CH 2–1. Purpose
This chapter addresses Analysis of Alternatives (AoAs) and cost estimation. It provides explanations of the Office of the Secretary of Defense’s Office of Cost Assessment and Program Evaluation’s (CAPE’s) policies and procedures found in DoDI 5000.73, Cost Analysis Guidance and Procedures and the Operating and Support Cost Estimating Guidebook as well as information required by DoDI 5000.02, Operation of the Defense Acquisition System.

CH 2–2. Background

CH 2–2.1 Life-Cycle Cost Estimating
Independent and sound cost estimates are vital for effective acquisition decision-making and oversight. Cost estimates also support efficient and effective resource allocation decisions throughout the Planning, Programming, Budgeting, and Execution process. Life-cycle cost estimates cover the entire life cycle of the program and include the development, production, operations and support (including both sustainment and disposal) phases, regardless of funding source.

CH 2–2.1.1 Major Defense Acquisition Programs
DoDI 5000.02, Enc 10, sec. 2 requires that a DoD Component Cost Estimate (CCE) and DoD Component Cost Position (CCP) be submitted prior to an MDAP receiving Milestone A or B approval or entering low-rate initial production or full-rate production.

The CCE documents the cost analysis conducted by the Service Cost Agency (SCA) in cases where the SCA is not developing an independent cost estimate (ICE). This cost analysis may range from an SCA non-advocate estimate, independent SCA assessment of another government estimate, or other SCA cost analysis, as determined by the SCA and reflected in DoD Component policy.

The CCP is the cost position established by the DoD Component. It is derived from the CCE and program office estimate per DoD Component policy. The CCP must be signed by the DoD Component Deputy Assistant Secretary for Cost and Economics (or Defense Agency equivalent) and include a date of record.

Additionally, 10 USC 2334 requires that the Office of Cost Assessment and Program Evaluation (CAPE) conduct or approve ICEs for MDAPs and major subprograms at the following times:

1) prior to certification at Milestone A and certification at Milestone B;
2) before any decision to enter into low-rate initial production or full-rate production;
3) in advance of certification following critical cost growth; and
4) at any time considered appropriate by DCAPE or upon the request of the USD(AT&L) or the milestone decision authority.

If DCAPE does not conduct the ICE for an MDAP or major subprogram, the appropriate Service Cost Agency or Defense Agency equivalent conducts the ICE for DCAPE’s review and approval.

CH 2–2.1.2 Major Automated Information System Programs
DoDI 5000.02, Enc 10, sec. 2 requires that a CCE and CCP be submitted prior to a MAIS program receiving Milestone A, B, or C approval or a full deployment decision.

Additionally, DoDI 5000.02, Enc 10, sec. 2 and DoDI 5000.73 (Encl. 2, para 3.a.(1)(b)) provide that DCAPE may prepare an ICE for ACAT IAC programs at any time considered appropriate by the DCAPE or upon the request of the USD(AT&L) or the MDA.

CH 2–2.1.3 Acquisition Category II and III Programs
Cost estimates for ACAT II and III programs are conducted in accordance with each Service’s policy. While OSD does not play an active role in the preparation of these estimates, the guidelines set forth in CH 2–3.3 and CH 2–3.4 should be followed to the greatest degree possible.
CH 2–2.1.4 Operating and Support

DoDI 5000.73 (Encl. 2, para 2.d.(6)) provides that post-initial operational capability (IOC) DoD Components must continue to track operating and support (O&S) costs and update O&S cost estimates yearly throughout a program’s life cycle to determine whether preliminary information and assumptions remain relevant and accurate and to identify and record reasons for variances.

O&S cost estimates are independently reviewed at post-IOC reviews. Each O&S cost estimate must be compared to earlier estimates and the program’s O&S affordability caps, and, as appropriate, used to update the life-cycle affordability analysis provided to the MDA and requirements validation authority. This comparison must identify the reasons for significant changes and categorize those reasons into external and internal ones.

CAPE provides guidance on O&S cost estimating in its Operating and Support Cost Estimating Guidebook.

CH 2–2.2 Cost and Software Data Reporting

Systematic and institutionalized cost data collection by each DoD Component is important to support credible cost estimates of current and future programs. The cost data collection systems subject to CAPE oversight are the Cost and Software Data Reporting system and the Visibility and Management of Operating and Support Costs system. CAPE also provides technical oversight to the central repository for earned value management (EVM) data.

DoDI 5000.02, Enc 1 (Table 7) requires cost reporting for all contracts over $50 million for MDAPs and MAIS programs and may be required for special interest contracts or those requested by the Services or CAPE. When it is determined that cost reporting is required for a contract, the cost working group integrated product team (CWlPT) meets to develop an appropriate cost reporting plan. Figure 1 sets forth the CW IPT participants and each participant’s role.

