the chart. Optionally, a second S-curve containing both sunk and to-go cost may be presented in which case both sunk cost and to-go costs must be clearly noted. Strive for a consistent x-axis range throughout a given presentation and even throughout each organization. It is suggested that the x-axis be centered on the mean with a range consistent with a CV of 0.3.



**Figure 4-8** Sample S-curve Presentation Chart

The second necessary chart is the time-phased estimate by program phase. This will show the TY estimate at the selected cumulative probability by year. An example is shown in **Figure 4-9**.

80% TY \$K Allocated from Second Level. PA dollars Phased Across the Point Estimate Schedule	Total TY	2014	2015	2016	2017	2018	2019	2020	2021	2022
Missile System	\$425,094	\$26,682	\$32,608	\$34,455	\$38,084	\$34,393	\$60,682	\$67,475	\$65,622	\$65,093
Engineering and Manufacturing Development	\$172,072	\$26,682	\$32,608	\$34,455	\$38,084	\$34,393	\$5,851			
Production & Deployment	\$253,022						\$54,831	\$67,475	\$65,622	\$65,093

**Figure 4-9** Sample Phased Estimate by Appropriation Presentation Chart

Note that the allocated total for EMD is slightly different than the S-curve value at 80%. The reason for this is that the S-curve is developed directly from the simulation which includes influence from duration uncertainty. The risk allocation approach is performed on constant year dollars, phased and then inflated to the TY. As shown in **Figure 4-10**, the 80% TY results from the simulation and allocation differ by about 1.6% for EMD. Production is almost identical because we did not include duration uncertainty in Production. The BY results match each other identically, except for the total. The total should not match since the simulation is the statistical result, not the sum of EMD and Production, while the allocated result is the sum. It may be useful to know the percentile of the current budget.

80%	BY Results		TY Results	
	Simulation	Allocation	Simulation	Allocation
	Result	Result	Result	Result
Missile System	\$376,127	\$381,908	\$421,719	\$421,268
Engineering and Manufacturing Development	\$163,168	\$163,168	\$174,934	\$172,072
Production & Deployment	\$218,740	\$218,740	\$253,240	\$253,022

**Figure 4-10** Comparing Simulation and Allocated TY Results

In addition to the S-curve and phased charts, a complete presentation of the risk analysis must contain the following items:

- The contents of the point estimate,

- General approach of how the uncertainty was defined and, in the case of the simulation method, how the bounds and distributions were chosen,
- Identify the most important contributors to the cost estimate uncertainty and any risk mitigation initiatives captured by the estimate,
- Identify the cost drivers that have the most impact on the cost estimate,
- The key point is to list those topics that have meaning to the decision maker.

**Presenting the risk story to leadership:**

Time-phased TY estimate by appropriation S-curve summary for each program phase.

S-curves should report CV, mean, and other points of interest.

S-curve x-axis range should be conditioned on a CV when comparing two or more S-curves. Technical review charts should be in backup to support a brief explanation of the drivers to decision makers.

**COMPARISONS TO PREVIOUS ESTIMATES**

---

If applicable, provide a comparison of the estimate to previous Milestone estimates. Note the major changes between estimates that have occurred and why.

**EXCURSIONS**

---

Discuss any major excursions that were used to provide information to leadership as part of the presentation of the final estimate. Note the key variables that differed from the baseline.

**SUMMARY**

---

This is a recap of the point cost estimates by WBS and by year. Separate constant year and then year tables are to be provided. The then-year risk with uncertainty adjustment should be shown as a separate line and confidence level noted. These tables will be by program phase.

## ACRONYMS

### Acronyms

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**APB SECTION C INPUTS**

"Provide a word description"

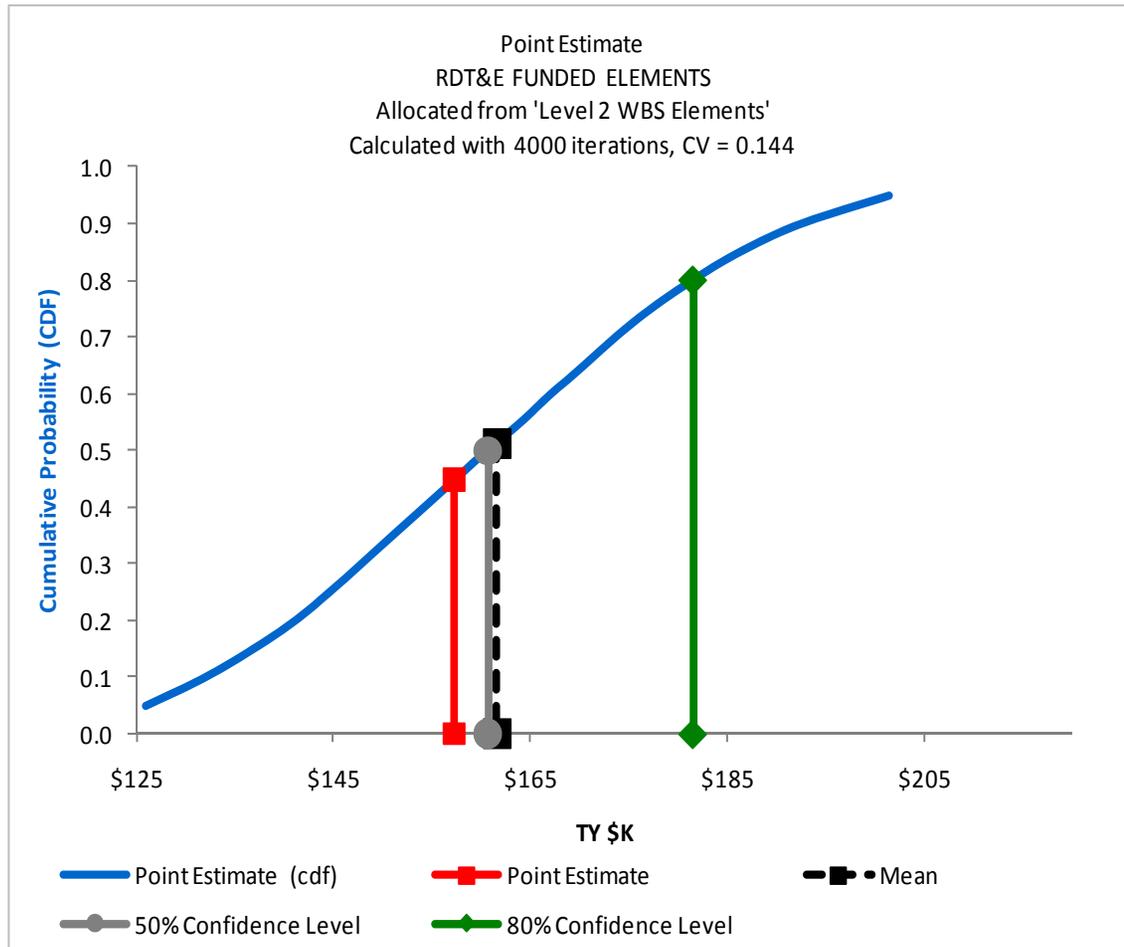
\*Example of APB Section C in CAG Appendix H.

TY s-curves

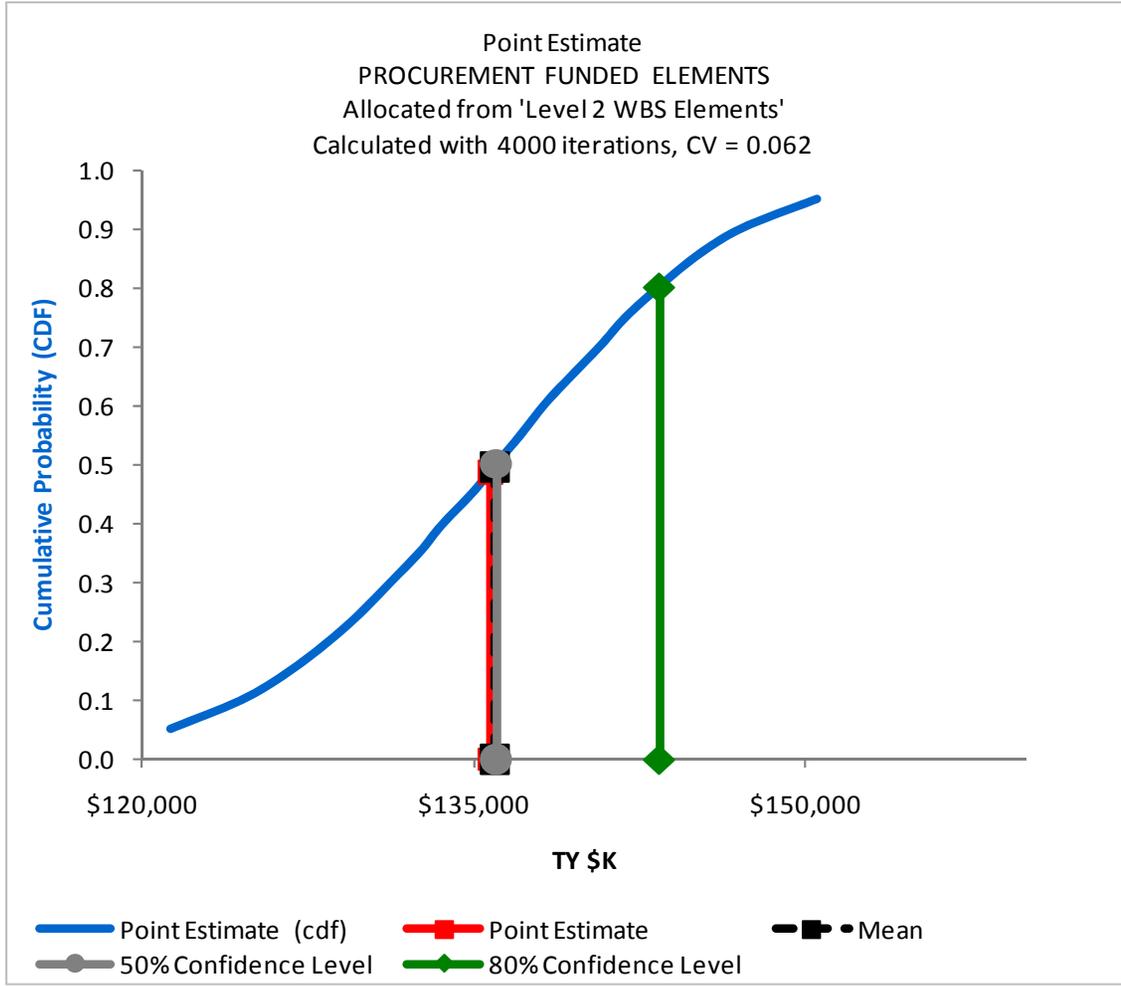
"Provide summary of risk/sensitivity analysis S-Curves."

