

OPERATING AND SUPPORT
COST-ESTIMATING GUIDE



OFFICE OF THE SECRETARY OF DEFENSE
COST ANALYSIS IMPROVEMENT GROUP

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1. INTRODUCTION

1.1 PURPOSE

This guide was prepared by the Office of the Secretary of Defense (OSD) Cost Analysis Improvement Group (CAIG) for use by Department of Defense (DoD) Components (i.e., military departments and defense agencies) in developing estimates of system operating and support (O&S) costs. Mandatory procedures for Component life-cycle cost estimates are contained in DoD Manual 5000.4-M, *DoD Cost Analysis Guidance and Procedures* (ref e), and in DoD Instruction 5000.2, *Operation of the Defense Acquisition System* (ref b). The primary purpose of this guide is to review and explain the policies and procedures contained in these documents, focused on the preparation, documentation, and presentation of system O&S cost estimates that are reviewed by the OSD CAIG. A secondary purpose of this guide is to identify and define a set of standard categories of O&S cost elements—known as a cost element structure—that the military departments may use in making presentations to the OSD CAIG.

1.2 APPLICABILITY

This guide primarily focuses on the preparation of O&S cost estimates for major systems subject to CAIG review in support of the Defense Acquisition Board (DAB) process¹. However, some portions of this guide also may be useful for other O&S cost analyses such as cost-effectiveness or design trade studies. In addition, the guide's cost element structure provides a well-defined standard presentation format for historical system O&S costs collected through the Visibility and Management of Operating and Support Costs (VAMOSC) programs of the military departments². This guide is not intended for use in the estimation of costs associated with Major Automated Information Systems (MAIS).

¹ Readers not familiar with this process and its terminology should refer to the *Defense Acquisition Guidebook* (ref c), Chapter 1, for an introduction.

² Each of the military departments has established a VAMOSC system. The Army's system is Operating and Support Management Information System (OSMIS); the Navy's system is Naval VAMOSC; and the Air Force system is Air Force Total Ownership Cost (AFTOC).

1.3 SYNOPSIS

Chapter 2 of this guide provides an overview of system life-cycle costs, and explains where O&S costs reside as one element of life-cycle costs. Chapter 3 discusses the many uses of O&S cost information in support of the defense acquisition process. Chapter 4 explains the process and procedures associated with an OSD CAIG review, with emphasis on issues unique to O&S costs. In particular, Chapter 4 gives details on documentation requirements for O&S cost estimates presented to the OSD CAIG. Chapter 5 provides an overview on the selection of analytic methods to estimate O&S costs, based on the particular circumstances (such as acquisition milestone or phase) of the system being reviewed. Finally, Chapter 6 introduces a cost element structure that the components may use as a guide in developing and presenting the results of O&S cost estimates.

2. OVERVIEW OF LIFE-CYCLE COSTS

2.1 LIFE-CYCLE COST CATEGORIES AND PROGRAM PHASES

DoD 5000.4-M, *DoD Cost Analysis Guidance and Procedures* (ref e), provides standardized definitions of cost terms that in total comprise system life-cycle costs. Life-cycle cost can be defined as the sum of four major cost categories, where each category is associated with sequential but overlapping phases of the system life cycle. Life-cycle cost consists of (1) research and development costs, associated with the concept refinement phase, technology development phase, and the system development and demonstration phase, (2) investment costs, associated with the production and deployment phase, (3) O&S costs, associated with the sustainment phase, and (4) disposal costs, occurring after initiation of system phase-out or retirement, possibly including demilitarization, detoxification, or long-term waste storage. Figure 2-1 depicts a notional profile of annual program expenditures by cost category over the system life cycle.

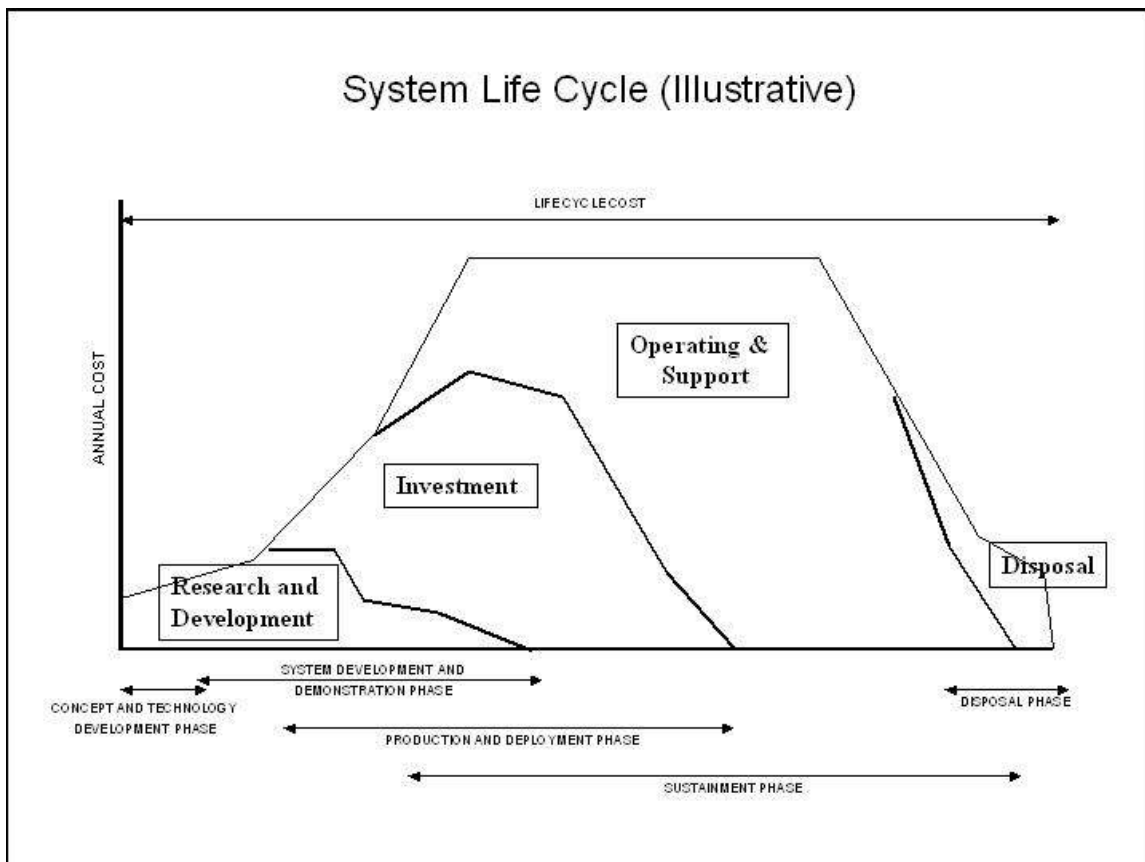


Figure 2-1. Illustrative System Life Cycle

2.2 LIFE-CYCLE COST CATEGORY DEFINITIONS

The following paragraphs summarize the primary cost categories associated with each program life-cycle phase:

- Research and Development. Consists of development costs incurred from the beginning of the conceptual phase through the end of the system development and demonstration phase, and potentially into low-rate initial production. Typically 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 program management; 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. Consists of production and deployment costs incurred from the beginning of low-rate initial production through completion of deployment. Typically includes costs associated with producing and deploying the primary hardware; system engineering and program management; 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. Consists of sustainment costs incurred from the initial system deployment through the end of system operations. 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. May include interim contractor support when it is outside the scope of the production program and the acquisition program baseline¹. 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. Direct costs refer to the resources immediately associated with the system or its operating unit. Indirect costs refer to the resources that provide indirect support to the system's manpower or facilities. For example, the pay and allowances (reflected in composite standard rates) for a unit-level maintenance technician would be treated as a direct cost, but the (possibly allocated) cost of medical support for the same technician would be an indirect cost.

¹ See DoD 7000.14-R, *Financial Management Regulation* (ref f), Chapter 1, section 010208, for guidance on funding policies concerning interim contractor support.

- Disposal. Consists of 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 and may not always be considered when preparing life-cycle cost estimates. 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.

The life-cycle cost categories correspond not only to phases of the acquisition process, but also to budget appropriations as well. Research and development costs are funded from RDT&E appropriations, and investment costs are funded from Procurement and MILCON appropriations. O&S costs are funded from Military Personnel, Operations and Maintenance, Procurement, and occasionally RDT&E appropriations.

2.3 IMPLICATIONS OF EVOLUTIONARY ACQUISITION

The application of life-cycle cost categories to program phases may need to be modified for programs with evolutionary acquisition strategies. DoD Instruction 5000.2, *Operation of the Defense Acquisition System* (ref b), describes the evolutionary acquisition approach for acquisition programs. In an evolutionary approach, the ultimate capability delivered to the user is provided in increasing increments. Evolutionary acquisition strategies (1) define, develop, produce and deploy an initial, militarily useful capability (Increment 1) based on proven technology, demonstrated manufacturing capabilities, and time-phased capabilities needs; and (2) plan for subsequent development, production and deployment of increments beyond the initial capability over time (Increments 2 and beyond). DoDI 5000.2 offers two types of approaches to achieve evolutionary acquisition:

Spiral Development. The capability needs document(s) include a firm definition of the first increment, but the remaining interim increments and the precise end-state capabilities are not known at program initiation. The acquisition strategy defines the first increment of capability, and how it will be funded, developed, tested, produced, and supported. The acquisition strategy also describes the desired general capability the evolutionary acquisition is intended to satisfy, and establishes a management approach that will be used to define the exact capabilities needs for each subsequent increment.

Incremental Development. The capability needs documents(s) include a firm definition of the entire end-state capability, as well as firm definitions of interim increments, including an initial operating capability (IOC) date for each increment. In this case, the program acquisition strategy defines each increment of capability and how it will be funded, developed, tested, produced, and operationally supported.

For a program with evolutionary acquisition, the question often arises concerning the scope of the life-cycle cost estimate presented at a milestone review. In the case of incremental development, the entire acquisition program (including all future increments) is included in the scope of the program to be approved at the review. The entire program therefore typically is included in the corresponding life-cycle cost estimate. In the case of spiral development, the situation will vary somewhat depending on circumstances. Normally, the life-cycle cost estimate should attempt to reflect as much of the program as can be defined at the time of the milestone review, and any exclusions (for portions of the program that cannot be defined at that time) should be clearly identified.

In either case, the application of life-cycle cost categories and program phases may need to be modified to account for the evolutionary acquisition strategy. Figure 2-2 depicts a notional profile of annual program expenditures by cost category for a program with evolutionary acquisition.