Figure 1: CWIPT Participants and Roles
CH 2–2.3 Analysis of Alternatives

The Analysis of Alternatives (AoA) 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 alternatives that satisfy established capability needs. After the Materiel Development Decision, the AoA is initiated to examine potential materiel solutions with the goal of identifying the most promising option, thereby guiding the Materiel Solution Analysis phase. Subsequently, an update to the AoA is initiated when necessary or mandated by the DAE at the start of the Technology Maturation and Risk Reduction phase and is reviewed at Milestone B (which usually represents the first major funding commitment to the acquisition program). The update to the AoA is used to refine the proposed materiel solution, as well as to reaffirm the rationale, in terms of cost-effectiveness, for initiation of the program into the formal systems.
acquisition process. For Major Defense Acquisition Programs at Milestone A, the Milestone Decision Authority (MDA) must certify in writing to the Congress that the Department has completed an AoA consistent with the study guidance developed by the Director, Cost Assessment and Program Evaluation (DCAPE), in addition to meeting other certification criteria. For Major Defense Acquisition Programs at Milestone B, the MDA must certify in writing to Congress that the Department has completed an AoA with respect to the program, in addition to meeting other certification criteria. Pursuant to DoDI 5000.02, the AoA is updated as needed at Milestone C.

CH 2–2.3.1 Role of the Analysis of Alternatives as Part of the Materiel Solution Analysis
The Aoa process plays a key role in support of the Materiel Solution Analysis Phase. After a program has an approved Materiel Development Decision, the Aoa process is necessary to better define the trade space across cost, schedule, and performance to enable the DAE and Service Sponsor to select a preferred materiel solution that addresses the capability gaps documented in the approved Initial Capabilities Document (ICD).

The DCAPE develops and approves study guidance for MDAP AoaS. The guidance is developed in consultation with other DoD organizations, as necessary. Prior to the MDD review, DCAPE provides the Aoa study guidance to the DoD Component designated by the MDA. Following receipt of the Aoa study guidance, the DoD Component prepares an Aoa study plan that describes the intended methodology for the management and execution of the Aoa. The Aoa study plan is coordinated with the MDA and approved by DCAPE prior to the MDD review. A suggested template for the Aoa study plan is provided in Section 2.3.2.

The study guidance requires, at minimum, full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered. The study guidance also requires an assessment of whether or not the joint military requirement can be met in a manner consistent with the cost and schedule objectives recommended by the JROC. The Aoa study guidance and resulting Aoa study plan should build on the prior analyses conducted as part of the Joint Capabilities Integration and Development System (JCIDS). The JCIDS process is described in CJCS Instruction 3170.01. The JCIDS analysis process that leads to an approved Initial Capabilities Document (ICD) is built upon the analysis known as the Capabilities-Based Assessment (CBA). The CBA provides recommendations (documented in the ICD) to pursue a materiel solution to address an identified capability gap. The CBA does not provide specific recommendations as to a particular materiel solution, but rather provides a more general recommendation as to the type of materiel solution (such as Information Technology system, incremental improvement to an existing capability, or an entirely new “breakout” or other transformational capability). In this way, the ICD can be used to establish boundary conditions for the scope of alternatives to be considered in the subsequent Aoa. The Aoa study guidance should be crafted to ensure that the Aoa considers a sufficiently robust set of alternatives, given program cost, schedule, and performance constraints.

CH 2–2.3.2. Analysis of Alternatives Study Plan
The first major step leading to a successful Aoa is the creation and coordination of a well-considered analysis plan. The study plan establishes a road map of how the analysis will proceed, and who is responsible for doing what. At a minimum, the study plan facilitates full consideration of possible trade-offs among cost, schedule, and performance objectives for each alternative considered, as well as an assessment of whether or not the joint military requirement can be met in a manner consistent with the cost and schedule objectives recommended by the JROC.

A recommended outline for the Aoa study plan may resemble the following (but note that the study plan specifics will depend on the scope of the analysis and the criteria outline in the study guidance):

- Introduction
  - Background
  - Purpose
  - Scope
• Ground Rules
  o Scenarios
  o Threats
  o Environment
  o Constraints, Limitations, and Assumptions
  o Timeframe
  o Excursions

• Alternatives
  o Description of Alternatives
  o Nonviable Alternatives
  o Operations Concepts
  o Sustainment Concepts

• Determination of Effectiveness Measures
  o Mission Tasks
  o Measures of Effectiveness
  o Measures of Performance

• Effectiveness Analysis
  o Effectiveness Methodology
  o Models, Simulations, and Data
  o Effectiveness Sensitivity Analysis

• Cost Analysis
  o Life-Cycle Cost Methodology
  o Additional Total Ownership Cost Considerations (if applicable)
  o Fully Burdened Cost of Delivered Energy (if applicable)
  o Models and Data
  o Cost Sensitivity and/or Risk Analysis

• Cost-Effectiveness Comparisons
  o Cost-Effectiveness Methodology
  o Displays or Presentation Formats
  o Criteria for Screening Alternatives

• Organization and Management
  o Study Team/Organization
  o AoA Review Process
  o Schedule

As every AoA is unique, the above outline should be tailored to support the analytic scope outlined in the respective study guidance. Each point in the above outline is discussed further in the next several sections.