**Table E – 1: LCCE at Various CPD Levels (TY11 \$K)**

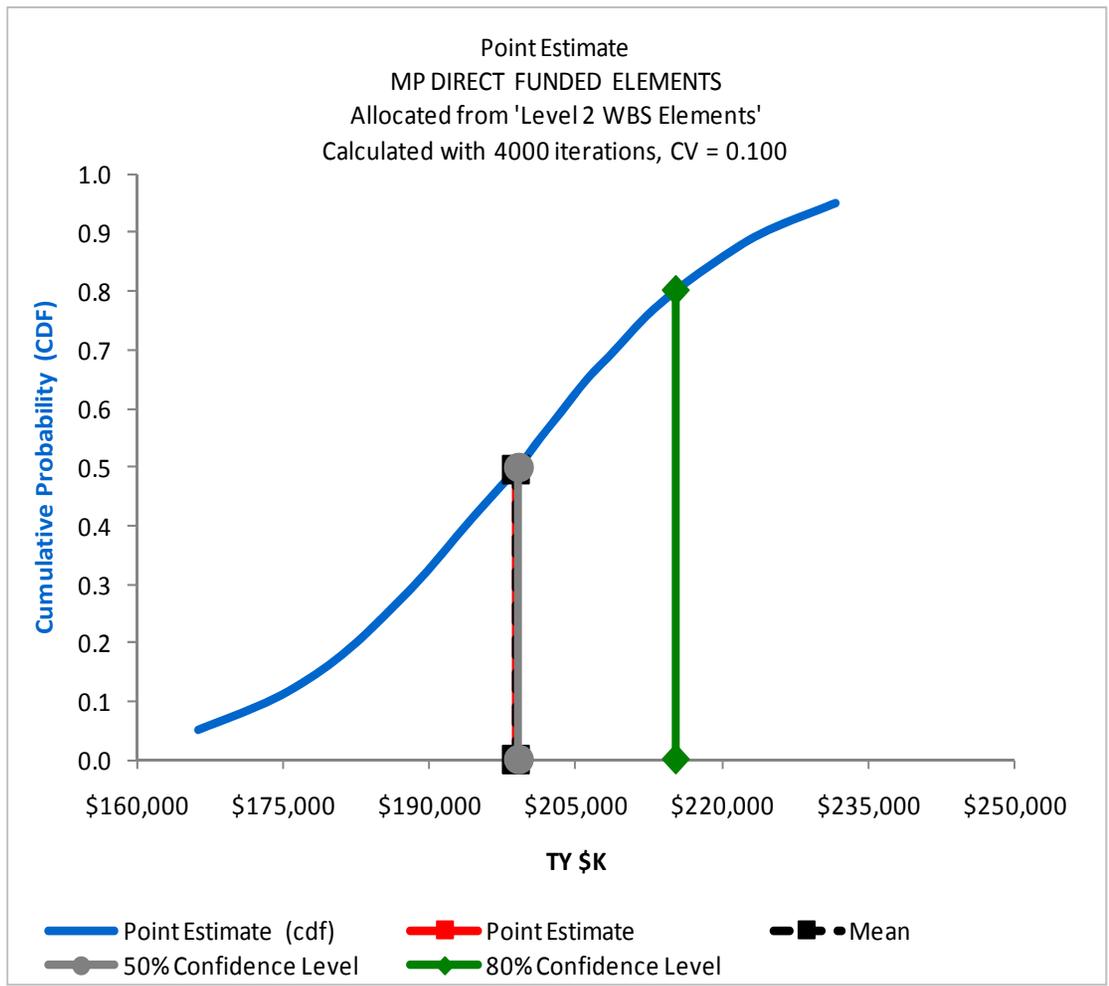
Appropriation	Point Estimate		Mean		50% Cum Prob	80% Cum Prob
	Cost	Cum Prob	Cost	Cum Prob		
RD TEN						
PMC						
MPMC						
OMMC						
<b>Total</b>						



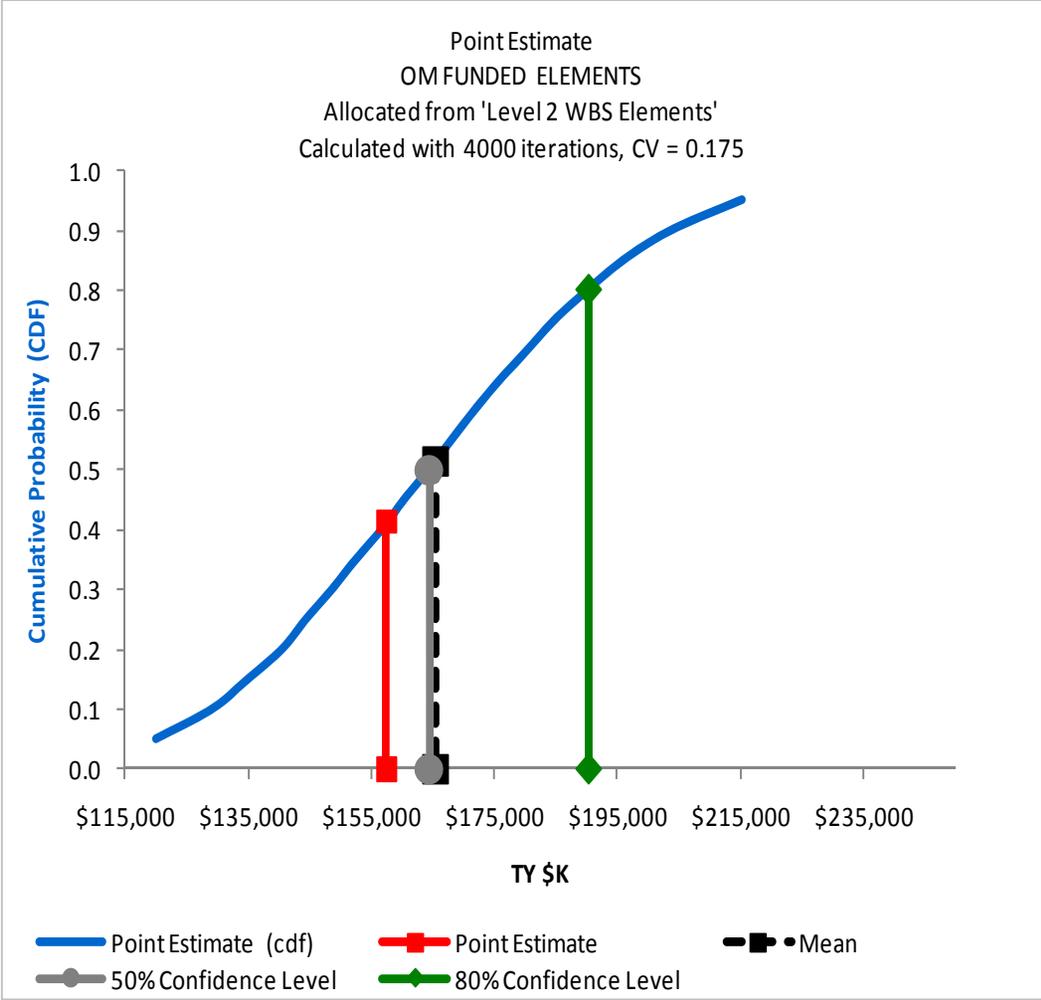
**Figure E - 1: RDTEN CPD (TY \$K)**



**Figure E - 2: PMC CPD (TY \$K)**



**Figure E - 3: MPMC CPD (TY \$K)**



**Figure E - 4: OMMC CPD (TY \$K)**

**OTHER (SPRUIILL CHARTS, PIB CROSSWALK, BOM, ETC)**

“Provide word descriptions and describe each table, chart, figure, etc.”

\*Example of Spruill Chart in CAG Appendix I (Spruill Chart should reflect same methodology as APB Section C).