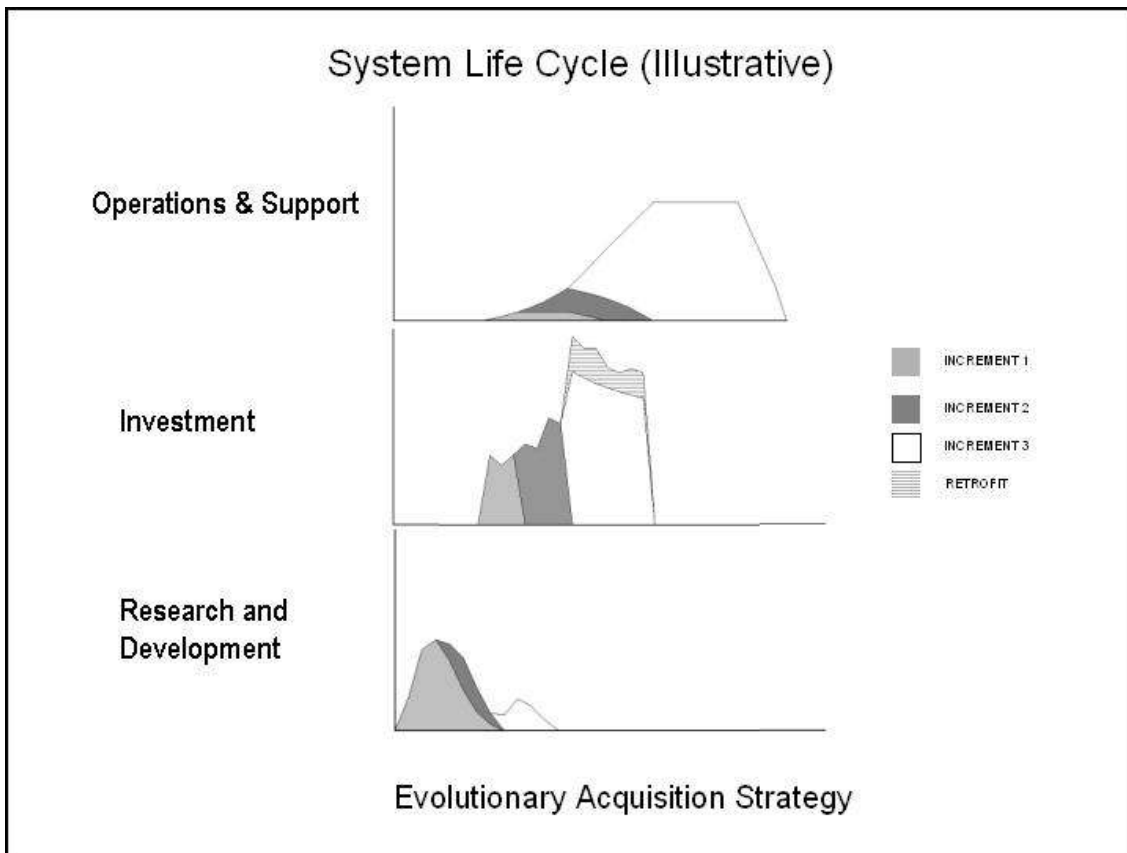


Figure 2-2. Illustrative System Life Cycle under Evolutionary Acquisition

Note that in the example illustrated above, any retrofit costs associated with upgrading the system to the final increment of capability is an investment cost. However, any modification cost associated with upgrading the system with new capabilities (beyond the final increment) is an O&S cost, except for the cost of any modification that qualifies as a major defense acquisition program in its own right.

3. ROLE OF O&S COST INFORMATION

3.1 INTRODUCTION

Although few or no O&S costs are incurred until after a system is deployed, many of the major program decisions that ultimately can determine a system's O&S costs are made early in the acquisition process. For that reason, beginning with program initiation, and at each subsequent acquisition decision milestone, O&S cost estimates play major roles in many different types of analyses and reviews. That point is the topic of this chapter.

3.2 COST AS AN INDEPENDENT VARIABLE

As stated in DoD Directive 5000.1, *The Defense Acquisition System*, (ref a), all participants in the acquisition system are expected to recognize the reality of fiscal constraints, and to view cost as an independent variable. Cost in this context refers to life-cycle cost, which should be treated as equally important to performance and schedule in program decisions. To institutionalize this principle, program managers may consider developing a formal Cost as an Independent Variable (CAIV) plan as part of the acquisition strategy. Part of such a plan may include the setting of cost goals and establishing a program of trade-off studies (most likely in conjunction with the system prime contractor). Further information on the implementation of a CAIV plan may be found in the *Defense Acquisition Guidebook* (ref c), Chapter 3.

O&S costs are specifically included in the CAIV process. O&S cost objectives may be established and included in the Acquisition Program Baseline (APB) at program initiation, and updated at each subsequent milestone review or program restructuring. The O&S cost goal typically would be an annual cost per deployable unit (e.g., battalion or squadron) or individual system (e.g., ship or missile). In some cases, O&S goals could be established in non-dollar terms (such as manpower requirements, or reliability and maintainability objectives). Further information on the setting of cost goals for the Acquisition Program Baseline may be found in the *Defense Acquisition Guidebook* (ref c), Chapter 2. In addition, O&S costs are a significant element in CAIV trade-off studies.

3.3 ANALYSIS OF ALTERNATIVES

An Analysis of Alternatives (AoA) is a study that is an important element of the defense acquisition process. An AoA is an analytical comparison of the operational effectiveness, suitability, and life-cycle cost of alternative programs that satisfy established capability needs. Initially, the AoA process typically explores numerous conceptual solutions with the goal of identifying the most promising options, thereby guiding the concept refinement phase. Subsequently, at Milestone B (which represents

the first major funding commitment to the acquisition program), the AoA is used to justify the rationale for formal initiation of the acquisition program. An AoA normally is not required at Milestone C unless significant changes to threats, costs, or technology have occurred, or the analysis is otherwise deemed necessary by the milestone decision authority. Further information on the Analysis of Alternatives process may be found in the *Defense Acquisition Guidebook* (ref c), Chapter 3.

With few exceptions, system O&S cost estimates are an important part of the Analyses of Alternatives. In most cases, the alternative that serves as the analysis baseline is the continuation (or service-life extension) of the existing system that the proposed acquisition program is intended to replace. Where the costs of various alternatives have significantly different time periods or distributions, appropriate discounting methods should be used to calculate the cost of each alternative.

3.4 AFFORDABILITY

DoD Directive 5000.1, *The Defense Acquisition System* (ref a), provides the fundamental acquisition policies for cost and affordability, as well as program stability. Affordability can be defined as the degree to which the life-cycle cost of an acquisition program is in consonance with the long-range modernization, force structure, and manpower plans of the individual DoD Components (military departments and defense agencies), as well as for the Department as a whole. For major defense acquisition programs, affordability assessments are required at Milestones B and C. The purpose of the assessment is for the DoD Component to demonstrate that the program's projected funding and manpower requirements are realistic and achievable, in the context of the DoD Component's overall long-range modernization plan. Further information on affordability assessments may be found in the *Defense Acquisition Guidebook* (ref c), Chapter 3.

Affordability assessments consider not only development and investment costs, but O&S costs as well. In addition, manpower (expressed in military end-strength and civilian full-time equivalents) is treated as a resource in affordability assessments, to determine if the program's manpower requirements are achievable within the Component's overall long-range manpower constraints. O&S costs and manpower are considered in these assessments to ensure that the new system will be affordable to operate and support. Typically, one method to evaluate the O&S affordability is to compare the estimated O&S costs for the new system to the projected O&S costs of the system being replaced (if there is one). One possible format for this type of comparison is discussed in the next chapter of this guide, and a sample of this format is provided in Appendix B.

3.5 FULL-FUNDING POLICY

It has been a long-standing DoD policy to seek full funding of acquisition programs, based on the most likely cost, in the budget year and out-year program years. Experience

has shown that full funding is a necessary condition for program stability. DoD Directive 5000.1, *The Defense Acquisition System* (ref a), affirms this full funding policy. Moreover, DoD Instruction 5000.2, *Operation of the Defense Acquisition System* (ref b), requires full funding—defined as inclusion of the dollars and manpower needed for all current and future efforts to carry out the acquisition and support strategies—as part of the entrance criteria for the transition into system development and demonstration.

Full funding is assessed by the milestone decision authority at each decision point. As part of this assessment, the milestone decision authority reviews the actual funding (in the most recent President’s Budget submission or Future Years Defense Program position) in comparison to the (time-phased) program office cost estimate or service cost position, as applicable. In addition, the milestone decision authority considers any funding recommendations made by the independent cost estimate team (either the OSD Cost Analysis Improvement Group for programs reviewed by the Defense Acquisition Board, or the DoD Component cost analysis team for programs delegated to the Component). If the milestone decision authority concludes that the current funding does not support the acquisition program, then the acquisition decision memorandum may direct a funding adjustment and/or program restructure in the next Future Years Defense Program update.

Early in the program, reviews of funding adequacy focus on development and investment costs. However, as the program nears or reaches low-rate initial production, O&S costs and associated funding may emerge as an area of review. Much of the O&S costs (such as unit manpower and unit operations) are typically funded by weapon system program, and straightforward comparisons between most likely cost and funding can be made and presented. Other O&S costs (such as indirect support and some depot maintenance) are centrally funded (i.e., not funded by individual weapon system accounts), making the comparisons much more difficult, if not impossible.

3.6 O&S COST INFORMATION AND PROGRAM MILESTONE

The nature of O&S cost estimates and cost comparisons depends on the acquisition program phase and the specific issues involved. DoD Instruction 5000.2, *Operation of the Defense Acquisition System* (ref b), describes the phases in the acquisition process and their associated milestone decision reviews. The major decision reviews are:

Milestone A	Decision to proceed with concept exploration
Milestone B	Decision to proceed with system development and demonstration
Milestone C	Decision to proceed with low-rate initial production
FRP Review	Decision to proceed with full-rate production (FRP)

At Milestone A, very little may be known about the system design, performance or physical characteristics, or operational and support concepts. Nevertheless, rough O&S cost estimates are expected, primarily to support the Analysis of Alternatives that guides the concept refinement phase as described earlier. At Milestone B, O&S cost estimates and comparisons ought to show increased fidelity, consistent with more fully developed

design and support concepts. O&S costs are very important at this formative stage. The long-term affordability of the program is assessed, program alternatives are compared in an update to the Analysis of Alternatives, and O&S cost objectives are established. At Milestone C and at the full-rate production decision review, O&S cost estimates should be updated and refined, based on the system's current design characteristics, the latest deployment schedule, and current logistics and training support plans. O&S experience obtained from system test and evaluation should be used to verify progress in meeting supportability goals or to identify problem areas. O&S cost objectives should be validated, and any funding issues associated with operations and support should be resolved.

4. OSD CAIG REVIEW PROCEDURES

4.1 INTRODUCTION

In the DAB process, the OSD CAIG serves as the principal advisory body to the milestone decision authority on the OSD assessment of a program's cost. This authority is established in DoD Directive 5000.04, *Cost Analysis Improvement Group* (ref d). For programs approaching major milestone decision points, the OSD CAIG conducts a review of the program office life-cycle cost estimate (or Component cost position, if applicable), and also prepares its own independent life-cycle cost estimate. In this capacity, the OSD CAIG has published its own guidance on criteria and procedures for the preparation, documentation, and presentation of cost estimates. This guidance is contained in DoD 5000.4-M, *DoD Cost Analysis Guidance and Procedures* (ref e), Chapter 2.

Section 4.2 provides a brief summary of the major events associated with an OSD CAIG review, and Section 4.3 provides additional clarifying discussion on the procedures for each event. These procedures apply to major defense acquisition programs—for which the milestone decision authority is the Under Secretary of Defense (Acquisition, Technology and Logistics)—reaching a Milestone B, Milestone C, or full-rate production decision review. They may also apply to other reviews when so directed by the USD(AT&L).

The discussion in the next section makes reference to the Defense Acquisition Board (DAB) and to the Overarching Integrated Product Team (OIPT). The DAB is the most senior oversight group chaired by the USD(AT&L). The OIPT is a mid-level group that charters the working-level integrated product teams (IPTs) for each review and manages their activities. At the milestone decision point, the OIPT leader provides the DAB members an integrated assessment of program issues using information gathered through the IPT process and various independent assessments.

4.2 OSD CAIG REVIEW TIMELINES

The following is a brief summary of the major events and timelines associated with an OSD CAIG review leading to a DAB milestone decision review. Days indicated are calendar days.

<u>Event</u>	<u>Date</u>
• Draft Cost Analysis Requirements Description (CARD) Delivered By Component	180 days before DAB meeting
• OSD CAIG Review Kick-off	180 days before DAB meeting

- Draft Documentation of Program Office Life Cycle Cost Estimate Delivered by Component 45 days before OIPT meeting
- Final Cost Analysis Requirements Description (CARD) Delivered By Component 45 days before OIPT meeting
- OSD CAIG Meeting 21 days before OIPT meeting
- Final Documentation of Program Office Life Cycle Cost Estimate Delivered by Component 10 days before OIPT meeting
- OSD CAIG Report Delivered to OIPT Members 3 days before OIPT meeting
- OIPT Meeting 2 weeks before DAB meeting
- DAB meeting

A more detailed discussion of these events is provided in the next section.