CH 2–2.3.2.1. Analysis of Alternatives Study Plan-Introduction
The introduction to the AoA plan describes the developments that led to the AoA, including prior relevant analyses (such as the Capabilities-Based Assessment). It should reference the applicable capability-needs document(s) and other pertinent documents, and highlight the capability gaps being addressed through the applicable capability needs. The introduction should describe the applicable AoA study guidance and any other terms of reference. It also should provide a broad overview of the planned AoA, which describes in general terms the level of detail of the study and the scope (breadth and depth) of the analysis necessary to support the specific milestone decision.

CH 2–2.3.2.2. Analysis of Alternatives Study Plan-Ground Rules
The ground rules described in the analysis plan include the scenarios and threats, as well as the assumed physical environment and any constraints or additional assumptions. The scenarios are typically derived from defense-planning scenarios and associated joint operational plans, augmented by more detailed intelligence products such as target information and enemy and friendly orders of battle. Environmental factors that impact operations (e.g., climate, weather, or terrain) are important as well. In
addition, environment, safety, and occupational health factors associated with the use of chemical and/or biological weapons may need to be considered as excursions to the baseline scenario(s).

The study plan should describe what future timeframe, or timeframes, will be considered in the analysis. Often, the time period(s) selected will be determined by the time period(s) assumed in the DoD-approved planning scenario. However, there is some flexibility on this point, especially if something significant -- such as the deployment of a new capability, or the retirement of a legacy system -- is projected to occur one or two years after one of the time periods in the scenario. A common and desirable practice is to consider two time periods of interest, say "near-term" and "far-term," separated by a decade or so.

The AoA study plan should describe the planned analytic excursions to the baseline scenarios and other major ground rules. Such excursions are strongly encouraged in order to explore any impact of changing threat levels, warning times, involvement of allied forces, and political constraints on basing or overflights, just to name a few issues. These excursions can be used to see if any major issues are critical to the relative cost-effectiveness of the alternatives considered in the AoA.

CH 2–2.3.2.3. Analysis of Alternatives Study Plan-Range of Alternatives

The analysis plan also should document the range of alternatives to be addressed in the analysis. In many cases, there will be a minimum set of alternatives required by the initial analysis guidance. Additional direction during subsequent AoA reviews may insert yet other alternatives. Practically, the range of alternatives should be kept manageable to ensure that the acquisition trade space is sufficiently well analyzed, while keeping the study schedule within a reasonable allotment. The number of alternatives can be controlled by avoiding similar but slightly different alternatives and by early elimination of alternatives (due to factors such as unacceptable life-cycle cost or inability to meet Key Performance Parameters). In many studies, the first alternative (base case) is to retain one or more existing systems, representing a benchmark of current capabilities. An additional alternative based on major upgrades and/or service-life extensions to existing systems also may be considered.

For each alternative, evaluation of system performance, unit effectiveness, and estimation of its life-cycle cost (or total ownership cost, if applicable) requires a significant level of understanding of its operations and support concepts. The operations concept describes the details of the peacetime, contingency, and wartime employment of the alternative within projected military units or organizations. It also may be necessary to describe the planned basing and deployment concepts (contingency and wartime) for each alternative. The sustainment concept for each alternative describes the plans and resources for system training, maintenance, and other logistics support.

It is important that the alternatives considered in the AoA should address alternative concepts for maintenance, training, supply chain management, and other major sustainment elements. In this way, the AoA can identify the preferred materiel solution not only in terms of traditional performance and design criteria (e.g., speed, range, lethality), but also support strategy and sustainment performance as well. In other words, the AoA should describe and include the results of the supportability analyses and trade-offs conducted to determine the most cost-effective support concept as part of the proposed system concept.