# POM/LCCE CROSSWALK

PIB	BUDGET	LCCE Elements	Explanation
<b>RDT&amp;E</b>			
<b>PRIME CONTRACTOR EXPENSES</b>			
Concept & Tech Dev			
System Dev & Demo		1.01.1 - Hardware Development	1.01.1 - Hardware development done by Contractor
Post Milestone C		1.01.2 - Software Development	1.01.2 - Software development done by Contractor
<b>GOVERNMENT EXPENSES</b>			
In-House Program Mgt			
Contractor Advise & Assist Serv		1.05.1.2 - Contractor SEPM	1.05.1.2 - Contractor Personnel within the Program Office
Travel / TAD		1.07 - Training Development	1.07 - Covers the cost of developing training
Operational T&E Costs		1.08 - Data Development	1.08 - Includes cost of developing data such as tech manuals
Post Milestone III/C		1.05.2 - Temporary Assigned Duty (TAD)	1.05.2 - PMO Travel
<b>TOTAL R&amp;D</b>		1.06 - System Test & Evaluation (ST&E)	1.06 - Covers both Developmental Test (DT) and Operational Test (OT)
		1.11 - Other RD TEN	1.11 - Facilities for testing at the SED
<b>PMC</b>			
Quantity			
Unit Cost (in dollars)			
End Item Subtotal (\$000)			
First-Article Test		2.02.1 - Hardware Procurement	2.02.1 - Cost to procure all hardware components, with the exception of those systems for the platform
Test Article (s)		2.02.2 - Software Procurement	2.02.2 - Cost to procure all system software
Contractor Consulting Services		2.02.3 - Integration	2.02.3 - Cost to integrate all the system components
Modification Kits		2.02.4 - Contractor SEPM	2.02.4 - Cost to manage
Installation of MOD Kits		2.05 - System Test & Evaluation	2.05 - Includes the procurement-funded costs of the system-related production test activities that are identifiable with the evaluation of the system
Integrated Logistics Support			
Factory Training		2.04.1.2 - Contractor SEPM	2.04.1.2 - Contractor Personnel within the Program Office
Special Purpose Test Equip		2.03 - Engineering Changes	2.03 - Costs for system engineering changes while in manufacturing
Spec Purpose Training Devices		2.13 - Modifications	2.13 - Cost for any changes after fielding
Gen Purpose Tools, Sets, & Kits	Gen Purpose Tools, Sets, & Kits		Assumed to be covered under the Engineering Changes Factor
General Purpose Test Equip	General Purpose Test Equip	2.06 - Training Equipment	2.06 - Cost to procure training equipment
Gen Purpose Training Devices		2.07 - Data Procurement	2.07 - Covers the cost to produce technical data
Support Vehicles/Equip		2.08 - Support Equipment	2.08 - Covers cost to procure any unique support equipment
MCHS	MCHS	2.10.5 - New Equipment Training (NET)	2.10.5 - New Equipment Trainers (NETs) immediately following system fielding
Workstations			
Servers			
Peripheral Refresh	Peripheral Refresh		
First Destination Transportation	First Destination Transportation	2.10.4 - First Destination Transportation (FDT)	2.10.4 - Cost to ship from USA Depots and OEM to Spawar. Costs covered by sender.
Travel		2.04.2 - TAD	2.04.2 - PMO Travel
Initial Spares	Initial Spares	2.10.1 - Initial Spares	2.10.1 - Initial spares
Other (Specify)		2.10.2 - Initial Consumables	2.10.2 - Initial Consumables up to the first two years following fielding
<b>TOTAL PMC</b>			
<b>PANMC</b>			
<b>TOTAL PANMC</b>			
<b>O&amp;MMC</b>			
Second Destination Trans (SDT)	Second Destination Trans (SDT)	5.07 - Second Destination Transportation	5.07 - Shipping from Spawar to receiving units
Travel	Travel	5.10.2 - TAD	5.10.2 - PMO Travel
Acquisition Support	Acquisition Support		
Management & Professional Service Support (CAAS)			
Contractor Engineer & Technical Services (CAAS)		5.06.2 Integrated Materiel Management	5.06.2 - Costs of materiel management and integration at SPAWAR
PM Support (Non-CAAS)		5.10.1.2 - Contractor SEPM	5.10.1.2 - Contractor Personnel within the Program Office
Contractor Log Support (CLS)	Contractor Log Support (CLS)		
Albany			
Non-Albany		5.01 - Field Maintenance Contractor Labor	5.01 - Contractor Logistics Support
O&M New Equipment	O&M New Equipment	5.04 - Consumables	5.04 - Cost of consumables for the first two years of fielding, afterwards this is the responsibility of the fleet
Depot Maintenance			
Post-Deploy Software Spt (PDSS)	PDSS		
MCTSSA			
Non-MCTSSA			
Training Support	Training Support		
Formal Schools Support (AG/SAG 3B4D)		5.11 - Recurring Training	5.11 - Contractor personnel responsible for updating the curriculum and training the military instructors as refresh occurs
Lifecycle Support (AG/SAG 3B4D)			
Other (Specify)			
Facilities		5.12.2 - Facilities	5.12.2 - Covers the cost of warehouse space for storage of systems
Tech Refresh		5.12.1 - Tech Refresh	5.12.1 Covers the cost of COTS H/W refresh, laptop refresh, and software refresh
<b>Total O&amp;M</b>			
<b>O&amp;MMCR</b>			
Acquisition Support	Acquisition Support		
Management & Professional Service Support (CAAS)			
Contractor Engineer & Technical Services (CAAS)			
PM Support (Non-CAAS)			
O&M New Equipment (Reserves)	O&M New Equipment		
Depot Maintenance			
Post-Deploy Software Spt (PDSS)	PDSS		
MCTSSA			
Non-MCTSSA			
<b>Total O&amp;MMCR</b>			
<b>Total Resource Requirements Summary</b>			
<b>RDT&amp;E</b>	RDT&E		
<b>PMC</b>	PMC		
<b>PANMC</b>	PANMC		
<b>O&amp;MMC</b>	O&MMC		
<b>O&amp;MMCR</b>	O&MMCR		
<b>Manpower (MPMC)</b>			
<b>Reserve Manpower (RPMC)</b>			
<b>Military Construction (MCON)</b>			
<b>Military Const Reserves (MCNR)</b>			
<b>Initiative Total</b>			

## **OTHER (CHARTS, CROSSWALKS, BOM, ETC)**

---

"Provide word descriptions and describe each table, chart, figure, etc."

\*Example Chart in CAG Appendices (This Chart should reflect same methodology as APB Section C).

# Appendix C CARD Briefing Templates

## Appendix C1 CARD In-progress Review (IPR) Template



**MARINE CORPS SYSTEMS COMMAND**  
HOME OF THE MARINE CORPS ACQUISITION PROFESSIONALS

[Program Name]  
CARD In-Progress Review

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**MARINE CORPS SYSTEMS COMMAND**  
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Section Number	Section Title	Status
1.0	System Overview	10
2.0	Risk	2
3.0	System Operational Concept	6
4.0	Quantity Requirements	8
5.0	System Manpower Requirements	8
6.0	System Activity Rates	8
7.0	System Milestone Schedule	8
8.0	Acquisition Plan and/or Strategy	2
9.0	System Development Plan	10
10.0	Element Facilities Requirements	8
11.0	Track to Prior CARD	N/A
12.0	Contractor Cost Data Reporting (CCDR) Plan	N/A

**Legend:**  
 RED=Low Quality or Fidelity of Data  
 YELLOW=Analyst Judgment/Assumptions Made  
 GREEN=Good Quality/Fidelity of Data

2 Incomplete  
 4 Partially Complete/Missing Significant Information  
 6 Partially Complete/Missing Some Information  
 8 Mostly Complete/Missing Little Information  
 10 Complete

1

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Section Number	Section Title	Section Description	Status	Rationale	Comments
1.0	System Overview				
1.1	System Characterization	This paragraph provides a general description of the system, including the functions it will perform and key performance parameters. A diagram or picture of the system, with the major parts and subsystems appropriately labeled is also included, along with OVs, SVs, an engineering WBS and a list of GFE.	PMO/SME Input	The KPPs and KSAs are derived from the latest CDD, version 2.0. Additionally, the OVs, SVs, and GFE were provided by engineers. Created a WBS for each of the three variants that was vetted through the PO.	
1.2	System Characteristics	This section provides a technical description of the hardware, software, and human characteristics of the system. It is divided into the following sub elements: Technical and physical description, software description, human performance engineering, system safety and system survivability.	PMO/SME Input	Each of the subsystems is described in detail as depicted in the info book provided by John Doe.	
1.3	System Quality Factors	This section identifies key system quality characteristics, including system operational availability (Ao) and the flowdown of reliability, availability and maintainability (RAM) requirements. Also discussed are portability/transportability and additional quality factors such as interoperability, integrity, and efficiency.	PMO/SME Input	RAM requirements described as outlined in the CDD.	
1.4	Embedded Security	This section discusses any embedded security in the system. Any hardware requirements are identified within 1.1 system characterization and described in detail here.	Missing Information	TBD	
1.5	Predecessor and/or Reference System	A predecessor and/or reference system is a currently operational or preexisting system with a mission similar to that of the proposed system. The discussion identifies key system-level characteristics of both the predecessor and/or reference system and the new or proposed system. Information on the planned disposition of the replaced systems is provided so that disposal costs and benefits can be considered in the cost estimate.	PMO/SME Input	Legacy system information on the UUNS systems provided by the PO.	

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Section Number	Section Title	Section Description	Status	Rationale	Comments
2.0	Risk				
3.0	System Operational Concept				
3.1	Organizational Structure	This section identifies the program manager's assessment of the program and the measures being taken or planned to reduce those risks. Relevant sources of risk include: design concept, technology development, test requirements, schedule, acquisition strategy, funding availability, contract stability, or any other aspect that might cause a significant deviation from the planned program.	Missing Information	Information included from the draft Risk Management Plan (RMP). This section will be updated when the Risk Registry is completed and provided to the team. Risk Cube diagram also incomplete at this time.	
3.2	Basing and Deployment Description	This section identifies the force structure elements associated with the operation of the system. In some cases, unit manpower documents may not be available for a system until after Milestone II. In those instances, notional unit manpower documents showing the relationship to the unit manpower documents for the predecessor system should be provided.	PMO/SME Input	PO Org provided. As progression toward the designation of an Acquisition Program, this information will be updated.	
3.3	Security	This paragraph describes the peacetime basing and wartime deployment plans for the system. It identifies the number and location of peacetime bases both in the continental United States (CONUS) and overseas, and describes any new bases or facilities that will be required. The paragraph also describes the anticipated deployment method of the system in terms of number of sites and operating locations.	Analyst Assumption	The fielding schedule included in this section is based off of IOC and FOC dates in the CDD as well as an approved AAO, but makes assumptions on the distribution of the systems procured/fielded. This schedule has been vetted through the PO and will be updated as required.	
3.4	Logistics	This paragraph describes the system's physical security, information security, and operations security features. Hardware and software aspects of communications and computer security should also be addressed.	PMO/SME Input	Security description based on information in the CDD pertaining to physical, communications and operations security as well as security maintenance.	
3.4	Logistics	This paragraph summarizes key elements of the Integrated Logistics Support Plan (ILSP). The information is divided into the following subparagraphs: Support concept, supply, and training.	Analyst Assumption	Discussion of the general support construct and ICLS are detailed. Much of this section is based off of support for the legacy systems and will be updated per a signed ILSP.	