4.3 OSD CAIG REVIEW PROCEDURES

4.3.1 Cost Analysis Requirements Description

A sound cost estimate must be based on a well-defined program. The Cost Analysis Requirements Description (CARD) is used to formally define the acquisition program and the system itself for purposes of preparing both the program office cost estimate and the OSD CAIG independent cost estimate. The CARD is prepared by the program office and approved by the appropriate Program Executive Officer (PEO). DoD 5000.4-M, *DoD Cost Analysis Guidance and Procedures* (ref e), Chapter 1, provides complete guidelines for the preparation of the CARD.

Much of the CARD's content will be used in the O&S cost estimates. Naturally, the level of detail of the information contained in the CARD will vary depending upon the maturity of the program. The topics listed below are addressed in the CARD, in both narratives and tabular data.

- System description and characteristics
 - Performance characteristics
 - Technical and physical description
 - Software description and sizing
 - Advanced technologies and materials
 - Subsystem descriptions, as appropriate

- System suitability factors
 - Reliability
 - Maintainability
 - Availability
 - Portability and transportability
- Risk areas associated with O&S or sustainment
- System operational concept
 - Organizational/unit structure
 - Basing and deployment description
- System support concept
 - System logistics concept
 - Hardware maintenance and support concept
 - Software support concept
 - System training concept
- System quantity requirements--includes quantities deployed by year
- System manpower requirements¹
- System activity rates (operating tempo or similar information)
- System milestone schedule
 - Deployment and site activation
 - System life/O&S phasing
 - Interim contractor support
- Facilities requirements
- Special support
 - Unique infrastructure
 - Special environmental considerations

For each topic listed above, the CARD should provide information and data for the program to be costed. In addition, the CARD should include quantitative comparisons between the proposed system and a predecessor and/or reference system, as much as possible². A reference system is a currently operational or pre-existing system with a mission similar to that of the proposed system. It is often the system being replaced or augmented by the new acquisition. For a program that is a major upgrade to an existing weapon platform, such as an avionics replacement for an operational aircraft, the new

¹ CARD manpower requirements should be consistent with the Component's Manpower Estimate Report called for in DoDI 5000.2 (ref b).

² See DoD 5000.4-M, (ref e) page 1-3-1, for a suggested format for this comparison.

system would be the platform as equipped with the upgrade, and the reference system would be the platform as equipped prior to the upgrade.

Also, if the program office is proposing any modifications to the OSD CAIG cost element structure, the proposal should be included with the draft CARD.

Naturally, the level of detail provided in the CARD will depend on the maturity of the program. Programs at Milestone B are less well-defined than programs at Milestone C or at full-rate production. In cases where there are gaps or uncertainties in the various program descriptions, these uncertainties should be acknowledged as such in the CARD. This applies to uncertainties in either general program concepts or specific program data. For uncertainties in program concepts, nominal assumptions should be specified for cost-estimating purposes. For example, if the future depot maintenance concept were not yet determined, it would be necessary for the CARD to provide nominal (but specific) assumptions about the maintenance concept. For uncertainties in numerical data, ranges that bound the likely values (such as low, most likely, and high estimates) should be included. In general, values that are “to be determined” (TBDs) are not adequate for cost estimating. Dealing with program uncertainty in the CARD greatly facilitates subsequent sensitivity or quantitative risk analyses in the life-cycle cost estimate.

For programs employing an evolutionary acquisition strategy, the CARD should be structured to reflect the specifics of the approach. For programs in incremental development, the entire acquisition program, including all increments, is included in the scope of the program to be approved at the program initiation milestone review. The entire program therefore typically is included in the CARD and in the subsequent program life cycle cost estimate. For programs in spiral development, the situation will vary somewhat depending on circumstances. Normally, the CARD should attempt to include as much of the program as can be described at the time of the decision review, and clearly document any exclusions for portions of the program that cannot be defined.

Clearly, much of the information needed for the CARD is often available in other program documents. The CARD should stand-alone as a readable document, but can make liberal use of appropriate references to the source documents to minimize redundancy and effort. In such cases, the CARD should briefly summarize the information pertinent to cost in the appropriate section of the CARD, and provide a reference to the source document. The source documents should be readily available to the program office and independent cost estimating teams, or alternatively can be provided as an appendix to the CARD. Many program offices provide controlled access to source documents through a web site (perhaps at a .mil address or on the SIPRNET).

The CAIG staff promptly evaluates the CARD for completeness and consistency with other program documents (such as capability needs documents). The expectation is that the CARD should be sufficiently comprehensive in program definition to support a life-cycle cost estimate. Normally, the CAIG staff provides any necessary feedback to the DoD Component if any additional information or revisions are needed. If the CARD is

found to be deficient to the point of unacceptability, the CAIG Chair will advise the OIPT leader that the planned milestone review should be postponed.

4.3.2 Kickoff Meeting

An OSD CAIG kick-off meeting will be held with representatives from the program office cost estimating team, the OSD CAIG independent cost estimate team, and other interested parties (typically Component staff members). The purpose of the meeting is to discuss requirements and issues for the upcoming milestone review, the scope of the cost estimates, and ground rules and assumptions on which the estimates will be based. Much of the discussion will focus on material provided in the draft CARD. This ensures that both cost teams have a common understanding of the program to be costed. In addition, ground rules are established for CAIG interactions with the program office or other field organizations. The CAIG also may coordinate any travel or visit requirements with appropriate DoD Component points of contact.

O&S-related topics normally covered at the kickoff meeting include system characteristics, O&S concepts, manpower requirements, deployment and activity rate assumptions, choice of cost element structure, and the choice (and availability of data) for the predecessor and/or reference system.

4.3.3 Draft Documentation

The OSD CAIG report provided to the OIPT and to the DAB provides not only the OSD CAIG independent cost estimate, but also an evaluation of the program office cost estimate (or Component cost position, if applicable). It is therefore important for the DoD Components to submit well-documented cost estimates that are ready for review. The standards for the cost documentation are described in DoD Manual 5000.4-M (ref e). The documentation should be sufficiently complete and well organized that a cost professional could replicate the estimate, given the documentation.

Along with the draft documentation of the program office cost estimate, the DoD Component provides an updated (and final) CARD to the CAIG. The expectation is that at this point no further changes to program definition will be considered. At the same time that the documents are provided, the CAIG staff will brief the results of its preliminary independent life-cycle cost estimate to the program office or Component staff, providing feedback and identifying any emerging cost issues.

4.3.4 OSD CAIG Meeting

The sponsoring DoD Component presents the program office life cycle cost estimate (or Component cost position, if applicable) to the members of the OSD CAIG. Other invited OSD and Joint Staff representatives may attend the meeting. A suggested outline for this presentation is contained in DoD 5000.4-M (ref e). In most cases, there are

separate briefings concerning a program overview, research and development costs, investment costs, and O&S costs.

Normally, the Component presentation to the OSD CAIG concerning O&S costs will include the following:

- **O&S Cost Summary.** The presentation will begin with a brief summary of ground rules and assumptions (such as O&S period, number of deployed systems, operations and support concepts, etc.), and follow with a brief table-format summary of total O&S costs in constant dollars by OSD CAIG cost element and sub-elements (see Chapter 6 for the cost element structure). If necessary, the O&S cost summary may need to include a comparison of the program office cost estimate to the Component cost position (if different).
- **Estimating Methods for Major Cost Elements.** The presentation will include a discussion of estimating methods (and source data) for the high-cost cost elements and sub-elements.
- **Sensitivity and/or Quantitative Risk Analysis.** This section of the presentation would include an identification of the major cost-drivers (such as system reliability and maintainability) associated with the high-cost cost elements and sub-elements, and show the sensitivity of the costs to changes in cost-drivers. If available, a formal quantitative risk analysis is encouraged.
- **Time-Phased O&S Display.** The presentation will include a display of time-phased O&S costs by major time periods (such as deployment, steady-state, and phase-out periods), as well as a display of annual steady-state recurring O&S costs¹.
- **Annualized Steady-State Costs for Typical Unit.** The presentation should include a display of the annual system O&S costs for a typical deployable or operating unit (such as squadron or battalion) or single system (such as ship or missile), compared to similar costs for the predecessor and/or reference system.
- **Cost Track to Prior Estimate.** If applicable, the presentation should also include a comparison between the current O&S cost estimate, and the most recent previous estimate. Major differences should be explained.

¹ In the steady-state period, annual O&S costs may or may not be identical. In some cases, variations may occur due to long overhaul cycles or other reasons. In these cases, annual-steady state O&S costs would be calculated as the average annual O&S cost over the steady-state period.

Sample suggested formats for each of the topics above are provided in Appendix B. The formats may be modified as appropriate. In addition to the formats, any other information that would be helpful in understanding the program office O&S cost estimate is encouraged.

In addition, at the CAIG meeting, the CAIG staff will brief the results of its final independent life-cycle cost estimate, providing further feedback to the program office or Component staff. If appropriate, the CAIG will provide a presentation of any major areas of difference between its independent cost estimate and the program office cost estimate or Component cost position, as applicable.

4.3.5 OSD CAIG Report

The OSD CAIG's final report will be delivered to the OIPT leader three days before the OIPT meeting. Immediately thereafter, it will be distributed to the OIPT members and made available to the DoD Component staff. The expectation is that any issues had already emerged in prior discussions and that the final CAIG report should not contain any surprises. The report normally is two to three pages, and typically includes the following:

- Summary of program office cost estimate
- Summary of CAIG independent cost estimate
- Comparison of the two estimates
- Assessment of program risks
- Comparison of (time-phased) CAIG cost estimate to current program funding-- recommendations concerning program funding

5. O&S COST ESTIMATING PROCESS

5.1 INTRODUCTION

The previous two chapters in this guide primarily focused on procedures associated with O&S cost estimates for major systems--subject to review by the OSD CAIG--prepared in support of major milestone or other program reviews held by the Defense Acquisition Board. This chapter is more generally applicable, and describes a recommended analytic approach for planning, conducting, and documenting an O&S cost estimate (whether or not the estimate is subject to OSD CAIG review).

The recommended analytic approach for preparing an O&S cost estimate is shown in Figure 5-1 below.