CH 2–2.3.2.4. Analysis of Alternatives Study Plan-Effectiveness Measures

The analysis plan should describe how the AoA will establish metrics associated with the military worth of each alternative. Military worth often is portrayed in AoAs as a hierarchy of mission tasks, measures of effectiveness, and measures of performance. Military worth is fundamentally the ability to perform mission tasks, which are derived from the identified capability needs. Mission tasks are usually expressed in terms of general tasks to be performed to correct the gaps in needed capabilities (e.g., hold targets at risk or communicate in a jamming environment). Mission tasks should not be stated in solution-specific language. Measures of effectiveness are more refined and provide the details that allow the proficiency of each alternative in performing the mission tasks to be quantified. Each mission task should have at least one measure of effectiveness supporting it, and each measure of effectiveness should support at least one mission task. Typically, a measure of performance is a quantitative measure of a system characteristic (e.g., range, weapon load-out, logistics footprint, etc.) chosen to enable calculation of one or more measures of effectiveness. Measures of performance are often linked to Key Performance
Parameters or other parameters contained in the approved capability needs document(s). Also, measures of performance are usually the measures most directly related to test and evaluation criteria.

CH 2–2.3.2.5. Analysis of Alternatives Study Plan-Effectiveness Analysis
The analysis plan spells out the analytic approach to the effectiveness analysis, which is built upon the hierarchy of military worth, the assumed scenarios and threats, and the nature of the selected alternatives. The analytic approach describes the level of detail at various points of the effectiveness analysis. In many AoAs involving combat operations, the levels of effectiveness analysis can be characterized by the numbers and types of alternative and threat elements being modeled. A typical classification would consist of four levels: (1) system performance, based on analyses of individual components of each alternative or threat system; (2) engagement, based on analyses of the interaction of a single alternative and a single threat system, and possibly the interactions of a few alternative systems with a few threat systems; (3) mission, based on assessments of how well alternative systems perform military missions in the context of many-on-many engagements; and (4) campaign, based on how well alternative systems contribute to the overall military campaign, often in a joint context. For AoAs involving combat support operations, the characterization would need to be modified according to the nature of the support. Nevertheless, most AoAs involve analyses at different levels of detail, where the outputs of the more specialized analysis are used as inputs to more aggregate analyses. At each level, establishing the effectiveness methodology often involves the identification of suitable models (simulation or otherwise), other analytic techniques, and data. This identification primarily should be based on the earlier selection of measures of effectiveness. The modeling effort should be focused on the computation of the specific measures of effectiveness established for the purpose of the particular study. Models are seldom good or bad per se; rather, models are either suitable or not suitable for a particular purpose.

It also is important to address excursions and other sensitivity analyses in the overall effectiveness analysis. Typically, there are a few critical assumptions that often drive the results of the analysis, and it is important to understand and point out how variations in these assumptions affect the results. As one example, in many cases the assumed performance of a future system is based on engineering estimates that have not been tested or validated. In such cases, the effectiveness analysis should describe how sensitive the mission or campaign outcomes are to the assumed performance estimates.

CH 2–2.3.2.6. Analysis of Alternatives Study Plan-Cost Analysis
The AoA plan also describes the approach to the life-cycle cost estimate. The cost analysis normally is performed in parallel with the operational effectiveness analysis. It is equal in importance as part of the overall AoA process. The cost analysis estimates the total life-cycle cost of each alternative, and its results are later combined with the operational effectiveness analysis to portray cost-effectiveness comparisons. It is important to emphasize that the cost analysis will be a major effort that will demand the attention of experienced, professional cost analysts.

The principles of economic analysis apply to the cost analysis in an AoA. Although the cost estimates used in an AoA originally are presented in constant dollars, they should be adjusted for discounting (time value of money), accounting for the distribution of the costs over the study time period of interest. In addition, the cost estimates should account for any residual values associated with capital assets that have remaining useful value at the end of the period of analysis. Further guidance on economic analysis is provided in DoDI 7041.3, "Economic Analysis for Decisionmaking."

The cost analysis should also describe the planned approach for addressing the Fully Burdened Cost of Energy for those AoAs where this issue is applicable.

CH 2–2.3.2.7. Analysis of Alternatives Study Plan-Cost-Effectiveness Comparisons
Typically, the next analytical section of the AoA plan deals with the planned approach for the cost-effectiveness comparisons of the study alternatives. In most AoAs, these comparisons involve alternatives that have both different levels of effectiveness and cost, which leads to the question of how to judge when additional effectiveness is worth additional cost. Cost-effectiveness comparisons in theory would be best if the analysis structured the alternatives so that all the alternatives have equal effectiveness (the best alternative is the one with lowest cost) or equal cost (the best alternative is the
one with the greatest effectiveness). Either case would be preferred; however, in actual practice, in many cases the ideal of equal effectiveness or equal cost alternatives is difficult or impossible to achieve due to the complexity of AoA issues. A common method for dealing with such situations is to provide a scatter plot of effectiveness versus cost. Figure 2 presents a notional example of such a plot.

Note that the notional sample display shown in Figure 2 does not make use of ratios (of effectiveness to cost) for comparing alternatives. Usually, ratios are regarded as potentially misleading because they mask important information. The advantage to the approach in the figure above is that it reduces the original set of alternatives to a small set of viable alternatives for decision makers to consider.