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- Continue charts as in previous slide for all sections of the CARD



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[Program Name]  
CARD In-Progress Review

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**MARINE CORPS SYSTEMS COMMAND**  
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Summary:

Section Number	Section Title
1.0	Program and System Description
2.0	Technical and Physical Description
3.0	Software Description and Sizing Information
4.0	System Operations and Support Concept
5.0	Disposal
6.0	CARD Plan
7.0	CSDR Plan
8.0	Track to Prior CARD

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## 1.0 Program and System Description

- 1.1
  - SUMMARY
  - Source



## 1.0 Program and System Description

- 1.2
  - SUMMARY
  - Source



## 1.0 Program and System Description

- 1.3
  - SUMMARY
  - Source



## 2.0 Technical and Physical Description

- 2.1
  - SUMMARY
  - Source



## 3.0 Software Description and Sizing Information

- 3.1
  - SUMMARY
  - Source



## Remaining Sections Number/Subject

- Remaining sub-categories for remaining sections

## Appendix D LCCE Cost Review Board Templates

### Appendix D1 Initial Cost Review Board (CRB) Template



**MARINE CORPS SYSTEMS COMMAND**  
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[Program Name]  
Initial Cost Review Board

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**MARINE CORPS SYSTEMS COMMAND**  
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Outline

- Purpose
- System Information
- Acquisition Strategy
- Logistics Support Strategy
- Ground Rules & Assumptions
- Data
- Program Data Assessment
- Next Steps

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- Purpose:
  - The estimate is in support of Milestone X (or specified purpose).
- Scope of the estimate:
- Team Composition:



- System Description
- Picture of system
- Quantities for each acquisition phase
- Procurement and fielding schedule
- If several system configurations are required, discuss each configuration
- Usage rates



- Insert official program schedule
- Acquisition strategy and cost impacts
- Address all testing requirements
- System integration and installation
  - Facilities, personnel and timeframe
- Fielding schedule



- Maintenance strategy (e.g. CLS, organic)
- Spares, consumables and reparable strategy
- Refresh rates
- Initial and sustainment training



- List and discuss the logic supporting these ground rules and assumptions.
- **Examples**
  - **Overarching**
    - Model developed in ACE 7.4
    - Estimate based on current CARD version
    - Constant BY for the estimate is FY11
    - All costs FY05-FY11 are considered sunk
    - Latest approved U.S. Government Inflation indices, May 2010, were used
    - LCCE covers FY11 – FY23 timeframe; end date is FOC +10 years; FOC = FY13, IOC = FY12.
    - No USMC force structure or end strength changes will occur
    - Latest civilian labor and locality rates sourced from FCoM



- **Examples**
  - **Research and Development (R&D)**
    - One post FOC engineering change development effort will occur.
    - Development effort for technical refresh is four to five years after FOC
  - **Investment**
    - AAO is 120 systems
    - Systems refurbished every 7 years
    - One unit will be damaged due to unforeseen occurrences (unprogrammed losses).
  - **Operating & Support (O&S)**
    - Operational Life: 10 years after FOC
    - Operating Time (OPTEMPO) is 13,292 hours per year for peacetime operations
    - Covered by a 3 year warranty and Contractor Logistics Support (CLS) for non-warranty repairs
    - Refresh: Software every 3 years, hardware every 5 years
  - **Disposal**
    - Disposal costs apply.



- Cite sources, collection, normalization, and analyses for each cost element
- Address data collection issues
- Identify commodity specific CES
- Provide Initial Cost Estimate Methodology Matrix (CEMM)
  - Identify CES elements containing costs
  - Identify any Cost methodologies (bottom up, parametric, analogy, actual costs) for those element with costs



- Discuss PM's risk matrix
- Discuss cost risk assessment
  - Technical
  - Programmatic
  - Schedule



- Describe next steps in the cost estimating process
  - Discuss POA&M to conduct cost estimate
  - Discuss potential impediments
  - Review action items



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Outline

- Purpose
- Action Items from Previous CRB
- Updated CEMM
- Additional Information / Data
- Additional Direction
- Cost Schedule
- Next Steps

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# Purpose

- Purpose:
- Scope of the estimate:
- Team Composition:

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# Action Items from Previous CRB

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- Go through each element of CES



- Data not Discussed in the Initial CRB



- Current schedule to conduct cost estimate
- Remaining cost activities
- Challenges to meet schedule



- Describe next steps in the cost estimating process
  - Discuss potential impediments
  - Review action items



**MARINE CORPS SYSTEMS COMMAND**  
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[Program Name]  
Initial Cost Review Board

Day/Month/Year

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**MARINE CORPS SYSTEMS COMMAND**  
HOME OF THE MARINE CORPS ACQUISITION PROFESSIONALS

Outline

- Purpose
- Ground Rules and Assumptions
- Estimate Summary
- Detailed Estimate Review
- Risk Analysis
- Budget Comparison
- Next Steps

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- Purpose:
- Scope
- Team Composition:



- Review overarching GR&A
  - Documentation/source
  - Organization
  - Inflation
  - Others as they apply



- Appropriate Summaries (By CES, APPN, FY, in both BY\$ and TY\$, etc.)
- Drivers
- Complete WBS/CES leveling
- Complete CEMM
- Indirect costs included



- Walk-through model by CES
- Estimate Details/Construct (included sections for)
  - Estimate Section Summary
  - CES Description
  - Appropriation
  - Assumptions
  - Methodology
  - Crosschecks
  - Phasing
  - Uncertainty
  - Documentation/sourcing
- Flow of data/calculations within the model



- Global Assumptions/Specifications
  - Simulation method
  - Number of iterations
  - Other items as required
- Local Assumptions/Specifications
  - Distribution
  - Dispersion
  - Truncation
  - Interpretation of bounds
- Complete set of results (e.g., S-Curves (BY & TY) and CVs for each APPN)



- Review Spruill chart
  - Discuss level of risk adjustment in LCCE (i.e., Required \$)
  - Discuss major shortfalls
  - Discuss possible affordability COA drills



- Describe next steps in the cost estimating process
  - Discuss POA&M to conduct cost estimate
  - Discuss potential impediments
  - Review action items
- Discuss Final CRB/approvals

## Appendix D4 Final CRB Template



**MARINE CORPS SYSTEMS COMMAND**  
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[Program Name]  
Initial Cost Review Board

Day/Month/Year

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**MARINE CORPS SYSTEMS COMMAND**  
HOME OF THE MARINE CORPS ACQUISITION PROFESSIONALS

Outline

- Purpose
- Estimate Schedule (POA&M)
- System Description
- Program Acquisition Schedule
- Overarching Ground Rules and Assumptions
- Line-By-Line Review Summary
- Estimating Methodology Summary Changes
- Cost Drivers/Carriers
- Estimate Details
- Risk Analysis
- Budget Comparison
- Other Issues
- LCCE Documentation Status
- Recommendations/Road-Ahead

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 **MARINE CORPS SYSTEMS COMMAND**  
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# Purpose

- Purpose:
- Scope:
- Team Composition:

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3

 **MARINE CORPS SYSTEMS COMMAND**  
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# System Description

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- Present overarching ground rules, assumptions, and constraints affecting cost
- Organize by type or logical grouping



- Summary of Line By Line model review results



- Summarize primary and crosscheck cost estimating methodologies
- Organize by CES



- Graphical or tabular summary of high cost elements



- Show tabular summary of estimate by CES
- Then show levels as appropriate
- Have cost model to show and follow



- Describe overall process
  - Level of analysis which performed
  - Probability level
- Explain rationale for distributions and ranges
- Display results including S-Curves with corresponding CVs
- Describe how delta risk dollars added to estimate and spread by FY
- Discuss acceptable risk level for the program (50<sup>th</sup>, 80<sup>th</sup>, or other)



- Display a Spruill Chart to give the CRB an indication of the potential for having to come back and find affordability options in the model



**MARINE CORPS SYSTEMS COMMAND**  
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# Other Issues

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# LCCE Documentation Status

- Discuss products to be delivered
- Discuss timeline for final products be delivered

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- Recommend approval of LCCE
- Describe next steps (e.g., Milestone on xx-xx-xx date)

## Appendix E MCSC, C&A Community Standard Cost Estimating Structure (CES)

This Appendix shows the standardized CES format within the C&AC. There may be occasions that this format is slightly changed to reflect variations for a particular weapon system or information technology program regarding cost elements or child levels for specific elements. However, deviation from the standardized CES should be minor so program CESs can remain comparative in nature when needed. In other words, deviation should be exercised when required and be the exception, not the rule.

The below CES is an example based upon MIL-STD-881C (for Research & Development and Investment) and the OSD CAPE Operating and Support (O&S) Cost Estimating Guide (CEG)(for O&S only). This CES example below is for an Electronics system (as found in Appendix B of the MIL-STD-881C). The C&AC has added two children items to 1.12 and 2.12 (Initial Spares & Repair Parts) to distinguish between Initial Spares and Repairables. This is consistent with how they are handled within the Operations & Support section.

All CES' should comply with the DON CEG requirement to report cost by Research & Development, Investment, Operating & Support, and Disposal, rather than by appropriation. Other facets to this standard structure are:

- Children can be added to the lowest levels shown below to account for additional distinctions among costs (e.g., contractor vs government, appropriation, recurring vs non-recurring, etc.).
- Do not add siblings to the standard cost elements as this makes comparison among programs more difficult and harder to compare with the source documents.