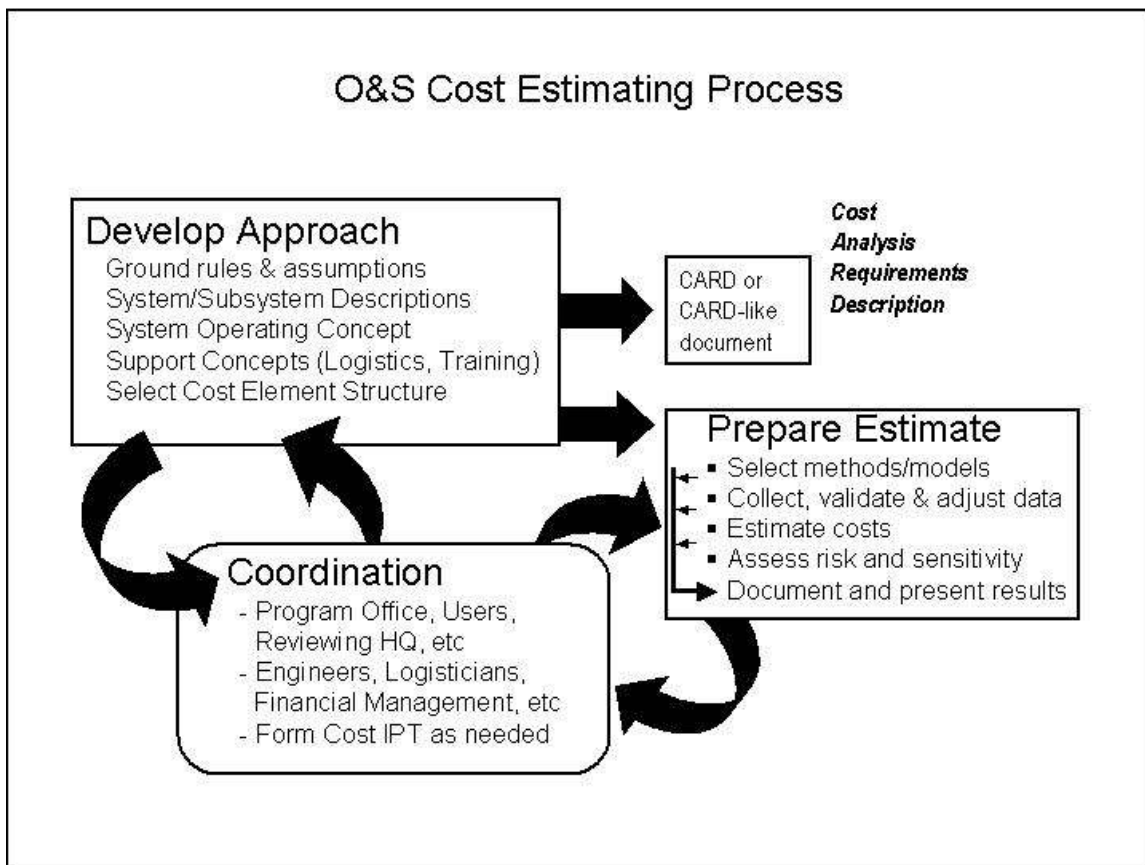


Figure 5-1. Recommended Analytic Approach for O&S Cost Estimates

The remainder of this chapter further describes this process.

5.2 DEVELOP APPROACH

The first step in preparing a credible O&S cost estimate is to begin with the development of a sound analytic approach. During this planning phase, critical ground rules and assumptions are established, and the program to be costed is carefully defined and documented. The program definition includes not only a technical description of the system (and perhaps major subsystems), but also a description of the system's O&S concepts. In addition, the choice of a cost element structure—a well organized and defined set of cost categories—is made to focus the future cost estimating effort. Each of these points is further amplified in the remainder of this section.

It also is important that the analytic approach to the O&S cost estimate be documented and reviewed by all potentially interested parties, before the actual work on preparing the cost estimate begins. This helps ensure that there are no false starts or misunderstandings later in the process.

Normally, O&S cost estimates sponsored by a system program office are prepared by a multi-disciplinary team with functional skills in cost analysis, financial management, logistics, engineering (including reliability and maintainability), and other talents. The team also should include participants or reviewers from major affected organizations, such as the system's operating command, product support center, maintenance depot, training center or command, and so forth. For sufficiently complex efforts, the estimating team may be organized as a formal Integrated Product Team (IPT). For independent O&S cost estimates, the team may be smaller and less formal, but the basic principle—complete coordination of the analytic approach with all interested parties—still applies.

5.2.1 Establish ground rules and assumptions

There usually are several assumptions that must be made before the actual O&S cost estimating can begin. Some of the more common ground rules and assumptions that need to be established are:

- **System Life/O&S Phasing.** The O&S estimate should extend over the full life expectancy of the system. Figure 5-2 displays some nominal life expectancies for some of the common classes of defense systems. Actual life expectancies will vary, and will depend on the system's durability requirements or specifications. The O&S phasing will include a phase-in period, the period during which the system is in steady-state operations, and a phase-down period. The timing of these three periods should be consistent with the planned deployment and retirement schedule. Figure 5-2 provides an example of this phasing for a system with a 20-year life expectancy.
- **Year Dollars/Inflation Indices.** O&S costs are usually presented in constant dollars—either in the dollars of the current fiscal year, or in a baseline year associated with the specific program. In addition, in some

cases, the near-term O&S costs by fiscal year are compared to the program annual O&S budget in current (then-year) dollars. The indices used to adjust for inflation should be specified and documented.

- War/Peace Conditions.** Normally, O&S costs are computed to reflect peacetime operations. However, in calculating peacetime support costs, it may be the case that some cost elements are resourced at levels able to support wartime operations in a surge condition.
- Scope of the Estimate.** In some cases, it is necessary to explicitly state the costs to be included, and the costs to be excluded. For example, when systems have complex interfaces with other systems or programs (that are outside the scope of the system being costed), the interfaces should be carefully defined.

Ground rules and assumptions made to estimate O&S costs should be consistent with any ground rules and assumptions made to estimate investment costs (such as initial spares or peculiar support).

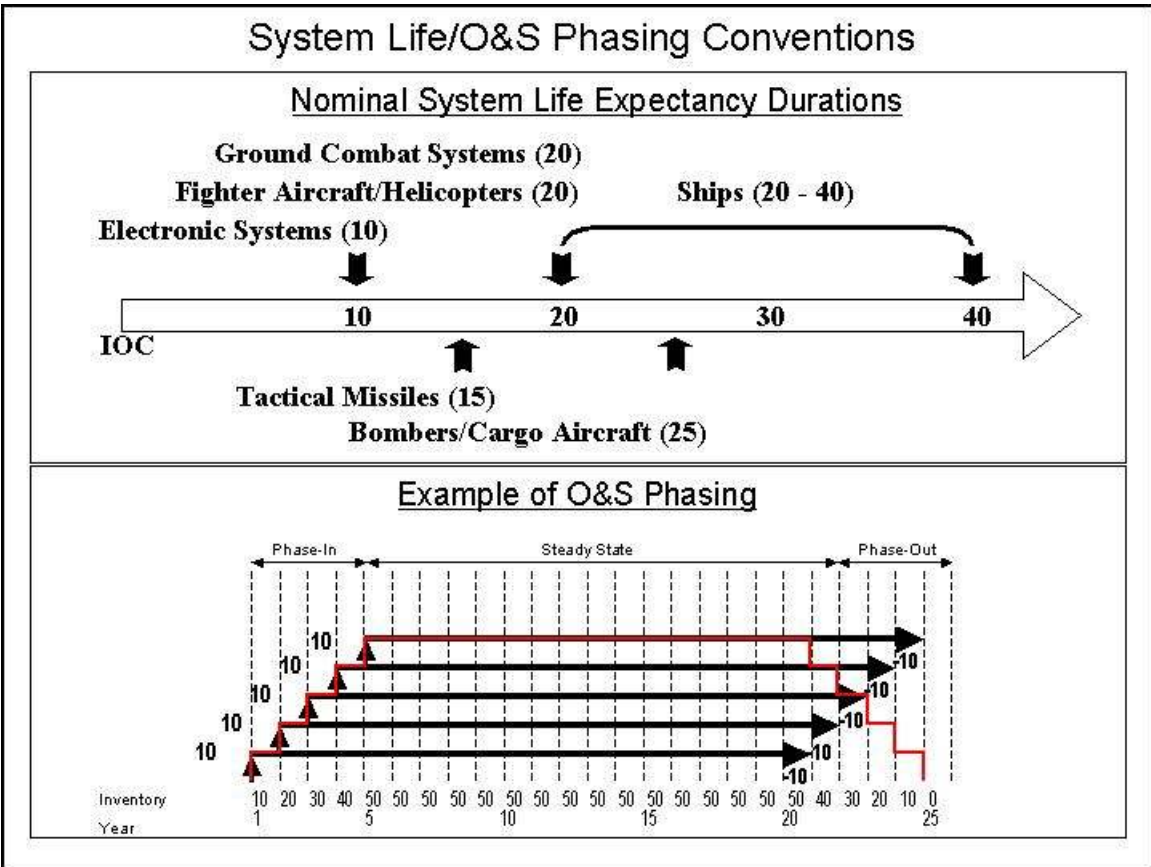


Figure 5.2. Examples of System Life/O&S Phasing Conventions

5.2.2 Define program and system content

In addition to establishing common ground rules and assumptions, it is a good practice to completely define the program content (i.e., describe what it is that will be costed). Figure 5-3 provides a brief summary of the topics that should be addressed prior to the initiation of an O&S cost estimate.

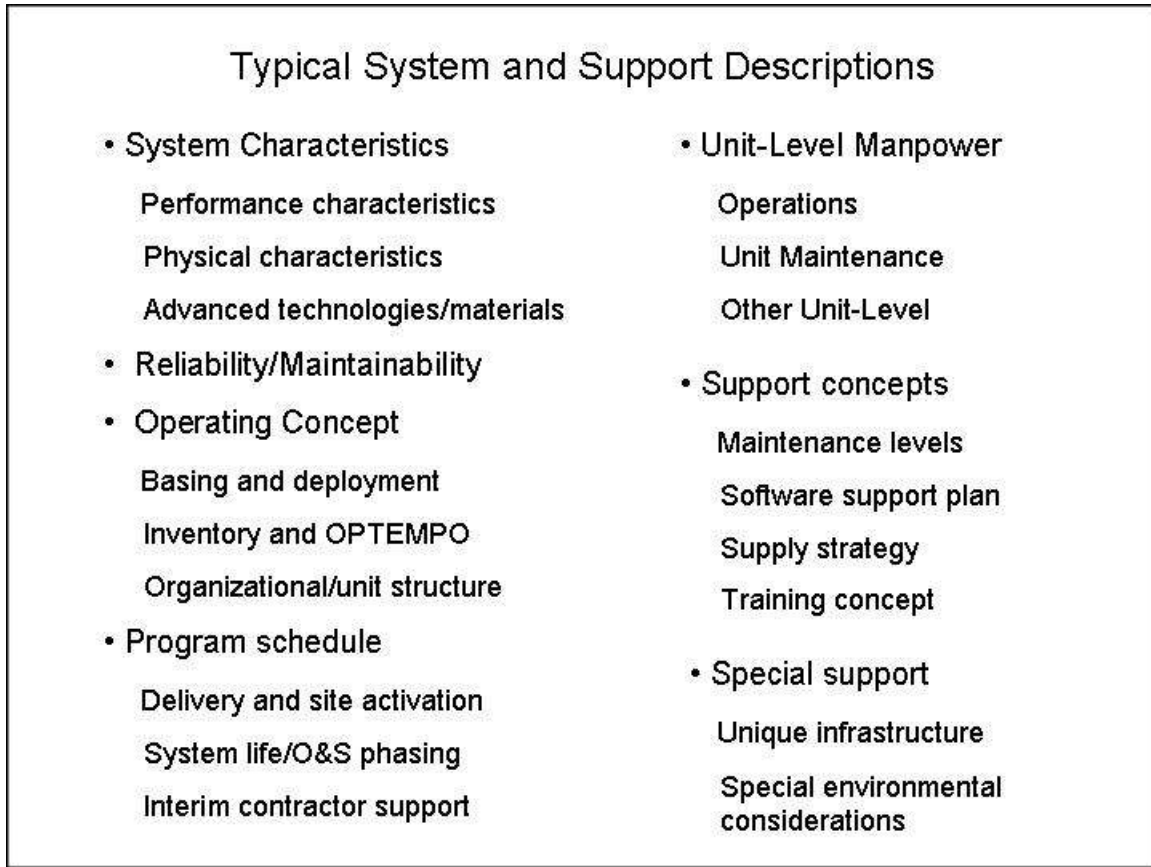


Figure 5.3. Typical Program and System Content

For programs that will be reviewed by the OSD CAIG, the program office is required to define its program in a comprehensive formal written document known as a Cost Analysis Requirements Description, or CARD. The format for this document is briefly summarized in Chapter 4 of this guide, and is completely described in DoD Manual 5000.4-M, DoD Cost Analysis Guidance and Procedures (ref e). For programs preparing an O&S cost estimate not subject to OSD CAIG review, the CARD format, possibly with appropriate tailoring, nevertheless provides a useful and flexible framework for developing a written program description suitable for an O&S cost estimate.