**Figure 2: Sample Scatter Plot of Effectiveness versus Cost**

![Sample Scatter Plot of Effectiveness versus Cost](image)

### CH 2–2.3.2.8. Analysis of Alternatives Study Plan-Organization and Management

Finally, the AoA plan should address the AoA study organization and management. Often, the AoA is conducted by a working group (study team) led by a study director and staffed appropriately with a diverse mix of military, civilian, and contractor personnel. Program offices or similar organizations may provide assistance or data to the AoA study team, but the responsibility for the AoA may not be assigned to a program manager, and the study team members should not reside in a program office. In some cases, the AoA may be assigned to an in-house analytic organization, a federally funded research and development center, or a similar organization.

The AoA study team is usually organized into panels along functional lines, with a chair for each panel. Typical functional areas for the panels could be threats and scenarios, technology and alternatives (responsible for defining the alternatives), operations and support concepts (for each alternative), effectiveness analysis, and cost analysis. In many cases, the effectiveness panel occupies the central position and integrates the work of the other panels. The study plan also should describe the planned oversight and review process for the AoA. It is important to obtain guidance and direction from senior reviewers with a variety of perspectives (operational, technical, and cost) throughout the entire AoA process.

The analysis plan is fundamentally important because it defines what will be accomplished, and how and when it will be accomplished. However, the plan should be treated as a living document, and updated as needed throughout the AoA to reflect new information and changing study direction. New directions are
inevitably part of the AoA process, so the analysis should be structured so as to be flexible. Frequently, AoAs turn out to be more difficult than originally envisioned, and the collaborative analytical process associated with AoAs is inherently slow. There are often delays in obtaining proper input data, and there may be disagreements among the study participants concerning ground rules or alternatives that lead to an increase in excursions or cases to be considered. Experience has shown that delays for analyses dealing with Special Access materials can be especially problematic, due to issues of clearances, access to data, storage, modeling, etc. It is often common for the study director to scale back the planned analysis (or at least consider doing so) to maintain the study schedule.

CH 2–2.3.3. Analysis of Alternatives Final Results

CH 2–2.3.3.1. Analysis of Alternatives Final Results and Assessment

Normally, the final results of the AoA initially are presented as a series of briefings. For potential and designated major defense acquisition programs (Acquisition Category (ACAT) I) and major automated information systems (ACAT IA), the final AoA results are provided to the Office of the Director, Cost Assessment and Program Evaluation (CAPE), no later than 60 days prior to the milestone decision meeting (Defense Acquisition Board or Information Technology Acquisition Board review). Providing emerging results to CAPE prior to the final briefing is wise to ensure that there are no unexpected problems or issues. For other programs, the AoA results should be provided to the DoD Component entity equivalent to CAPE, if applicable. In any case, the AoA final results should follow all of the important aspects of the study plan, and support the AoA findings with the presentation. In particular, all of the stated AoA conclusions and findings should follow logically from the supporting analysis.

Having received the final AoA briefing(s), the CAPE evaluates the AoA and provides an independent assessment to the Head of the DoD Component (or the Principal Staff Assistant) and to the Milestone Decision Authority. CAPE, in collaboration with the OSD and Joint Staff, shall assess the extent to which the AoA:

1. Illuminated capability advantages and disadvantages
2. Considered joint operational plans
3. Examined sufficient feasible alternatives
4. Discussed key assumptions and variables and sensitivity to changes in them;
5. Calculated costs
6. Assessed the following:
   • Technology risk and maturity
   • Alternative ways to improve the energy efficiency of DoD tactical systems with end items that create a demand for energy consistent with mission requirements and cost effectiveness
   • Appropriate system training to ensure that effective and efficient training is provided with the system

CH 2–2.3.3.2. Analysis of Alternatives Final Report

Usually, in addition to a final briefing, the AoA process and results are documented in a written final report. The report typically is not published formally by the time of the program milestone decision review, due to schedule constraints. However, the report nevertheless may be important to the historical record of the program, since the report serves as the principal supporting documentation for the AoA. The report also may serve as a reference source for analysts conducting future AoAs. The final report can follow the same format as the study plan, with the addition of these sections:

- Effectiveness Analysis
  - Effectiveness Results
- Cost Analysis
  - Life-Cycle Cost Results
- Cost-Effectiveness Comparisons
  - Cost-Effectiveness Results
By following the same format, much of the material from the (updated) study plan can be used in the final report.