<b>881C Based - Electronics System CES</b>
Total <881C Electronic Program Name> Life Cycle Cost Estimate
<b>1.0 - Research &amp; Development</b>
1.1 - Prime Mission Product (PMP) 1...n (Specify)
1.1.1 - PMP Subsystem 1...n (Specify)
1.1.1.1 - PMP Subsystem Hardware 1...n
1.1.1.2 - PMP Subsystem Software Release 1...n
1.1.1.3 - Subsystem Integration, Assembly, Test and Checkout
1.1.2 - PMP Software Release 1...n (Specify)
1.1.2.1 - Software Product Engineering
1.1.2.2 - Computer Software Configuration Item (CSCI) 1...n
1.1.2.3 - Subsystem Integration, Assembly, Test and Checkout
1.1.3 - PMP Integration, Assembly, Test and Checkout

1.2 - Platform Integration, Assembly, Test and Checkout
1.3 - System Engineering
1.4 - Program Management
1.5 - System Test and Evaluation
1.5.1 - Development Test and Evaluation
1.5.2 - Operational Test and Evaluation
1.5.3 - Mock-ups / System Integration Labs (SILs)
1.5.4 - Test and Evaluation Support
1.5.5 - Test Facilities
1.6 - Training
1.6.1 - Equipment
1.6.2 - Services
1.6.3 - Facilities
1.7 - Data
1.7.1 - Technical Publications
1.7.2 - Engineering Data
1.7.3 - Management Data
1.7.4 - Support Data
1.7.5 - Data Depository
1.8 - Peculiar Support Equipment
1.8.1 - Test and Measurement Equipment
1.8.2 - Support and Handling Equipment
1.9 - Common Support Equipment
1.9.1 - Test and Measurement Equipment
1.9.2 - Support and Handling Equipment
1.10 - Operational/Site Activation
1.10.1 - System Assembly, Installation and Checkout on Site
1.10.2 - Contractor Technical Support
1.10.3 - Site Construction
1.10.4 - Site/Ship/Vehicle Conversion
1.10.5 - Sustainment/Interim Contractor Support
1.11 - Industrial Facilities
1.11.1 - Construction/Conversion/Expansion
1.11.2 - Equipment Acquisition or Modernization
1.11.3 - Maintenance (Industrial Facilities)

1.12 - Initial Spares and Repair Parts (Depot Level Repairables (DLRs) & Consumables)
1.12.1 - Repairables
1.12.2 - Consumables
1.13 – Other Research & Development, 1-n (Specify)
2.0 - Investment
2.1 - Prime Mission Product (PMP) 1...n (Specify)
2.1.1 - PMP Subsystem 1...n (Specify)
2.1.1.1 - PMP Subsystem Hardware 1...n
2.1.1.2 - PMP Subsystem Software Release 1...n
2.1.1.3 - Subsystem Integration, Assembly, Test and Checkout
2.1.2 - PMP Software Release 1...n (Specify)
2.1.2.1 - Software Product Engineering
2.1.2.2 - Computer Software Configuration Item (CSCI) 1...n
2.1.2.3 - Subsystem Integration, Assembly, Test and Checkout
2.1.3 - PMP Integration, Assembly, Test and Checkout
2.2 - Platform Integration, Assembly, Test and Checkout
2.3 - System Engineering
2.4 - Program Management
2.5 - System Test and Evaluation
2.5.1 - Development Test and Evaluation
2.5.2 - Operational Test and Evaluation
2.5.3 - Mock-ups / System Integration Labs (SILs)
2.5.4 - Test and Evaluation Support
2.5.5 - Test Facilities
2.6 - Training
2.6.1 - Equipment
2.6.2 - Services
2.6.3 - Facilities
2.7 - Data
2.7.1 - Technical Publications
2.7.2 - Engineering Data
2.7.3 - Management Data
2.7.4 - Support Data
2.7.5 - Data Depository
2.8 - Peculiar Support Equipment

2.8.1 - Test and Measurement Equipment
2.8.2 - Support and Handling Equipment
2.9 - Common Support Equipment
2.9.1 - Test and Measurement Equipment
2.9.2 - Support and Handling Equipment
2.10 - Operational/Site Activation
2.10.1 - System Assembly, Installation and Checkout on Site
2.10.2 - Contractor Technical Support
2.10.3 - Site Construction
2.10.4 - Site/Ship/Vehicle Conversion
2.10.5 - Sustainment/Interim Contractor Support
2.11 - Industrial Facilities
2.11.1 - Construction/Conversion/Expansion
2.11.2 - Equipment Acquisition or Modernization
2.11.3 - Maintenance (Industrial Facilities)
2.12 - Initial Spares and Repair Parts (DLRs & Consumables)
2.12.1 - Repairables
2.12.2 - Consumables
2.13 – Other Research & Development, 1-n (Specify)
<b>3.0 - Operating &amp; Support</b>
3.1 - Unit Level Manpower (includes active and reserve military, government civilian, and contractor manpower costs)
3.1.1 - Operations
3.1.2 - Unit Level Maintenance
3.1.3 - Other Unit-Level
3.2. - Unit Operations
3.2.1 - Operating Material
3.2.1.1 - Energy (Fuel, Petroleum, Oil and Lubricants [POL], Electricity)
3.2.1.2 - Training Munitions and Expendable Stores
3.2.1.3 - Other Operational Material
3.2.2 - Support Services
3.2.3 - Temporary Duty
3.2.4 - Transportation
3.3 - Maintenance
3.3.1 - Consumable Materials and Repair Parts
3.3.2 - Depot Level Repairables ((DLR) / Repair of Repairables)
3.3.3 - Intermediate Maintenance (External to Unit-Level)
3.3.4.1 - Intermediate-Level Consumable Materials and Repair Parts

3.3.4.2 - Intermediate-Level Government Labor
3.3.4.3 - Intermediate-Level Contractor Maintenance
3.3.4.4 - Other Intermediate-Level Maintenance
3.3.4 – Depot Maintenance
3.3.5 – Other Maintenance
3.4 - Sustaining Support (System Level Cost Only)
3.4.1 - System Specific Training
3.4.1.1 - System Specific Operator Training
3.4.1.2 - System Specific Maintenance Training
3.4.1.3 - System Specific Other Support Training
3.4.2 - Support Equipment Replacement and Repair
3.4.3 - Sustaining/Systems Engineering
3.4.4 - Program Management
3.4.5 - Information Systems
3.4.5.1 – Tech Refresh
3.4.5.2 – License Fees
3.4.5.3 – Maintenance
3.4.6 - Data and Technical Publications
3.4.7 - Simulator Operations and Repair
3.4.7.1 – Simulator Operations Hardware Support
3.4.7.2 – Simulator Operations Manpower
3.4.7.3 – Simulator Tech Refresh
3.4.8 - Other Sustaining Support
3.5 - Continuing System Improvements
3.5.1 - Hardware Modifications
3.5.2 - Software Maintenance
3.6 - Indirect Support
3.6.1 - Installation Support
3.6.1.1 - Base Operations Support
3.6.1.2 - Base Communications
3.6.1.3 - Facilities Support
3.6.2 - Personnel Support
3.6.2.1 - Personnel Administration
3.6.2.1.1 - Personnel Management
3.6.2.1.2 - Acquisition of New Personnel
3.6.2.1.3 - Personnel Not Available for Duty (Transients, Patients, Students)
3.6.2.2 - Personnel Benefits
3.6.2.2.1 - Family Housing
3.6.2.2.2 - Dependent Support Programs
3.6.2.2.3 - Commissaries and Exchanges
3.6.2.3 - Medical Support

3.6.3 - General Training and Education
3.6.3.1 - Recruit and Initial Officer Training
3.6.3.2 - General Skill Training
3.6.3.3 - Professional Military Training
3.7 – Other Operating & Support, 1-n (Specify)
4.0 - Disposal 1-n ... (Specify)

## Appendix F Cost Element Methodology Matrix (CEMM)

Program Name:  
State \$ Type

Date:  
POC:

CES/ WBS #	CES/WBS Name	Appropriation	Program Office Funded Cost (Y/N)	Methodology /Formula	Methodology Sources	Unique Ground Rules & Assumptions	Data Source	Data Rationale	Phasing / Profiling Method	Uncertainty Range	Uncertainty Source	Uncertainty Rationale	APB Crosswalk (Acq or Other)	Crosschecks
1.0	Research & Development													
2.0	Investment													
3.0	Operating & Support													
4.0	Disposal													

## Appendix G AoA Quick Reference Guide

- 1) Standing USMC AoA IPT Secretariat: Provided by C&A Branch.
- 2) AoA IPT members [ACAT III-IV]: Assistant Commander Programs, MCSC - chairman, Deputy Director PA&E, P&R; Director OAD, MCCDC; Appropriate CD&I Director, MCCDC.
- 3) AoA IPT members [ACAT II or programs of special interests]: Substitute or add members as required.

### Background

- Commanding General, MCSC acquisition policy letter 1-07 dtd 09 Feb 2007 outlines the planning, execution and acceptance of AoAs for all ACAT level programs.
- AoAs must be independent of the PM and may not be conducted under the PM's direct supervision.
- A new analysis effort should not be initiated if the preferred alternative has already been identified by previous analyses and the MDA and CD&I formally agree. Instead, the current PM should develop an AoA Fulfillment package that documents the previous analysis. The package will be staffed by the AoA IPT Secretariat for signature of all the AoA IPT members.

### Purpose and Program Benefits

An AoA provides the means to field the preferred capability concept identified in the ICD and illustrate key program cost-benefit tradeoffs and performance drivers by:

- Considering wide-ranging alternatives that explore the "art of the possible".
- Identifying attainable, realistic and measurable objective and threshold performance metrics for CDDs and CPDs, especially KPPs and KSAs.
- Providing a comparison of materiel solution/concepts on the basis of cost and effectiveness (or benefit) and illuminating the efficient frontier.
- Early interaction with other System of Systems (SoS) or Family of Systems (FoS) elements required to achieve full capability.
- Allows input from Marine Corps Operational Test and Evaluation Activity (MCOTEA) early to ensure testable system parameters