Most of the necessary information to prepare a written program description can be extracted and synthesized from common program source documents, such as:

- Capability Development Document (CDD)

- Capability Production Document (CPD)
- Acquisition Program Baseline (APB)
- Contract specifications
- Test and Evaluation Master Plan (TEMP)
- Manpower Estimate Report (MER)
- Product support strategy or Integrated Logistics Support Plan (ILSP)

The written program description should stand-alone as a readable document, but can make liberal use of suitable references to the source documents to minimize redundancy and effort.

In cases where there are gaps or uncertainties in the various program descriptions, this should be acknowledged in the written document. This applies to uncertainties in either general program concepts or specific program data. For uncertainties in program concepts, one or more specific candidate concepts (such as organic versus contractor depot maintenance concepts) should be specified. For uncertainties in numerical data, ranges that bound the likely values (such as low, most likely, and high estimates of system maintainability) should be included. These approaches to dealing with program uncertainty will greatly facilitate future sensitivity analyses in the O&S cost estimate.

5.2.3 Select cost element structure

The final step in developing the analytic approach to an O&S cost estimate is establishing the cost element structure that will be used as the format for the estimate. The cost element structure describes and defines the specific elements to be included in the O&S cost estimate in a disciplined hierarchy. Using a formal cost element structure (prepared and coordinated in advance of the actual estimating) identifies all of the costs to be considered, and organizes the estimate results¹. In instances with both program office and independent cost estimates, a common cost element structure allows meaningful comparisons.

Chapter 6 of this guide describes the standard cost element structure that the components may use in presenting O&S cost estimates to the OSD CAIG.

5.3 PREPARE ESTIMATE

The following paragraphs describe the normal steps in completing an O&S cost estimate. The discussion summarizes the steps entailed in selecting estimating techniques or models, collecting data, estimating costs, and conducting sensitivity or risk analysis. In addition, the importance of good documentation of the estimate is explained.

¹ The cost element structure is used to organize an O&S cost estimate similar to the way that a work breakdown structure is used to organize a development or production cost estimate. See DoD 5000.4-M (ref e), Chapter 3.

Throughout the preparation of the estimate, coordination with all interested parties remains important. Frequent in-progress reviews or meetings are usually a good practice.

5.3.1 Select methods or models

A number of techniques may be employed to estimate the O&S costs of a weapon system. The suitability of a specific approach will depend to a large degree on the maturity of the program and the level of detail of the available data. Most O&S estimates are accomplished using a combination of five estimating techniques:

- **Parametric.** The parametric technique uses regression or other statistical methods to develop Cost Estimating Relationships (CERs). A CER is an equation used to estimate a given cost element using an established relationship with one or more independent variables. The relationship may be mathematically simple (e.g. a simple ratio) or it may involve a complex equation (often derived from regression analysis of historical systems or subsystems). CERs should be current, applicable to the system or subsystem in question, and appropriate for the range of data being considered.
- **Analogy.** An analogy is a technique used to estimate a cost based on historical data for one (or occasionally two) analogous system(s)¹. In this technique, a currently fielded system, similar in design and operation to the proposed system, is used as a basis for the analogy. The cost of the proposed system is then estimated by adjusting the historical cost of the current system to account for differences (between the proposed and current systems). Such adjustments can be made through the use of factors (sometimes called scaling parameters) that represent differences in size, performance, technology, reliability and maintainability, and/or complexity. Adjustment factors based on quantitative data are usually preferable to adjustment factors based on judgments from subject-matter experts.
- **Engineering Estimate.** This technique uses discrete estimates of labor and material costs for maintenance and other support functions. The system being costed normally is broken down into lower-level components (such as parts or assemblies), each of which is costed separately. The component costs are then aggregated using simple algebraic equations to estimate the total system cost (hence the common name “bottoms-up” estimate). For example, system maintenance costs could be calculated for each system component using data inputs such as system operating tempo, component mean time between maintenance action, component mean labor hours to repair, and component mean

¹ An analogy may also be used to estimate a cost for a subsystem (such as airframe, hull, avionics, or propulsion).

material cost per repair. Engineering estimates require extensive knowledge of a system's (and its components) characteristics, and lots of detailed data (often obtained from the system prime contractor). These methods are normally employed for mature programs.

- **Actual Costs.** With this technique, actual cost experience or trends (from prototypes, engineering development models, and/or early production items) are used to project future costs for the same system. Such projections may be made at various levels of detail, depending on the availability of data. A common source for such data is the Visibility and Management of O&S Costs (VAMOSC) data system managed by each military department. VAMOSC data is described further in the next section.
- **Cost Factors.** Cost factors are applicable to certain cost elements not related to weapon system characteristics. Often, cost factors are simple per capita factors that are applied to weapon system direct (i.e., unit-level) manpower to estimate indirect cost elements such as base operations, military medical care, or general training and education (not associated with a specific weapon system).

In many instances, it is a common practice to employ more than one cost estimating method, so that a second method can serve as a cross-check to the preferred method. Analogy estimates are often used as cross-checks, even for mature systems.

5.3.2 Collect, validate and adjust data

There are many possible sources of data that can be used in O&S cost estimates. Regardless of the source, the validation of the data (relative to the purpose of its intended use) always remains the responsibility of the cost analyst. In some cases, the data will need to be adjusted or normalized. For example, in analogy estimates, the reference system cost should be adjusted to account for any differences—in system characteristics (technical, physical, complexity, or hardware cost), support concepts, or operating environment—between the reference system and the proposed system being costed.

For currently fielded major systems, historical cost data for the most part is available from the Visibility and Management of O&S Costs (VAMOSC) data system managed by each military service. Data can be obtained for entire systems, or at lower levels of detail. VAMOSC provides not only cost data, but may contain related non-cost data (such as operating tempo or maintenance manhours) as well. This type of data is useful for analogy estimates (between proposed systems and appropriate predecessor or reference systems) and for “bottoms-up” engineering estimates (for fielded systems or components, possibly adjusted for projected reliability and maintainability growth). VAMOSC data should always be carefully examined before use in a cost estimate. The data should be displayed over a period of a few years (not just a single year), and stratified by different sources (such as major command or base). This should be done so

that abnormal outliers in the data can be identified, investigated, and resolved as necessary.

VAMOSOC data is sometimes supplemented with more specialized reliability and maintainability data, which can be obtained from the military service maintenance data collection systems. The importance of data validation is equally important when this type of data is used in a cost estimate. In addition, VAMOSOC data for unit-level manpower is often supplemented with information from more detailed unit manning documents (such as tables of organization and equipment).

Data that can be used for detailed bottoms-up engineering estimates can often come from contractor data bases (such as logistics data management systems). Appropriate government personnel should validate this type of data before use, possibly on a sampling basis. This is especially important in cases when the hardware being costed is not mature (e.g., not yet tested or deployed). The validation should address the completeness of the component population, the realism of component reliability and maintainability estimates, the legitimacy of the component unit prices, and so forth.

5.3.3 Estimate costs

With the completion of the steps described earlier in this chapter, the actual computations of the O&S cost estimate can begin. The time and energy in front-end planning for the estimate is well worth the endeavor, since the amount of mid-course corrections and wasted effort will be minimized. In actual practice, the planning process may be more iterative than the sequence of discrete steps described earlier. Nevertheless, the basic principals displayed in Figure 5-1 remain valid and important.

5.3.4 Assess risk and sensitivity

For any system, estimates of future O&S costs are subject to varying degrees of uncertainty. The uncertainty is due to not only uncertainty in cost estimating methods, but also in uncertainties in program or system definition or in technical performance. Although this uncertainty cannot be eliminated, it is useful to identify associated risk issues and to attempt to quantify the degree of uncertainty as much as possible. This bounding of the cost estimate may be attempted through sensitivity analyses or through a formal quantitative risk analysis.

Sensitivity analysis attempts to demonstrate how the cost estimate would change if one or more assumptions change. Typically, for the high-cost elements, the analyst identifies the relevant cost-drivers, and then examines how costs vary with changes in the cost-driver values. For example, a sensitivity analysis might examine how maintenance manning varies with different assumptions about system reliability and maintainability values, or how system fuel consumption varies with system weight growth. In good sensitivity analyses, the cost-drivers are not changed by arbitrary plus/minus percentages, but rather by a careful assessment of the underlying risks. Sensitivity analysis is useful

for identifying critical estimating assumptions, but has limited utility in providing a comprehensive sense of overall uncertainty.

In contrast, quantitative risk analysis can provide a broad overall assessment of variability in the cost estimate. In risk analysis, selected factors (technical, programmatic and cost) are described by probability distributions. Where estimates are based on cost models derived from historical data, the effects of cost estimation error may be included in the range of considerations included in the cost risk assessment. Risk analysis assesses the aggregate variability in the overall estimate due to the variability in each input probability distribution, typically through monte-carlo simulations. It is then possible to derive an estimated empirical probability distribution for the overall O&S cost estimate. This allows the analyst to describe the nature and degree of variability in the estimate.

5.3.5 Document results

A complete cost estimate should be formally documented. The documentation serves as an audit trail of source data, methods and results. The documentation should be easy to read, complete and well organized--to allow any reviewer to understand the estimate fully. The documentation also serves as a valuable reference for future cost analysts, as the program moves from one acquisition milestone to the next.

The documentation should address all aspects of the cost estimate: all ground rules and assumptions; the description of the system and its O&S concepts; the selection of cost estimating methods; data sources; the actual estimate computations; and the results of any sensitivity or risk analyses. The documentation for the ground rules and assumptions, and the system description, should be written as an updated (final) version of the CARD or CARD-like document described in section 5.2.2 ("Define program and system content"). The documentation for the portion of the cost estimate dealing with data, methods, and results may be published separately from the CARD or CARD-like document, but if that is the case, the two documents should be completely consistent and refer to each other.

6. OSD CAIG COST ELEMENT STRUCTURE

6.1 INTRODUCTION

The cost structure in this document has been established as a guide to assist DoD cost analysts develop and present the results of O&S cost analyses. The intent is that this structure will be used as described in this guide, but it may need to be modified to accommodate unique circumstances that rise from time to time with new systems. When used to support a cost estimate that will be reviewed by the OSD CAIG, if the proposed O&S cost element structure is different than the one presented in this guide, then the proposed structure should be documented in the draft CARD and reviewed with the CAIG staff (see section 4.3.2 of this guide).

The OSD CAIG O&S cost structure categorizes and defines cost elements that cover the full range of O&S costs that could occur in any defense system. The cost structure identifies where a specific type of cost should appear in an estimate – if that cost applies to the system for which the estimate is being done. Some cost elements refer to expenses that may not apply to every system. For example, ground radar systems do not have Training Munitions or Expendable Stores. In this case, the O&S estimate for the radar system would omit (or record as zero) that portion of the cost structure.

As business practices in the DoD evolve, it may become difficult to use the lowest levels of the cost structure exactly as defined in this guide. For example, the maintenance concept for a new system may not readily be described in terms of Organizational, Intermediate, and Depot Maintenance. In these cases, adjustments in the cost element structure may be required. Two principles should be followed in making these changes. First, costs should be retained in the same major category where they appear in the cost structure if at all possible. Second, if costs that cannot be segregated span two or more cost elements in different areas of the structure, then those costs should be assigned to the cost element that represents the predominant portion of the cost or allocated among the elements. For example, organizational and intermediate maintenance material costs may be indistinguishable in some cases and these costs can be combined and reported in as organizational level maintenance material. When such consolidations are necessary, appropriate notes should be included with the cost estimate documentation.

The O&S cost element structure is divided into six major categories. The basic scope and intent of the six major categories should be retained, even if changes are made to lower level entries. The six top-level categories are:

1.0 UNIT-LEVEL MANPOWER

Cost of operators, maintainers, and other support manpower assigned to operating units. May include military, civilian, and/or contractor manpower.