**CH 2–2.3.4. Analysis of Alternatives Considerations for Major Automated Information Systems**

DoDI 5000.02, Enc 1 requires an AoA for MAIS programs at milestone decisions. Much of the discussion on AoAs provided in the earlier sections of the Guidebook is more applicable to weapon systems, and needs to be modified somewhat for MAIS programs. This section discusses AoA issues for MAIS programs. The AoA should include a discussion of whether the proposed program: (1) supports a core/priority mission or function performed by the DoD Component; (2) needs to be undertaken because no alternative private sector or governmental source can better support the function; and (3) supports improved work processes that have been simplified or otherwise redesigned to reduce costs, improve effectiveness, and make maximum use of commercial off-the-shelf technology. The analysis should be tied to benchmarking and business process reengineering studies (such as analyses of simplified or streamlined work processes, or outsourcing of non-core functions).

For all MAIS program AoAs, one alternative should be the status quo alternative as used in the Economic Analysis, and one alternative should be associated with the proposed MAIS program. Other possible alternatives could be a different system, network, and/or data architectures, or they might involve different options for the purchase and integration of commercial off-the-shelf products, modifications, and upgrades of existing assets or major in-house development.

Most likely, the effectiveness analysis in a MAIS program AoA will not involve scenario-based analysis as is common for the weapon system AoAs. The effectiveness analysis for an MAIS program should be tied to the organizational missions, functions, and objectives directly supported by the implementation of the system being considered. The results of the AoA should provide insight into how well the various alternatives support the business outcomes that have been identified as the business goals or capabilities sought. In some cases, it may be possible to express the assessment of effectiveness across the alternatives in monetary terms, so effectiveness could be assessed as benefits in the framework for the Economic Analysis. In other cases, the effectiveness might be related to measurable improvements to business capabilities or better or timelier management information (leading to improved decision-making, where it can be difficult or impossible to quantify the benefits). In these cases, a common approach is to portray effectiveness by the use of one or more surrogate metrics. Examples of such metrics might be report generation timeliness, customer satisfaction, or supplier responsiveness. In addition to management information, the effectiveness analysis also should consider information assurance and interoperability issues.

The cost analysis supporting the AoA should follow the framework of the Economic Analysis. The life-cycle cost estimates of the alternatives considered in the AoA should be consistent with and clearly linked to the alternatives addressed in the Economic Analysis. Both the effectiveness analysis and the cost analysis should address the risks and uncertainties for the alternatives, and present appropriate sensitivity analysis that describes how such uncertainties can influence the cost-effectiveness comparison of the alternatives.

The appropriate sponsor or domain owner should lead the development of the AoA for a MAIS program. Experience has shown that the MAIS programs for which the sponsor or domain owner engages with CAPE early in the process are much more likely to be successful than those that select a preferred alternative before contacting CAPE or completing the AoA.

The DoD Component performing the AoA should develop a study plan that addresses the AoA study guidance, as applicable. At a minimum, the study plan should address the following topics:

**AoA Study Plan Outline**

- Introduction (Background, Purpose and Scope)
- Ground Rules: Constraints and Assumptions
- Description of Alternatives
- Determination of Effectiveness Measures
1. Measures of Effectiveness (MOEs) operationally relevant and measurable
2. Measures of Performance technical characteristics required to satisfy MOEs, which are measurable and employed as an operational test criterion
e. Effectiveness Analysis Methodology
f. Cost Analysis
g. Cost-Effectiveness Comparisons
h. Risk & Sensitivity Analysis
  1. Mission
  2. Technology
  3. Programmatic, to include funding
i. Study Organization and Management
j. Schedule, with associated deliverables

CH 2–3. Business Practice

CH 2–3.1 Acquisition Category ID Cost Estimate Timeline

Figure 3 sets forth the typical timeline of events and deadlines to support the timely completion of an ICE for ACAT ID programs. This timeline may be tailored, as needed, depending on the program and the information needed to best support the decision-maker. The key events are as follows:

- At least 210 days before the planned overarching integrated product team (OIPT) meeting, the SCA will notify CA of a program’s upcoming milestone or acquisition event requiring an ICE.
- A kick-off meeting is held no later than 180 days before the OIPT meeting. Before the kick-off meeting, the SCA and CA will develop an agenda of information to discuss; the agenda will include requirements for the cost estimates, alternatives to consider, and the assumptions on which the cost estimates will be based. A CA representative and SCA representative will co-chair the kick-off meeting.
- The Program Management Office (PMO) will prepare and deliver the draft Cost Analysis Requirements Description (CARD) to CA no later than 180 days before the planned OIPT meeting. For joint programs, the CARD will include the common program agreed to by all participating DoD Components, as well as any unique program requirements of the participating DoD Components. Templates and instructions for preparing the CARD are available at http://cade.osd.mil/policy/card.
- No later than 45 days after receipt of the draft CARD (usually at least 135 days before the planned OIPT meeting), CA will provide feedback to the PMO on the draft CARD.
- No later than 45 days after receipt of the draft CARD (usually at least 135 days before a planned OIPT meeting), if the CARD is insufficient, CA and the SCA will sign a memorandum to the PMO informing the PMO that the CARD is insufficiently developed to continue with the preparation of the cost estimates. In this scenario, the planned OIPT meeting and defense acquisition board (DAB) meeting may be delayed.
- Following the kick-off meeting and continuing until the OIPT meeting, the CA analyst and representatives from the SCA and PMO will conduct site visits and collect and review program data. During this time, the CA analyst and SCA and PMO representatives will have ongoing discussions concerning the cost estimating strategies and methodologies used to develop all relevant cost estimates, including the ICE, CCE, program office estimate (POE), and CCP.
- At least 45 days before the OIPT meeting, the PMO and SCA representatives will brief CA on the working level drafts of the POE, CCE, CCP, and any other relevant estimates available at the time. Following this briefing, the PMO and SCA representatives will provide CA with any updates to the working level drafts of the estimates as appropriate or on request.
- A final copy of the CARD, signed by the program executive officer and program manager, must be provided to CA by the PMO at least 45 days before the scheduled OIPT meeting and placed into the electronic CA Library.
- At CA’s discretion, approximately 28 days before the OIPT meeting, the CA, PMO, and SCA representatives may meet to compare and discuss the results of the ICE and the CCP.
The SCA must deliver the final, signed CCP and full funding certification memorandum to CA at least 10 days before the planned OIPT meeting. Copies of these documents will be submitted to the CA Library. If the program concept evolves after a milestone review, the SCA may update the CCP, and the DoD Component may fully fund the program in the Future Years Defense Program (FYDP) to the updated CCP. A copy of the updated CCP must be submitted to the CA Library.

A CA representative will brief a summary of the ICE at the OIPT.

Before the DAB review, CA will issue its ICE report, a copy of which will be placed in the CA Library.

Figure 3: Timeline for Preparation of ACAT ID ICES

CH 2–3.2 Acquisition Category IC Cost Estimate Timeline

The DCAPE typically reviews the ICE prepared by the DoD Component for ACAT IC programs. In certain cases, the DCAPE will prepare the ICE for ACAT IC milestone reviews. The timeline in Figure 4 is followed when determining whether CA or the DoD Component will prepare the ICE and, if the DoD Component is preparing the ICE, the timeline for CA review.

- At least 210 days before the planned cost review board (CRB) meeting, the SCA will notify CA of an ACAT IC program's upcoming milestone that requires either a DoD Component ICE or a CA ICE.
- No later than 180 days before the planned CRB meeting, the PMO and SCA will brief the appropriate CA division director on the program, to include available data and methodologies. At or before the briefing, the PMO must deliver a draft CARD to CA. Templates and instructions for preparing the CARD are available at http://cade.osd.mil/policy/card.
- At least 165 days before the planned CRB meeting, CA will make a decision whether to review the DoD Component ICE or prepare a CA ICE. CA will issue a memorandum, a copy of which will be placed into the CA Library, documenting its decision. If CA decides to prepare the ICE, the program will follow a tailored version of the timeline and procedures described in paragraph 2b(1) of this enclosure for ACAT ID programs.
• If CA decides to review the DoD Component ICE, the CA analyst will continue to meet with technical and cost analysts from the PMO and SCA from 165 to 30 days before the CRB meeting. If, during this time, CA determines that there are significant changes to the program or increased cost or schedule risk, CA may decide to perform a CA ICE of the program.
• The PMO will deliver the final draft CARD to CA at least 45 days before the CRB meeting. The final draft CARD should be in near complete form, with only minor changes occurring between its delivery and the delivery of the final signed CARD at least 21 days before the CRB meeting.
• At least 30 days before the CRB meeting, PMO and SCA representatives will brief CA on working level drafts of the POE, DoD Component ICE, CCP, and any other relevant estimates available at the time.
• During the 30 days before the CRB meeting, CA will review the DoD Component ICE and provide feedback to the SCA. Based on the feedback, SCA will revise the DoD Component ICE as needed.
• At the CRB, the SCA will deliver the final DoD Component ICE to CA. CA will review and assess the adequacy of the ICE and document its assessment in a memorandum, copies of which will be delivered to the DoD Component Acquisition Executive (CAE) and placed in the CA Library.
• Following the CAE decision, the SCA will deliver to CA a signed CCP and full funding certification memorandum, copies of which will be placed into the CA Library.