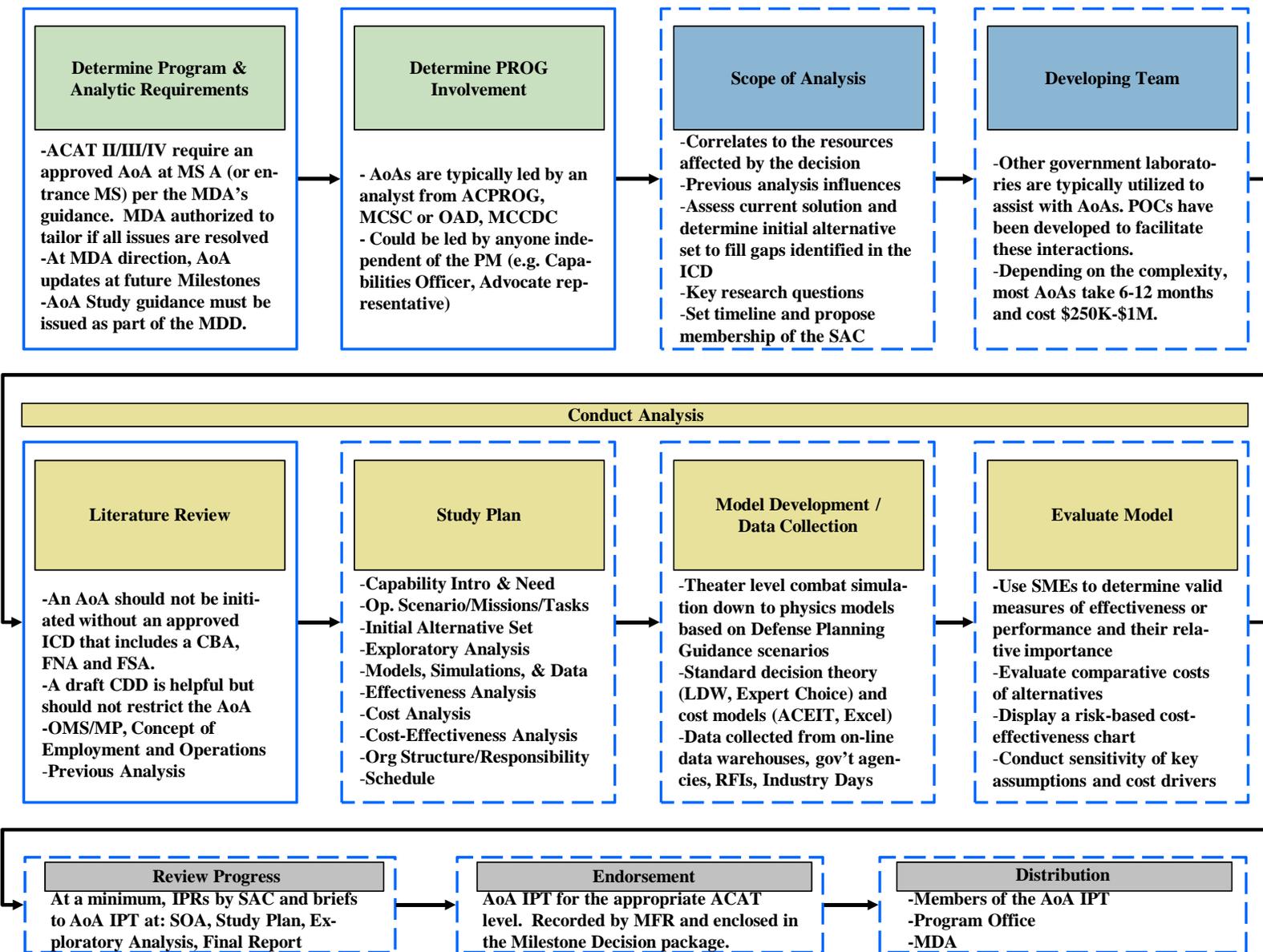
### Process

- Planning
  - Form a study advisory committee (SAC) of stakeholders to generate a Scope of Analysis (SOA) and Study Guidance for AoA IPT approval.
  - Review applicable requirements documentation and previous analysis.
- Execution
  - Conduct exploratory analysis to first identify and then screen alternatives.

- Gather SME input and review literature to identify tasks, conditions, and standards and their corresponding measures of effectiveness/performance.
- Submit a draft final report to approval/endorsement authorities.
- Acceptance
  - Senior Stakeholders via AoA IPT review, critical comments addressed.
  - Joint CD&I & MDA review and acceptance.
  - Promulgation to Stakeholders.
- Fulfillments
  - Programs should contact the AoA Secretariat for AoA Fulfillments. These are granted based on previous analysis conducted that fulfills the AoA requirement.

#### References

MCSC Acquisition Policy Letter 1-07, 09 Feb 2007  
SECNAVINST 5000.2  
DON Acquisition and Capabilities Guidebook  
DODI 5000.02



Appendix H APB Inputs to Section C (with sunk costs from program initiation)

<b>Section C</b>				
<b>NOTE: The APB Section C should not be utilized for ACAT level determination. However, if Base Year (BY) values are converted to Constant FY 2000 dollars, this could inform of ACAT level criteria.</b>				
	<b>ORIGINAL APB (Date)</b>		<b>UPDATED APB (Date)</b>	
<b>Then Year (\$K)</b>				
<b>Item</b>	<b>Objective</b>		<b>Objective</b>	
Acquisition Cost, RDT&E				
Procurement Cost (Acquisition), (e.g., PMC)				
Acquisition Cost, MILCON				
Acquisition Cost, O&M				
O&M				
Civ Pers				
Acquisition Cost, (other Appn as required)				
Acquisition Cost Sub-total				
Other Cost, RDT&E				
Other Cost, Procurement				
Other Cost, MILCON				
Other Cost, O&M				
O&M				
Civ Pers				
Other Cost, (other Appn as required)				
Other Cost Sub-total				
Total				
<b>Base Year (BY\$K)</b>				
<b>Item</b>	<b>Objective</b>	<b>Threshold</b>	<b>Objective</b>	<b>Threshold</b>
Acquisition Cost, RDT&E				
Procurement Cost (Acquisition), (e.g., PMC)				
Acquisition Cost, MILCON				
Acquisition Cost, O&M				
O&M				
Civ Pers				
Acquisition Cost, (other Appn as required)				
Acquisition Cost Sub-total				
Other Cost, RDT&E				
Other Cost, Procurement				
Other Cost, MILCON				
Other Cost, O&M				
O&M				
Civ Pers				
Other Cost, (other Appn as required)				
Other Cost Sub-total				
Total				
<b>Unit Cost (BY20XX \$K)</b>				
<b>Item</b>	<b>Objective</b>	<b>Threshold</b>	<b>Objective</b>	<b>Threshold</b>
Average Procurement Unit Cost (APUC)				
Program Acquisition Unit Cost (PAUC)				
<b>Quantities</b>				
Procurement Quantity				
Program Acquisition Quantity				

APB Section C Notes:
This template should be used for both weapon and IT/AIS systems, reflect the LCCE, and populated per these notes.
The base year of the APB should be in the year of "program initiation" (normally MS B) and any subsequent APB should also be converted to that same base year as the original APB for comparison. Sunk costs should be included from "program initiation" and further should be defined within the ADM.
Acquisition Cost (All acquisition related appropriations) is equal to the sum of the development cost for prime mission equipment, the development cost for support items; and the system-specific facilities cost. These are only costs associated with program initiation through FOC.
Procurement Cost (Acquisition) equals the sum of the procurement cost for prime mission equipment, the procurement cost for support items, and the procurement cost for initial spares. These are only costs associated with program initiation through FOC.
Other Cost (All acquisition related appropriations) is all other costs associated with the respective appropriation beyond FOC and those other costs not associated with any of the Acquisition costs.
Total rows for the objective values, which are in Then Year (TY) adjusted for inflation and Base Year (BY), should reflect the LCCE.
The starting point for objective values are derived from the highest total cost of the unadjusted point estimate, median, or mean then applied at that confidence interval for each appropriation (i.e. highest total is at mean therefore each appropriation shown at the mean).
Threshold values for each appropriation are 10% higher than the objective value.
Procurement Quantity is the quantity associated with the procurement costs. This is typically "N/A" for IT/AIS.
Program Acquisition Quantity is the total number of fully configured end items (to include research and development (R&D) units) a DOD component intends to buy through the life of the program, as approved by USD(AT&L). This quantity may extend beyond the FYDP years but shall be consistent with the current approved program. This is typically "N/A" for IT/AIS.
APUC is calculated by dividing the Procurement Costs (Base Year) by the Procurement Quantity row (this item is sometimes referred to Average Unit Procurement Cost (AUPC) and is calculated the same). If the Procurement Quantity is "N/A", then this category is also "N/A".
PAUC is calculated by dividing the Acquisition Costs (Base Year) by the Program Acquisition Quantity row. If the Program Acquisition Quantity is "N/A", then this category is also "N/A".

## Appendix I References and Other Training Resources

Below are the references used to compile this document as well as those commonly used by MCSC, Cost & Analysis Community.

### Federal

- Federal Acquisition Regulation (FAR)  
<https://www.acquisition.gov/far/>
- General Accounting Office (GAO)  
<http://www.gao.gov/>
- GAO-09-3SP, United States Government Accountability Office, Cost Estimating and Assessment Guide, Best Practices for Developing and Managing Capital Program Costs  
<http://www.gao.gov/products/GAO-09-3SP>
- Office of Management and Budget (OMB)  
<http://www.whitehouse.gov/omb>
- Office of Personnel Management Salary Tables  
<http://www.opm.gov/oca/>
- USC Title 10 - Armed Forces  
<http://uscode.house.gov/>
- USC Title 40 - Public Buildings, Property, and Works  
<http://uscode.house.gov/>

### Department of Defense

- Analysis of Alternatives
  - AoA Handbook, 2010  
[https://mcscviper.usmc.mil/sites/mcscebab/References%20%20General%20Information/AoA\\_Handbook.pdf](https://mcscviper.usmc.mil/sites/mcscebab/References%20%20General%20Information/AoA_Handbook.pdf)
  - Reliability, Availability, Maintainability, and Cost (RAM-C) Report  
<http://www.acq.osd.mil/se/docs/DoD-RAM-C-Manual.pdf>
- DODD 5000.01 The Defense Acquisition System  
<https://acc.dau.mil/CommunityBrowser.aspx?id=314789&lang=en-US>

- DODI 5000.02 Operation of the Defense Acquisition System  
<http://www.dtic.mil/whs/directives/corres/pdf/500002p.pdf>
- DOD 5000.73 Cost Analysis Guidance and Procedures  
<http://www.dtic.mil/whs/directives/corres/pdf/500073p.pdf>
- DOD 5000.04-M-1 Cost and Software Data Reporting (CSDR) Manual  
<http://www.dtic.mil/whs/directives/corres/publ.html>
- MIL-STD-881C Department of Defense Standard Practice, Work Breakdown Structure for Defense Materiel, October 3, 2011  
<https://acc.dau.mil/CommunityBrowser.aspx?id=482538>
- Defense Acquisition Guidebook  
<https://dag.dau.mil/Pages/Default.aspx>
- Department of the Defense Cost Analysis Symposium (DODCAS)  
<https://www.ncca.navy.mil/dodcas/index.cfm>
- Department of Finance and Accounting Services (DFAS), Military Pay Tables  
<http://www.dfas.mil/militarymembers.html>
- Department of Finance and Accounting Services (DFAS), Civilian Pay Tables  
<http://www.dfas.mil/civilianemployees.html>
- DOD Better Buying Power  
<http://bbp.dau.mil/>
- Economic Analysis (Major Automated Information System (MAIS))  
<https://dap.dau.mil/acquipedia/Pages/ArticleDetails.aspx?aid=92151a90-cd55-4468-a697-524b3b4deac1>
- Improving Milestone Process Effectiveness Memo, June 23, 2011  
[https://www.ncca.navy.mil/references/kendall\\_memo\\_23jun11.pdf](https://www.ncca.navy.mil/references/kendall_memo_23jun11.pdf)
- Resetting the Planning, Programming, Budgeting, and Execution Process, June 12, 2014  
[https://www.ncca.navy.mil/references/PPBE\\_OSD\\_Memo.pdf](https://www.ncca.navy.mil/references/PPBE_OSD_Memo.pdf)
- DoD Product Support BCA Guidebook  
<https://acc.dau.mil/bca-guidebook>