2.0 UNIT OPERATIONS

Cost of unit operating material (e.g., fuel and training material), unit support services, and unit travel. Excludes all maintenance and repair material.

3.0 MAINTENANCE

Cost of all maintenance other than maintenance manpower assigned to operating units. May include contractor maintenance.

4.0 SUSTAINING SUPPORT

Cost of support activities other than maintenance that can be attributed to a system and are provided by organizations other than operating units.

5.0 CONTINUING SYSTEM IMPROVEMENTS

Cost of hardware and software modifications to keep the system operating and operationally current.

6.0 INDIRECT SUPPORT

Cost of support activities that provide general services that cannot be directly attributed to a system. Indirect support is generally provided by centrally managed activities that support a wide range of activities.

Beyond these six levels, the cost element structure is organized as a hierarchy. The next lower level in the hierarchy is presented in Figure 6-1 below. Frequently, cost estimates are made at even lower levels in the hierarchy, depending on the availability of data.

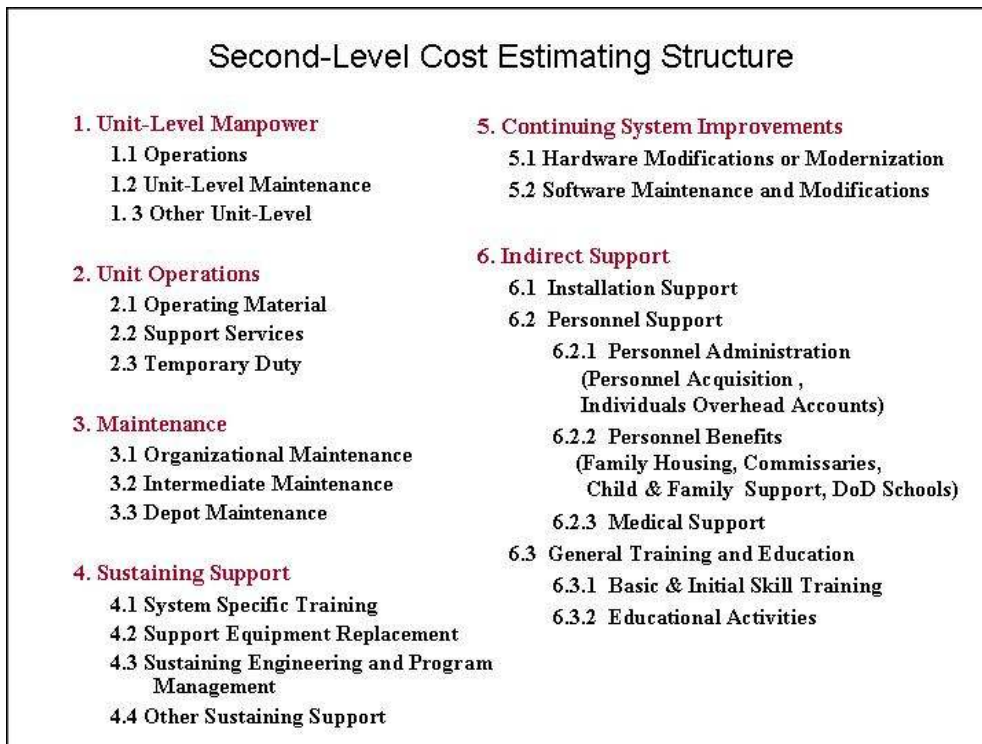


Figure 6.1. Second Level of Cost Element Structure Hierarchy

The next section explains the types of costs that are included in each major category and provides the subcategories at lower levels in the hierarchy.

6.2 DEFINITIONS

1.0 UNIT-LEVEL MANPOWER

The unit-level manpower element includes the costs of all operator, maintenance, and other support manpower at operating units (or at maintenance and support units that are organizationally related and adjacent to the operating units). Unit-level manpower includes active and reserve military, government civilian, and contractor manpower costs. While the cost elements in this category make the distinction between operators, maintainers, and other unit-level manpower, that distinction may not apply to all situations. For example, in O&S cost estimates for Navy ships, the ship manpower is typically estimated and documented for the entire crew as a whole, and is not broken down into operators, maintainers, and other support.

Unit-level manpower costs are intended to capture direct costs – i.e., costs of unit-level individuals that can be clearly associated with the system performing its intended defense mission. The scope of unit-level includes the lowest-level operating unit capable of independent system operations, and associated augmenting maintenance and support units (if any) integral to system operations. For systems owned by deploying units, the scope of unit-level manpower includes those operator, maintenance, and other support personnel that consistently deploy with the systems to their deployment locations¹. For example, for an Air Force aircraft, the scope of unit-level includes the aircraft squadron and associated maintenance and support units in the same wing. As another example, for an Army tank, the scope of unit-level includes the tank battalion and associated maintenance and support companies (typically organized in support battalions) in the same division. For systems not organized into units, such as ships or ground radar stations, the unit-level concept does not apply, and unit manpower costs may be estimated on an individual system basis.

Manpower associated with general and indirect support, such as manpower supporting base level functions, are accounted for as indirect costs, item 6.0. In other words, manpower included in functions covered by indirect costs (item 6.0) is not regarded as unit-level manpower.

To the extent possible, government manpower costs should be based on personnel grades and skill categories². Costs of military, government civilian, and contractor personnel should be shown separately in the estimate of unit-level manpower costs.

¹ For systems that deploy, the manpower that deploys with the system may be scenario dependent. The scope of unit-level manpower in an O&S cost estimate should include only the manpower that routinely deploys with the system, regardless of scenario.

² When available, the Manpower Estimate Report (MER) is a common source for system manpower requirements. See the *Defense Acquisition Guidebook* (ref c), section 3.5.

Manpower costs for active officers and enlisted personnel should include all of the elements of the DoD Standard Composite Rates for military personnel, which includes the following items: basic pay, retired pay accrual, basic allowance for quarters/variable housing allowance, basic allowance for subsistence/subsistence- in- kind, incentive and special pays, permanent change of station, and miscellaneous expenses such as the employers contribution to social security (FICA) and uniform/clothing allowances. (See DoD *Financial Management Regulation* (ref f), Volume 11A, Chapter 6, Appendix I for full definitions of categories--refer to the web site <http://www.defenselink.mil/comptroller/fmr/11a/11a06a0i.pdf>).

Manpower costs for reserve officers and enlisted personnel should include pay and allowances, retired pay accrual¹, FICA, clothing, and subsistence. PCS costs will be included for full-time members. Reserve manpower costs vary significantly among different categories of reserve personnel. Cost estimates of Reserve Component (RC) personnel should separately identify the number of personnel using the following categories²:

- Fulltime – Active Guard Reserve (AGR) members
- Drill Personnel (Pay Group A) – drilling members of a Selected Reserve Unit

The cost of drill personnel depends on the extent of their annual drill time. The average annual drill time should be used and documented in developing a cost estimate.

The costs of government civilian manpower should include all of the components of the DoD Composite Standard Rates for civilian employees, which include the following elements: basic pay, additional variable payments for overtime, holiday pay, night differentials, cost-of-living allowances, and the government contribution to employee benefits, insurance, retirement, and Social Security contributions. (See DoD *Financial Management Regulation* (ref f), Volume 2A, Chapter 3, Exhibit OP-8--refer to the web site <http://www.defenselink.mil/comptroller/fmr/02a/Chapter3.pdf>).

The costs of contractor manpower should be based on the full price of contract labor to the government (i.e., fully burdened).

1.1 Operations Manpower

The costs of all military, civilian, and contractor manpower required to operate a system. For example:

- Aircraft and Helicopters – Aircrews including pilots, navigators, mission specialists, load masters, etc.

¹ Retired pay accrual rates for reserve and active duty personnel are different.

² There are other categories of RC personnel than the two listed. These other categories are seldom relevant in an O&S cost estimate, but if they are part of the manning package, they also may be considered separately.

- Ships – Command staff, combat information center personnel, fire control (if operations, maintenance and other support categories are estimated separately)
- Electronic System – Console operators
- Armored Vehicles – Crew chief, tank commander, gunner, driver, loader

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

1.2 Unit-Level Maintenance Manpower

The costs of all military, civilian, and contractor manpower that performs unit-level maintenance on a primary system, associated support equipment, and unit-level training devices. This element includes the costs of organizational maintenance manpower (usually resident in the system operating unit) and unit-level intermediate maintenance personnel¹. The costs of intermediate-level maintenance personnel resident in a support organization that is not unit-level relative to the operating unit, such as a Navy shore-based Intermediate Maintenance Activity, are included in element 3.2 (Intermediate Maintenance). For cases where individuals maintain more than one system, manpower costs should be allocated on a relative workload basis.

1.3 Other Unit-Level Manpower

The cost of all military, civilian, and contractor manpower that performs administrative, security, logistics, safety, engineering, and other mission support functions at the unit level. These costs include only the costs of manpower positions that exist to wholly or predominately support the system whose costs are being estimated. For systems that deploy, these costs include the costs of manpower positions that routinely deploy to support the system². Some examples are:

- Unit Administrative Staff. Manpower required for unit command, administration, supervision, operations control, planning, scheduling, safety, quality control of crew training and operational proficiency, etc.
- Security. Manpower required for system security. Duties may include system level entry control, close and distant boundary support, and security alert operations. (Does not include base level access control unless the entire facility exists to solely to support the weapon system.)
- Logistics. Manpower required for logistics support. Functions may include supply, transportation, inventory control, fuel handling, etc.

¹ Unit-level organizational and intermediate maintenance manpower costs may be displayed separately (say as elements 1.2.1 and 1.2.2), if desired.

² For example, Air Force aircraft O&S cost estimates for unit-level manpower usually include the costs of security police that deploy with the aircraft. In this instance, the security police provide “inside-the-fence” protection directly tied to the mission of the aircraft. In contrast, Army tank O&S cost estimates for unit-level manpower normally would not include any costs for division military police. In this instance, the military police provide broad “outside-the-fence” support to the division commander not necessarily tied to the mission of the tank.

- Ordnance Support. Includes manpower providing munitions handling, weapons assembly, etc. Excludes any ordnance support manpower included in element 1.2 (unit-level maintenance).
- Other Support. Manpower required to provide system specific fixed and mobile communications, information, intelligence, photo interpretation, and other special mission support or to operate unit simulators and training devices.

2.0 UNIT OPERATIONS

Unit Operations includes the unit-level consumption of operating materials such as fuel, electricity, expendable stores, training munitions and other operating materials. Also included are any unit-funded support activities; training devices¹ or simulator operations that uniquely support an operational unit; temporary additional duty/temporary duty (TAD/TDY) associated with the unit's normal concept of operations; and other unit funded services. Unit-funded service contracts for administrative equipment as well as unit-funded equipment and software leases are included in this portion of the estimate. Unit Operating costs provided through a system support contract should be separately identified from those provided organically. (Simulator costs that provide support to multiple units should be included in 4.1 Sustaining Support/System Specific Training.)

2.1 Operating Material

2.1.1 Energy (Fuel, Petroleum, Oil and Lubricants [POL], Electricity)

These costs include cost of POL, propulsion fuel, and fuel additives used by systems in performing their normal peacetime missions. These costs also include the cost of field-generated electricity and commercial electricity necessary to support the operation of a system.²

2.1.2 Training Munitions and Expendable Stores

These costs include the unit-level consumption of training munitions, rockets, missiles, and expendable stores in the course of normal peacetime training missions. Includes the cost of live and inert ammunition, bombs, rockets, training missiles, sonobuoys, and pyrotechnics expended in training and non-combat firings such as firepower demonstrations. This category also includes other expendable stores such as chaff, flares, fuel tanks, travel pods or other items that lose their identity in use and may be dropped from stock record accounts when issued or used.