Figure 4: Timeline for ACAT IC Cost Estimate Review

CH 2–3.3 How to Conduct a Cost Estimate
Conduct of a cost estimate is a multistep process involving planning, gathering data, conducting the estimate, risk and uncertainty analysis, and presenting the estimate. Depending on the program and data available, the methodology for the conduct of the estimate may vary. The BCF 131 presentations set forth guidance for each stage of the estimating process.
CH 2–3.4 Milestone-Specific Analysis
At each milestone or decision point, the analyst should provide a holistic view of the program and not just an estimate of the proposed solution. The cost analyst should provide analysis to the decision maker which provides insight enabling the decision maker to answer two main questions:

- Has the DoD fully funded the program of record within the Future Years Defense Program (FYDP)?
- Is the program of record an affordable solution for the DoD’s needs?

Determining the answer to the first question is straightforward: namely, is there funding in the budget and the FYDP that corresponds to the amount of funding forecasted to be necessary to carry out the program? The answer to the second question is more complex, and the analysis will vary at each milestone. Specific strategic questions for analysis at each milestone are described below.

At all milestones, when presenting analysis that will help the decision maker determine whether the program of record is one that fulfills the DoD’s needs and that the DoD can afford, the analyst should provide insight into:

- The cost of the solution
- Time needed to achieve the solution
- Whether the solution pushes the envelope on performance
- Any potential cost in extending the life of the current materiel solution until the new proposed solution is operational
- Whether the solution impacts the DoD Component’s portfolio by affecting other programs that are valuable to the DoD.

The key strategic questions the analyst should consider while conducting the Milestone A cost estimate are:

- What is the cost and performance trade space for the conceptual materiel solution and other potential solutions?
- Is the program affordable to both buy and operate in the long term?
- Are CA’s insights into the program consistent with the preferred solution of the AoA?

When conducting the Milestone B cost estimate, the key strategic questions the analyst should consider are:

- What is the cost and performance trade space for the detailed materiel solution and other potential solutions?
- Is the program affordable to both acquire and operate in the long term?
- Are there alternative acquisition or programmatic strategies that can result in a more affordable and efficient program?
  - What is the nature and duration of competition for both prime and major subcontractors?
  - What is the appropriate time to down select to one contractor?
  - Are there ways to invest in manufacturing efficiencies?
- What technologies or strategies can be pursued to lower the overall sustainment cost?
  - What investments can be made in sustainability?
  - Have alternative sustainment strategies been considered in the BCA?
  - Is there a way to introduce competition into planned contractor logistics support for a system?

When conducting the cost estimate for the low-rate initial production decision, the analyst should answer key strategic questions, including:

- What is the most efficient and affordable way to procure the system when considering rate of procurement, programmatic, recompeting the contract, and use of government furnished equipment?
• What is the most efficient and affordable way to transition to low-rate initial production and full-rate production?
  o What is the timing of initial procurement relative to operational testing results and demonstrated manufacturing capabilities?
  o How many operational systems should be purchased before testing is complete?
• What technologies or strategies can be pursued to lower the sustainment costs?
• Do the results of the cost analysis support the product support strategy BCA results?
• Is the system affordable when compared to the annual O&S costs of the legacy system being replaced?
• Is contractor logistics support or organic support more efficient and affordable?
• Is the system cost effective, balancing the risks associated with the estimate of its O&S costs and related parameters such as reliability with higher system readiness and better mission availability?

When conducting the cost estimate for the full-rate production decision, the analyst should consider key strategic questions, including:

• Are there alternative procurement profiles that result in a more affordable and efficient program?
• Could substantial savings be achieved through the use of a multiyear procurement contract for the program?
• What changes should be made to the sustainment strategy in the BCA?

CH 2–3.5 Cost Analysis Requirements Description
The Cost Analysis Requirements Description (CARD) is a complete, detailed description of a DoD program for use in preparing an ICE, POE, CCE, CCP, or other cost estimate, as required. The CARD is completed by the program office staff as they should have the most in-depth knowledge and understanding of the program details.

The foundation of a sound cost estimate is a well-defined program, and the CARD is used to articulate details about the program. The primary objective of the CARD is to succinctly describe the key technical, programmatic, operational, and sustainment characteristics of a program, along with supporting data sources, and to provide all of the program information necessary to develop a cost estimate. By using the CARD, different organizations preparing cost estimates can develop their estimates based on the same understanding of program requirements. As a program evolves and its costs and funding needs change, the CARD, as a living document, evolves with it.

The secondary objective of the CARD is to collect in-depth technical data to allow for validation or updating of cost estimating relationships (CERs) and the development of new CERs. Though not required for completion of estimates, this information, particularly for systems whose designs have matured to the point of deployment, is of great value to the entire acquisition community in ensuring high quality estimates in the future.

The CARD is composed of a narrative and a workbook. Requirements for the narrative, as well as template workbooks for each commodity, are available electronically at http://cade.osd.mil/policy/card.

CH 2–Version and Revision History
The table below tracks chapter changes. It indicates the current version number and date published, and provides a brief description of the content.

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