- Integrated Baseline Review  
<https://dap.dau.mil/acquikipedia/Pages/ArticleDetails.aspx?aid=cf5eb839-0881-4044-9f23-2c675726b481>
  - Department of Defense Activity Address Directory (DODAAD), 17 Aug 1987 (MCO 4420.4H W/CH 1)
  - <http://www.marines.mil/Portals/59/Publications/MCO%204420.4H%20W%20CH%201.pdf> Defense Acquisition University (DAU)  
<http://www.dau.mil/default.aspx>
  - DOD Cost Guidance Home Page  
<https://www.cape.osd.mil/costguidance/>
  - Defense Information Systems Agency  
<http://www.disa.mil/>
  - Defense Federal Acquisition Regulation (DFAR)  
<http://www.acq.osd.mil/dpap/dars/dfarspgi/current/index.html>
  - Under Secretary of Defense, Acquisition Technology and Logistics (USD,AT&L), Memorandum for Acquisition and Logistics Professionals, Implementation of Will-Cost and Should-Cost Management, April 22, 2011  
[https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3285/USD\\_ATL\\_Memo\\_Should-Cost%20Will-Cost\\_April\\_22\\_2011.pdf](https://dap.dau.mil/policy/Lists/Policy%20Documents/Attachments/3285/USD_ATL_Memo_Should-Cost%20Will-Cost_April_22_2011.pdf)
  - Full Cost of Manpower (FCoM) cost analysis tool  
<https://fcom.cape.osd.mil/>
  - Operating and Support Cost-Estimating Guide, Office of the Secretary of Defense  
<https://acc.dau.mil/CommunityBrowser.aspx?id=188404>  
  
[https://www.ncca.navy.mil/references/caig\\_os\\_guide.pdf](https://www.ncca.navy.mil/references/caig_os_guide.pdf)
  - Required Signed and Documented Component-level Cost Position for Milestone Reviews Memo, March 12, 2009  
[https://www.ncca.navy.mil/references/Required\\_Signed\\_Documented\\_Component\\_level\\_Cost\\_Position\\_for\\_Milestone\\_reviews\\_dtd03\\_12\\_09.pdf](https://www.ncca.navy.mil/references/Required_Signed_Documented_Component_level_Cost_Position_for_Milestone_reviews_dtd03_12_09.pdf)
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## Department of the Navy

SECNAVINST 5000.2E Department of the Navy Implementation and Operation of the Defense Acquisition System and the Joint Capabilities Integration and Development System

[https://www.ncca.navy.mil/references/SECNAVINST\\_5000.2E.pdf](https://www.ncca.navy.mil/references/SECNAVINST_5000.2E.pdf)

- SECNAVINST 5223.2A Department of the Navy Cost Analysis  
[https://www.ncca.navy.mil/references/SECNAVINST\\_5223.2A.pdf](https://www.ncca.navy.mil/references/SECNAVINST_5223.2A.pdf)
- SECNAVINST 5420.196A Establishment and Review of Department of the Navy Independent Cost Estimates for Acquisition Category's IC and IA Programs, December 03, 2012  
[https://www.ncca.navy.mil/references/SECNAVINST\\_5420.196A.pdf](https://www.ncca.navy.mil/references/SECNAVINST_5420.196A.pdf)
- Department of the Navy Independent Cost Assessment Manual  
[https://www.ncca.navy.mil/references/DON\\_ICA\\_Manual.pdf](https://www.ncca.navy.mil/references/DON_ICA_Manual.pdf)
- Department of the Navy Cost Estimating Guide  
[https://www.ncca.navy.mil/references/DON\\_Cost\\_Estimating\\_Guide.pdf](https://www.ncca.navy.mil/references/DON_Cost_Estimating_Guide.pdf)
- Department of the Navy Total Ownership Cost Guidebook  
[https://www.ncca.navy.mil/references/DON\\_TOC\\_Guidebook.pdf](https://www.ncca.navy.mil/references/DON_TOC_Guidebook.pdf)
- Department of the Navy Service Cost Positions Memo, January 7, 2010 ((ASN(RD&A) and ASN(FM&C))  
[https://www.ncca.navy.mil/references/ASN\\_FM-C\\_ASN\\_RD-A\\_DoN\\_SCP\\_Memo\\_07012010.pdf](https://www.ncca.navy.mil/references/ASN_FM-C_ASN_RD-A_DoN_SCP_Memo_07012010.pdf)
- Department of the Navy Acquisition Business Management  
<https://www.ncca.navy.mil/references.cfm>
- Department of the Navy Cost Analysis Symposium (DON-CAS)  
<https://www.ncca.navy.mil/doncas/index.cfm>
- Department of the Navy Economic Analysis Guide:
  - DON Economic Analysis Guide Terms, Definitions, explanations and best practices;  
[https://www.ncca.navy.mil/references/DON\\_Economic\\_Analysis\\_Guide.pdf](https://www.ncca.navy.mil/references/DON_Economic_Analysis_Guide.pdf)
  - DON Economic Analysis Quick-Start Guide, step-by-step instructions;  
[https://www.ncca.navy.mil/references/DON\\_Economic\\_Analysis\\_Quick\\_Start\\_Guide.pdf](https://www.ncca.navy.mil/references/DON_Economic_Analysis_Quick_Start_Guide.pdf)

- Department of the Navy Economic Analysis Template;  
[https://www.ncca.navy.mil/references/DON\\_Economic\\_Analysis\\_Template.docx](https://www.ncca.navy.mil/references/DON_Economic_Analysis_Template.docx)
- Naval Center for Cost Analysis (NCCA)  
<https://www.ncca.navy.mil/>
- Naval Center for Cost Analysis (NCCA) Joint Inflation Calculator (JIC)  
<https://www.ncca.navy.mil/tools/inflation.cfm>
- Naval Sea Systems Command Cost Estimating Handbook  
<http://www.navsea.navy.mil/Home/05C/CostEstimatingHandbook.aspx>
- NCCAINST 4451.1B Department of the Navy Cost Estimating Documentation Policy and Guide, September 28, 2012  
[https://www.ncca.navy.mil/references/NCCAINST\\_4451.1B\\_CEDP.pdf](https://www.ncca.navy.mil/references/NCCAINST_4451.1B_CEDP.pdf)
- Cost Analysis Requirements Description (CARD) Interim Policy (18 Jun 15)  
<https://acc.dau.mil/CommunityBrowser.aspx?id=723414>
- Implementation of Should Cost Management Memo, July 19, 2011 (ASN(RD&A))  
[https://www.ncca.navy.mil/references/DON\\_Should\\_Cost\\_Signed\\_Memo.pdf](https://www.ncca.navy.mil/references/DON_Should_Cost_Signed_Memo.pdf)
- Joint Memorandum on Savings Related to "Should Cost", April 22, 2011 (USD(AT&L) and USD(C/CFO))  
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[https://mcscviper.usmc.mil/sites/mcscebab/References%20%20General%20Information/Acquisition%20Policy%20Letter%201-07,%20Analysis%20of%20Alternatives%20\(AoA\).pdf](https://mcscviper.usmc.mil/sites/mcscebab/References%20%20General%20Information/Acquisition%20Policy%20Letter%201-07,%20Analysis%20of%20Alternatives%20(AoA).pdf)

#### **Other References & Links**

- Automated Cost Estimating Integrated Tools (ACEIT)  
<http://www.aceit.com/>
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<http://www.cna.org/centers/cna>
- Institute for Operations Research and the Management Sciences (INFORMS)  
<http://www.informs.org/>
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<http://www.iceaaonline.com/>
- Department of the Army Cost Analysis Manual, US Army Cost and Economic Analysis Center  
<http://asafm.army.mil/offices/LinksDocuments.aspx?OfficeCode=1400>
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<https://acc.dau.mil/psm-guidebook>

- SPAWAR Instruction 7720.4, Policy and Responsibilities for SPAWAR Cost Estimating and Analysis Division (SPAWAR 1.6)  
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## Appendix J Acronyms

The acronyms and terms found in Appendix J pertain to the body of knowledge found in the CAG. For a more exhaustive list, refer to the Defense Acquisition University (DAU) Glossary of Defense Acquisition Acronyms and Terms located at: <https://dap.dau.mil/glossary/Pages/Default.aspx>

AA	Affordability Analysis
AAP	Abbreviated Acquisition Program
AC PROG	Assistant Commander for Programs
ACAT	Acquisition Category
ACE	Automated Cost Estimating
ACEIT	Automated Cost Estimating Integrated Tools
ADM	Acquisition Decision Memorandum
AIS	Automated Information System
AoA	Analysis of Alternatives
APB	Acquisition Program Baseline
APM	Assistant Program Manager
APUC	Average Procurement Unit Cost
ASN (RDA)	Assistant Secretary of the Navy (Research, Development and Acquisition)
ASN(FM&C)	Assistant Secretary of the Navy (Financial Management and Comptroller)
ATP	Authority to Participate
AT&L	Acquisition Technology and Logistics
BA	Benefit Analysis
BCA	Business Case Analysis
BES	Budget Estimate Submission
BY	Base Year
C&A	Cost and Analysis
C&AB	Cost and Analysis Branch
C&AC	Cost and Analysis Community
CAE	Component Acquisition Executive
CAG	Cost Analysis Guidebook
CAO	Competency Aligned Organization
CAPE	Cost and Program Evaluation
CARD	Cost Analysis Requirements Description
CCDR	Contractor Cost Data Report
CCP	Component Cost Position
CDD	Capabilities Development Document
CDF	Cumulative Distribution Function
CEMM	Cost Element Methodology Matrix
CER	Cost Estimating Relationship