¹ The costs of operating simulators and other training devices owned by the operating unit would be broken out and included in the cost elements of Unit Operating Costs. For example, Operating Material costs for simulators would be included with the other Operating Material (2.1.1, 2.1.2, 2.1.3 as appropriate) of the unit. The operating material costs associated with trainers and prime operating system would be shown separately within the cost element if available at that level of detail.

² For a nuclear powered ship, the cost of the material associated with the recoring of a reactor can be regarded as an energy cost, whereas the cost of the recoring activity can be regarded as a ship overhaul cost.

2.1.3 Other Operational Material

This element includes operating material costs other than energy, training munitions, or expendable stores. The costs identified must be related to the system whose O&S requirements are being assessed. Illustrative examples include computer supplies, paper, diskettes, ribbons, charts, maps, and administrative supplies used for housekeeping, health and safety.

2.2 Support Services

This includes unit-level costs for purchased support services. These services may vary greatly from one unit to another. They may include but are not limited to:

- Un-reimbursed food services, rations, postal services (postage/box rental), laundry services.
- Lease or rental of administrative, computational, or support equipment or software.
- Lease costs of special facilities or land (e.g., for the storage of warheads and missiles)
- Unit-funded service contracts for administrative, computational, or support equipment.
- Communications services (e.g., data/voice links, dedicated lines, microwave channels), port services, and other unit-funded utilities not part of base operating support costs.
- Transportation costs for moving equipment (e.g., communications equipment, combat vehicles, missiles) to and from test ranges or training areas
- Transportation of personnel and material to remote operating sites for operations, maintenance, or support.

2.3 Temporary Duty

Temporary additional duty or temporary duty (TAD/TDY) pay and allowances costs include unit personnel¹ travel for training, administrative, or regularly scheduled training away from the unit's permanent operating location that are associated with a unit's concept of operations and support. TAD/TDY costs include military and commercial transportation charges, rental costs for passenger vehicles, mileage allowances, and subsistence expenses (e.g., per diem allowances and incidental travel expenses). Excludes temporary duty associated with contingencies or wartime operations.

3.0 MAINTENANCE

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

¹ Military, government civilian, or contractor.

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

3.1 Organizational Maintenance and Support

Organizational maintenance includes the cost of materials and other costs used to maintain a primary system, training devices, simulators, and support equipment. The costs of unit-level maintenance manpower are included with element 1.2.

Maintenance materials are broken into categories that may not be applicable in all services or for all types of systems. It is therefore acceptable to combine consumable and repair parts costs where a service's logistics system does not differentiate between them.

3.1.1 Organization-Level Consumables

Organizational consumable maintenance material includes the costs of material consumed in the maintenance and support of a primary system and its associated support and training equipment at the unit level. Illustrative types of maintenance consumables are coolants and deicing fluids. To the extent possible, the consumable material cost of the primary system, support equipment, training devices, and simulators should be separately identified.

3.1.2 Organization-Level Repair Parts

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

3.1.3 Organization-Level DLRs

Organizational level depot level reparable (DLRs) include the net¹⁰ cost the operating unit incurs for DLR spares (also referred to as exchangeable items) used to maintain equipment at the unit level¹¹. To the extent possible, the DLR costs of the primary system, support equipment, training devices, and simulators should be separately identified.

3.1.4 Contract Maintenance Services

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

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

¹⁰ Net cost reflects the credit units receive for returning serviceable items.

¹¹ DLR costs may be incurred at all levels of maintenance and are included in the maintenance cost at the level(s) where they occur.

3.1.5 Other Unit Maintenance (e.g., environmental costs, transportation, etc.)

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

3.2 Intermediate Maintenance

Intermediate maintenance includes the cost of labor and materials and other costs expended by intermediate level maintenance organization in support of a primary system, simulators, training devices, and associated support equipment. Where intermediate level maintenance activities cannot be separately identified from organizational level maintenance, the costs are often combined as either organizational or intermediate maintenance. Where organizational and intermediate maintenance material or labor costs are combined, the cost estimate should note that fact in the documentation to avoid an interpretation that a portion of the maintenance costs were omitted.

3.2.1 Intermediate Level Consumable Parts

The cost of government furnished consumable materials used in maintaining and repairing a primary system, simulators, training devices, and associated support equipment by intermediate-level maintenance activities.

3.2.2 Intermediate Level Repair Parts

The cost of government furnished repair parts used in maintaining and repairing a primary system, simulators, training devices, and associated support equipment by intermediate-level maintenance activities.

3.2.3 Intermediate Level DLRs

The cost of government furnished DLRs used in maintaining and repairing a primary system, simulators, training devices, and associated support equipment by intermediate-level maintenance activities.

3.2.4 Government Labor

The costs (using DoD Standard Composite Rates, or hourly equivalent) of military and government civilian manpower that performs intermediate maintenance on a primary system, simulators, training devices, or associated support equipment at intermediate-level maintenance activities. For cases where individuals maintain more than one system, manpower costs should be allocated on a relative workload basis. This cost element excludes any maintenance manning within the unit-level maintenance manning defined under element 1.2.

Note: In some cases, there may be contingents within the intermediate maintenance activity that deploy with the operating unit when deployed. For example, Navy and Marine Corps aircraft squadrons have a group of enlisted individuals who actually work for the supporting intermediate level maintenance activity, but nevertheless are included as part of the squadron manning document. In the Navy, this group of contingents is known as the Sea Operational

Detachment, and in the Marine Corps this group is known as the Marine Air Logistics Squadron Augmentation Unit. The normal practice in O&S cost estimates is to assign the manpower costs of such contingents to element 1.2 (unit-level maintenance), and to assign the remaining intermediate maintenance manpower associated with the system to this element.

3.2.5 Contractor Maintenance

The separate costs of burdened contract labor, material, and assets used in providing maintenance services to a primary system, simulators, training devices, and associated support equipment at intermediate-level maintenance activities.

3.2.6 Other Intermediate Maintenance (e.g., environmental costs, transportation, etc.)

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

3.3 Depot Maintenance

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

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

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

Note: For O&S cost estimates of Navy ships, the depot maintenance cost element is normally broken down into lower levels: scheduled ship overhaul, nonscheduled ship repair, and equipment rework. Scheduled ship overhaul is associated with Regular Overhauls (ROH) and Selected Restricted Availabilities (SRA). Nonscheduled ship repair is associated with Restricted Availabilities (RAV) and Technical Availabilities (TAV). In the CAIG cost element structure, fleet modernization is regarded as a continuing system improvement (element 5.0), and is not part of depot maintenance costs.

3.3.1 Government Depot Repair

Includes government labor, material, and support service costs for depot repair. If depot repair costs are estimated on the basis of a total charge for a specific function, such estimates should separately identify costs for labor, material, and support services, if possible.

Government Material. The cost of government furnished equipment (GFE) or other materials used for depot level maintenance activities. Includes consumables, DLRs, repair parts, assemblies, subassemblies, and material consumed in the maintenance and repair of a primary system or associated support equipment. DLR costs and other material detail costs are most often included in depot repair costs as part of the overall charge to the customer and are not typically identified separately; however, they may be identified separately if they are significant cost elements.

Government Labor. The cost (using DoD Standard Composite Rates, or hourly equivalent) of military and government civilian personnel who perform depot maintenance on a primary system or associated support equipment.

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

3.3.2 Contractor Depot Repair

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

3.3.3 Other Depot Maintenance

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

4.0 SUSTAINING SUPPORT

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

4.1 System Specific Training

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

4.1.1 System Specific Operator Training

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

4.1.2 System Specific Non-Operator Training

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

4.2 Support Equipment Replacement

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

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

4.3 Operating Equipment Replacement

The costs incurred to replace mission equipment or software due to technical obsolescence or to a life expectancy that is less than that for the entire system. This may include the costs of periodic technical refreshment in automated systems. Other examples may include mission equipment that has an expected life less than the system's mission life (e.g., some satellite systems) or perishable components of a weapon. These costs are not intended to account for losses due to accidental loss (e.g., attrition). If these changes result in or are a part of a weapon system's modifications, the costs may be reported under hardware or software modifications, elements 5.1 & 5.2.

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

4.4 Sustaining Engineering And Program Management

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

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

4.5 Other Sustaining Support (e.g., special sustaining test requirements)

This element includes any significant sustaining support costs not otherwise accounted for. This cost element may be used to identify expenses such as those listed below, if they apply to the system for which the estimate is being made:

- Test and evaluation¹ in support of deployed systems, such as range costs, test support, data reduction, and test reporting.
- Air, sea, and land support not funded by the unit and provided by other activities to verify the proper operation of an electronic, communication, sensor, or other similar system.
- Centrally provided technical assistance, such as Help Desks, that provide DoD-wide or Service-wide support.
- Communication services (e.g., data/voice links, dedicated lines, microwave channels), hardware, and software leases purchased on a DoD-wide or Service-wide basis for direct system specific support of a system.

5.0 CONTINUING SYSTEM IMPROVEMENTS

This portion of the cost element structure includes the costs of hardware and software updates that occur after deployment of a system that improve a system's safety, reliability,

¹ This is intended to record periodic testing of operational assets structured to confirm that the system continues to retain its operational capabilities. This would not include testing to support development activities or testing integral to development of hardware or software modifications.

maintainability, or performance characteristics to enable the system to meet its basic operational requirements throughout its life. These costs include government and contract labor, materials, and overhead costs. Costs should be separated into government and contractor costs within each cost element, if possible.

The continuing system improvements portion of an O&S estimate does not include all changes to a system developed subsequent to the initial delivered configuration. System improvements identified as part of an incremental evolutionary acquisition strategy or pre-planned product improvement program that are included in the acquisition cost estimate are not included in this portion of an O&S cost estimate. Any improvement of sufficient dollar value that it would qualify as a distinct Major Defense Acquisition Programs (MDAP) in its own right normally would not be included in this portion of the O&S cost estimate.

5.1 Hardware Modifications or Modernization

These costs include costs associated with modifying the defense system, support equipment, and training devices. All costs associated with developing, producing, and installing the modifications are included. When hardware modifications require changes in system or support software or technical documentation, these costs should be included with hardware modifications costs.

5.2 Software Maintenance & Modifications

The labor, material, and overhead costs incurred after deployment in supporting the update, maintenance and modification, integration, and configuration management of software. Depot-level maintenance activities, government software centers, laboratories, or contractors may incur these costs. Includes any licensing costs for software not owned by the operating units (see element 2.2). Includes operational, maintenance, support and diagnostic software programs for the primary system, support equipment, and training equipment. The respective costs of operating and maintaining the associated computer and peripheral equipment in the software support activity and the cost to conduct all testing of the software should also be included.

5.2.1 Correction Of Deficiencies

The costs to develop, test, and deploy software changes that correct defects in defense systems.

5.2.2 Software Enhancements

The costs to develop, test, and deploy software that enhances defense systems are included as long as those changes do not change the basic mission of the system.

6.0 INDIRECT SUPPORT

Indirect support costs are those installation and personnel support costs that cannot be directly related to the units and personnel that operate and support the system being analyzed.

O&S cost analyses should include marginal indirect costs. The intention is to include only the costs that would likely change if the action being analyzed (e.g., new system development, etc.) occurs.

Indirect support costs are more relevant in situations when total DoD manpower would change or when installations are affected (i.e., expanded, contracted, opened, or closed). Indirect support costs may also be relevant in analyses involving a choice between government and contracted support. In these cases it is important to compare the government and contracted alternatives on a comparable basis, including the relevant indirect costs of all alternatives¹.

6.1 Installation Support

Includes base operations support; facilities sustainment, restoration, and modernization; base communications; and other similar costs. Base operating support may include functions such as communications, supply operations, personnel services, installation security, base transportation, etc.

6.2 Personnel Support

Includes the costs for the acquisition, initial training, and quality of life programs necessary to maintain a quality force. Indirect personnel support costs are frequently allocated to a system based on the number and type of system-specific individuals identified in the Unit Manpower portion of the O&S cost estimate.

6.2.1 Personnel Administration

6.2.1.1 Personnel Acquisition

Includes costs for recruiting, examining and processing individuals into the military service and for advertising in support of recruiting activities.

6.2.1.2 Personnel Not Available For Duty (Transients, Prisoners, Patients, Students)

Includes the costs for military personnel placed in the personnel holding account because they are not available for assignment to a unit for medical or disciplinary reasons, or are about to be discharged. Includes military personnel not assigned to a unit because they are in transit to the next permanent duty station, to schooling, or other training.

6.2.2 Personnel Benefits

Includes costs for operation and maintenance of family housing child development centers, family centers, family advocacy programs, youth development programs, commissaries and DoD schools.

6.2.2.1 Family Housing

¹ OMB Circular A-76 establishes Federal policy regarding the performance of commercial activities and implements the statutory requirements of the Federal Activities Inventory Reform Act of 1998, Public Law 105-270. The Supplement to Circular A-76 establishes the procedures for determining whether commercial activities should be performed under contract with commercial sources or in-house using Government facilities and personnel.

Includes the operating and maintenance costs of dwelling units, community facilities, roads, driveways, walkways, and utilities for use by family housing occupants.

6.2.2.2 Dependent Support

Includes the costs of child development centers, youth development programs, family centers, family advocacy programs, counter-drug demand reduction programs, and other similar programs necessary to support the families of service members. Includes the education of dependents of federal employees in overseas assignments and for eligible dependents of federal employees residing on federal property where an appropriate public education is unavailable in the nearby community.

6.2.2.3 Commissaries And Exchanges

Includes the appropriated costs of employee salaries at defense commissaries.

6.2.3 Medical Support

The costs for medical care for active duty personnel and their dependents.

Includes provisions for patient care in regional defense facilities, station hospitals and medical clinics, and dental facilities as well as care in non-defense facilities.

Also includes TRICARE and other health support activities.

6.3 General Training and Education

The costs for general training and education not associated with a specific weapon or other system provided through central activities. Includes the costs of recruit and initial skills training¹; professional military education; and academic education programs.

¹ This includes undergraduate pilot and navigator training but not training for specific systems.

APPENDIX A: REFERENCES

- (a) DoD Directive 5000.1, The Defense Acquisition System, May 12, 2003
- (b) DoD Instruction 5000.2, Operation of the Defense Acquisition System, May 12, 2003
- (c) Defense Acquisition Guidebook, December 20, 2004
- (d) DoD Directive 5000.04, Cost Analysis Improvement Group (CAIG), August 16, 2006
- (e) DoD Manual 5000.4-M, DoD Cost Analysis Guidance and Procedures, December 1992 (update pending)
- (f) DoD 7000.14-R, Financial Management Regulation, February 10, 2005

The first three documents are available on-line at the Defense Acquisition Resource Center web site at: <http://akss.dau.mil/darc/darc.html>

The last three documents are available on-line at the Washington Headquarters Services (DoD Issuances) web site at: <http://www.dtic.mil/whs/directives>

APPENDIX B: SAMPLE PRESENTATION FORMATS

Section 4.3.4 of this guide provided a suggested outline for O&S cost presentations to the OSD CAIG. This appendix provides suggested sample formats that follow that outline. The formats may need to be modified as appropriate. In addition to the formats, any other information that would be helpful in understanding the O&S cost estimate is encouraged.

O&S COST ESTIMATE
PROGRAM OFFICE ESTIMATE (POE) OR
SERVICE COST POSITION (SCP)

DATE:
WEAPON SYSTEM:
CONSTANT FY___\$ (000)

GROUND RULES AND ASSUMPTIONS

OPERATIONS CONCEPT

Deployed Quantity
Average # of Systems/Unit
System optempo

O&S PHASING

System Life
Years of Phase-In
Years of Steady State
Years of Phase-Out

MAINTENANCE CONCEPT

Interim Contractor Support Period
Organic or Contractor Maintenance
Levels of Maintenance

SYSTEM MANNING

Crew Composition
Unit-Level Maintenance Manpower per System

Figure B-1A. SAMPLE GROUND RULES AND ASSUMPTIONS
(Can be modified and expanded, as needed)

O&S COST SUMMARY
PROGRAM OFFICE ESTIMATE (POE) OR
SERVICE COST POSITION (SCP)

DATE:
WEAPON SYSTEM:
CONSTANT FY___\$ (000)

SUMMARY

COST ELEMENTS

POE or SCP

UNIT-LEVEL MANPOWER

UNIT OPERATIONS

MAINTENANCE

SUSTAINING SUPPORT

CONTINUING SYSTEM IMPROVEMENTS

INDIRECT SUPPORT

GRAND TOTAL

Figure B-1B. SAMPLE O&S COST SUMMARY
(Can be presented as pie-chart, if desired)

O&S COST METHODS
 PROGRAM OFFICE ESTIMATE (POE) OR
 SERVICE COST POSITION (SCP)

DATE:
 WEAPON SYSTEM:
 CONSTANT FY___\$ (000)

<u>COST ELEMENTS</u>	<u>METHODS</u>	<u>POE or SCP</u>	<u>Method</u>
UNIT-LEVEL MANPOWER	Operations Unit Maintenance Other Unit-Level		
UNIT OPERATIONS	Operating Material Support Services Temporary Duty		
MAINTENANCE	Organizational Maintenance Intermediate Maintenance Depot Maintenance		

Figure B-2A. SAMPLE O&S COST METHODS
 (Can be expanded where appropriate)

O&S COST METHODS
 PROGRAM OFFICE ESTIMATE (POE) OR
 SERVICE COST POSITION (SCP)

DATE:
 WEAPON SYSTEM:
 CONSTANT FY___\$ (000)

<u>COST ELEMENTS</u>	<u>METHODS</u>	<u>POE or SCP</u>	<u>Method</u>
SUSTAINING SUPPORT	System Specific Training Support Equipment Replacement Sustaining Engineering/Program Management Other Sustaining Support		
CONTINUING SYSTEM IMPROVEMENTS	Hardware Modifications Software Maintenance and Modifications		
INDIRECT SUPPORT	Installation Support Personnel Support General Training and Education		
GRAND TOTAL			

Figure B-2B. SAMPLE O&S COST METHODS (cont.)
 (Can be expanded where appropriate)

O&S COST SENSITIVITY ANALYSES
 PROGRAM OFFICE ESTIMATE (POE) OR
 SERVICE COST POSITION (SCP)

DATE:
 WEAPON SYSTEM:
 CONSTANT FY___\$ (000)

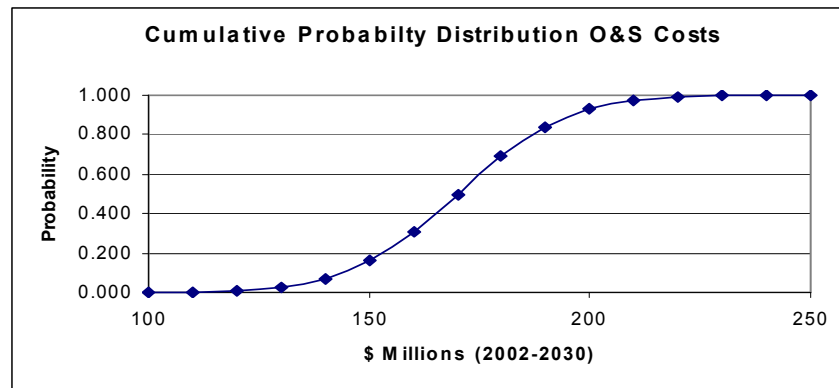
SENSITIVITY ANALYSES

<u>COST DRIVERS</u>	<u>RANGE OF POSSIBLE VALUES</u>			<u>% CHANGE IN O&S COST</u>		
	<u>LOW</u>	<u>BASE</u>	<u>HIGH</u>	<u>LOW</u>	<u>BASE</u>	<u>HIGH</u>
SYSTEM RELIABILITY					--	
SYSTEM MAINTAINABILITY					--	
FUEL CONSUMPTION					--	
OVERHAUL INTERVAL					--	
SOFTWARE SIZE					--	
SYSTEM UNIT PRICE(S)					--	
OTHER					--	

Figure B-3A. SAMPLE O&S COST SENSITIVITY ANALYSES
 (Can be modified and/or expanded)

O&S COST RISK ANALYSIS
PROGRAM OFFICE ESTIMATE (POE) OR
SERVICE COST POSITION (SCP)

DATE:
WEAPON SYSTEM:
CONSTANT FY___\$ (000)



COST DRIVERS

DISTRIBUTION

PARAMETERS

SYSTEM RELIABILITY

SYSTEM MAINTAINABILITY

FUEL CONSUMPTION

OVERHAUL INTERVAL

SOFTWARE SIZE

SYSTEM UNIT PRICE(S)

OTHER

Figure B-3B. SAMPLE O&S COST RISK ANALYSIS
(Can be modified and/or expanded)

O&S COST TIME-PHASING
PROGRAM OFFICE ESTIMATE (POE) OR
SERVICE COST POSITION (SCP)

DATE:
WEAPON SYSTEM:
CONSTANT FY__ \$ (000)

O&S TIME-PHASING

	PHASE-IN FY __ to FY __	STEADY-STATE FY __ to FY __	PHASE-OUT FY __ to FY __	TOTAL	ANNUAL STEADY-STATE
<u>COST ELEMENTS</u>					
UNIT-LEVEL MANPOWER					
UNIT OPERATIONS					
MAINTENANCE					
SUSTAINING SUPPORT					
CONTINUING SYSTEM IMPROVEMENTS					
INDIRECT SUPPORT					
GRAND TOTAL					

Figure B-4. SAMPLE O&S COST TIME-PHASING
(Can be presented as area-chart, if desired)

O&S COST TYPICAL UNIT COMPARISON
 ANNUAL STEADY-STATE O&S COSTS
 PROGRAM OFFICE ESTIMATE (POE) OR
 SERVICE COST POSITION (SCP)

TYPICAL UNIT ANNUAL STEADY-STATE

DATE:
 WEAPON SYSTEM:
 CONSTANT FY___\$ (000)

	REFERENCE SYSTEM (NAME)	PROPOSED SYSTEM (NAME)
<u>TYPICAL UNIT DATA</u>		
SYSTEMS/UNIT		
SYSTEM OPTEMPO		
<u>COST ELEMENTS</u>		
UNIT-LEVEL MANPOWER		
UNIT OPERATIONS		
MAINTENANCE		
SUSTAINING SUPPORT		
CONTINUING SYSTEM IMPROVEMENTS		
INDIRECT SUPPORT		
GRAND TOTAL		
TOTAL O&S \$/SYSTEM/YEAR		

Figure B-5. SAMPLE O&S COST TYPICAL UNIT COMPARISON
 (Typical unit is squadron, battalion, ship, or individual system)
 (Can be presented as stacked-bar chart, if desired)

O&S COST TRACK
 PROGRAM OFFICE ESTIMATE (POE) OR
 SERVICE COST POSITION (SCP)

DATE:
 WEAPON SYSTEM:
 CONSTANT FY___\$ (000)

COST TRACK

<u>COST ELEMENTS</u>	<u>CURRENT</u> <u>POE or SCP</u>	(Date) <u>PRIOR</u> <u>POE or SCP</u>	<u>DELTA</u>	<u>EXPLANATION</u>
UNIT-LEVEL MANPOWER				
UNIT OPERATIONS				
MAINTENANCE				
SUSTAINING SUPPORT				
CONTINUING SYSTEM IMPROVEMENTS				
INDIRECT SUPPORT				
GRAND TOTAL				

Figure B-6. SAMPLE O&S COST TRACK
 (Can be modified and/or expanded, as needed)
 (May need to normalize for quantity changes)