CES	Cost Element Structure
CIO	Chief Information Officer
CNA	Center for Naval Analysis
COMMARSSYSCOM	Commander Marine Corps Systems Command
COR	Contracting Officer Representative
CPD	Capabilities Production Document
CRB	Cost Review Board
CRM	Comment Resolution Matrix
CSCI	Computer Software Configuration Item
CSDR	Cost and Software Data Reporting
CTS	Contractor Technical Services
CV	Coefficient of Variation
CY	Constant Year
DAES	Defense Acquisition Executive Summary
DAG	Defense Acquisition Guidebook
DAMIR	Defense Acquisition Management Information Retrieval
DAU	Defense Acquisition University
DBS	Defense Business System
DCARC	Defense Cost and Resource Center
DOD	Department of Defense
DON	Department of the Navy
DR	Decision Review
DRPM	Direct Report PM
DSS	Decision Support System
EA	Economic Analyses
ECP	Engineering Change Proposal
ESS	Enterprise Support Services
EVM	Earned Value Management
FDT	First Destination Travel
FFRDC	Federally Funded Research and Development Centers
FOC	Full Operational Capability
FOS	Family of Systems
FRP	Full Rate Production
FY	Fiscal Year
FYDP	Future Years Defense Program
GFE	Government Furnished Equipment
GFI	Government Furnished Information
GFM	Government Furnished Material
GFP	Government Furnished Property
GR&A	Ground Rules and Assumptions
HQMC	Headquarters Marine Corps
IA	Independent Assessment

IBR	Integrated Baseline Review
ICD	Initial Capabilities Document
ICA	Independent Cost Assessment
ICE	Independent Cost Estimate
IGCE	Independent Government Cost Estimate
IMS	Integrated Master Schedule
IPM	Integrated Program Management
IPT	Integrated Planning Team
IPR	In Progress Review
ISA	In Service Authority
IT	Information Technology
ITR	Independent Technical Review
JCIDS	Joint Capabilities Integration and Development System
JIC	Joint Inflation Calculator
JROC	Joint Requirements Oversight Committee
KPP	Key Performance Parameters
KSA	Key System Attribute
LCC	Life Cycle Cost
LCCE	Life Cycle Cost Estimate
LCCM	Life Cycle Cost Model
LLI	Long Lead Items
LRIP	Low Rate Initial Production
MAIS	Major Automated Information System
MAR	Major Automated Information System (MAIS) Annual Report
MAT	Milestone Assessment Team
MCOTEA	Marine Corps Operational Test and Evaluation Activity
MCSC	Marine Corps Systems Command
MDA	Milestone Decision Authority
MDAP	Major Defense Acquisition Program
MDD	Materiel Development Decision
MILCON	Military Construction
MILPERS	Military Personnel
MQR	MAIS Quarterly Report
MS	Milestone
NCCA	Naval Center for Cost Analysis
NSWC	Naval Surface Warfare Center
O&M	Operations and Maintenance
O&MMC	Operations and Maintenance Marine Corps
O&MMCR	Operations and Maintenance, Marine Corps Reserve
O&S	Operations and Support
OMB	Office of Management and Budget
OPN	Other Procurement Navy

OUSD(AT&L)	Office of the Under Secretary of Defense Acquisition Technology & Logistics
OUSD(C)	Office of the Under Secretary of Defense Comptroller
PA&E	Program Analysis and Evaluation
P&R	Programs and Resources
PANMC	Procurement of Ammunition, Navy and Marine Corps
PAUC	Program Acquisition Unit Cost
PB	President's Budget
PCG	POM Coordinating Group
PdM	Product Manager
PEB	Program Evaluation Board
PEO	Program Executive Officer
PIP	Product Improvement Program
PjM	Project Manager
PLCCE	Program Life Cycle Cost Estimate
PM	Program Manager
PMB	Performance Measurement Baseline
PMC	Procurement Marine Corps
PME	Prime Mission Equipment
PMO	Program Management Office
POA&M	Plan Of Action and Milestones
POE	Program Office Estimate
POM	Program Objective Memorandum
PoPS	Probability of Program Success
PPBES	Planning, Programming, Budgeting, and Execution System
RDT&E	Research Development Test and Evaluation
ROI	Return On Investment
SAC	Study Advisory Committee
SAR	Selected Acquisition Report
SAT	Systems Approach to Training
SCP	Service Cost Position
SECNAVINST	Secretary of the Navy Instruction
SME	Subject Matter Expert
SPAWAR	Space and Naval Warfare Systems Command
SRDR	Software Resources Data Reporting
SECNAV	Secretary of the Navy
SLOC	Source Lines of Code
SOA	Scope of Analysis
SOS	System of Systems
SRDR	Software Resources Data Reports
SYSCOM	Systems Command
TOC	Total Ownership Costs
ORSA	Operations Research and Systems Analysis

OSD	Office of the Secretary of Defense
TRB	Technical Review Board
TY	Then Year
WBS	Work Breakdown Structure
USMC	United States Marines Corps

## Appendix K Signature Pages

Program Name CARD

Date

### COST ANALYSIS REQUIREMENTS DESCRIPTION

## Appendix K1 CARD Signature Page Template (when MDA is ASN RDA or USD AT&L)

### Submitted by:

\_\_\_\_\_  
NAME (Signer's name in all capital letters)  
Program Manager XXXXX

\_\_\_\_\_  
Date

### Technically Reviewed by:

\_\_\_\_\_  
NAME  
Assistant Program Executive Officer – Engineering  
XXXXX (e.g. Land Systems Marine Corps)

\_\_\_\_\_  
Date

\_\_\_\_\_  
NAME  
Assistant Program Executive Officer – Logistics  
XXXXX (e.g. Land Systems Marine Corps)

\_\_\_\_\_  
Date

### Cost & Analysis Review by:

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader or  
Program Executive Officer Lead Analyst

\_\_\_\_\_  
Date

### Accepted by:

\_\_\_\_\_  
NAME  
Cost & Analysis Branch Head

\_\_\_\_\_  
Date

### Approved by:

\_\_\_\_\_  
NAME  
Program Executive Officer  
XXXXX (e.g. Land Systems Marine Corps)

\_\_\_\_\_  
Date

Program Name CARD

Date

**COST ANALYSIS REQUIREMENTS DESCRIPTION**

Appendix K2 CARD Signature Page Template (when MDA is COMMARCORSYSCOM or PEO)

**Submitted by:**

\_\_\_\_\_  
NAME (Signer's name in all capital letters)  
Project Manager XXXXX

\_\_\_\_\_  
Date

**Technically Reviewed by:**

\_\_\_\_\_  
NAME  
Assistant Program Manager – Engineering

\_\_\_\_\_  
Date

\_\_\_\_\_  
NAME  
Assistant Program Manager – Logistics

\_\_\_\_\_  
Date

**Cost & Analysis Review by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader or  
Program Executive Officer Lead Analyst

\_\_\_\_\_  
Date

**Accepted by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Branch Head

\_\_\_\_\_  
Date

**Approved by:**

\_\_\_\_\_  
NAME  
Program Manager, XXXXX

\_\_\_\_\_  
Date

Program Name CARD

Date

**COST ANALYSIS REQUIREMENTS DESCRIPTION**

**Appendix K3 CARD Signature Page Template (when MDA is PM)**

**Submitted by:**

\_\_\_\_\_  
NAME (Signer's name in all capital letters)  
Project Officer XXXXX

\_\_\_\_\_  
Date

**Technically Reviewed by:**

\_\_\_\_\_  
NAME  
Assistant Product Manager – Engineering

\_\_\_\_\_  
Date

\_\_\_\_\_  
NAME  
Assistant Product Manager – Logistics

\_\_\_\_\_  
Date

**Cost & Analysis Review by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Study Director or  
Program Executive Officer Lead Analyst

\_\_\_\_\_  
Date

**Accepted by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader

\_\_\_\_\_  
Date

**Approved by:**

\_\_\_\_\_  
NAME  
Product Manager, XXXXX

\_\_\_\_\_  
Date

**LIFE CYCLE COST ESTIMATE (LCCE)**

**Appendix K4 LCCE Signature Page Template (when MDA is ASN RDA or USD AT&L)**

**Submitted by:**

\_\_\_\_\_  
NAME (Signer's name in all capital letters)  
Cost & Analysis Study Director or  
Program Executive Officer Lead Analyst

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Date

**Reviewed by:**

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NAME  
Program Manager, XXXXX

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Date

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader

\_\_\_\_\_  
Date

**Endorsed by:**

\_\_\_\_\_  
NAME  
COMMARCORSYSCOM or  
Program Executive Officer

\_\_\_\_\_  
Date

**Approved by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Branch Head

\_\_\_\_\_  
Date

## LIFE CYCLE COST ESTIMATE (LCCE)

### Appendix K5 LCCE Signature Page Template (when MDA is COMMARSYSCOM or PEO)

**Submitted by:**

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NAME (Signer's name in all capital letters)  
Cost & Analysis Study Director or  
Program Executive Officer Lead Analyst

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Date

**Reviewed by:**

\_\_\_\_\_  
NAME  
Project Manager, XXXXX

\_\_\_\_\_  
Date

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader

\_\_\_\_\_  
Date

**Endorsed by:**

\_\_\_\_\_  
NAME  
Program Manager, XXXXX

\_\_\_\_\_  
Date

**Approved by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Branch Head

\_\_\_\_\_  
Date

**LIFE CYCLE COST ESTIMATE (LCCE)**

**Appendix K6 LCCE Signature Page Template (when MDA is PM)**

**Submitted by:**

\_\_\_\_\_  
NAME (Signer's name in all capital letters)  
Cost & Analysis Study Director or  
Program Executive Officer Lead Analyst

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Date

**Reviewed by:**

\_\_\_\_\_  
NAME  
Project Officer, XXXXX

\_\_\_\_\_  
Date

**Endorsed by:**

\_\_\_\_\_  
NAME  
Program Manager, XXXXX

\_\_\_\_\_  
Date

**Approved by:**

\_\_\_\_\_  
NAME  
Cost & Analysis Team Leader

\_\_\_\_\_  
Date