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TEACHING NOTE

ANALYSIS OF ALTERNATIVES

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INTRODUCTION

The ***Analysis of Alternatives (AoA)*** is a documented evaluation of the performance, operational effectiveness, operational suitability, and estimated costs of alternative systems to meet a capability need that has been identified through the Joint Capabilities Integration and Development Systems (JCIDS) process. The AoA assesses the advantages and disadvantages of various materiel alternatives being considered to satisfy the capability need. The AoA also considers the sensitivity of each alternative to possible changes to key assumptions or variables. The AoA is a key input to the process of defining the system capabilities set forth and further refined in the Capability Development Document (CDD).

Note: Where applicable, this teaching note has incorporated provisions of the Weapon Systems Acquisition Reform Act of 2009 (WSARA). As of the date this teaching note, the Under Secretary of Defense (Acquisition, Technology, and Logistics) (USD (AT&L)) had not yet formally revised DoDI 5000.02 to reflect the requirements of that public law; however, that office had issued a Directive-Type Memorandum (DTM – 09-027) to institutionalize selected requirements of that law.

OVERVIEW:

Determination of DoD's need for a new capability, as well as the refinement of that capability, is accomplished through the JCIDS process, which is under the purview of the Office of the Joint Chiefs of Staff (OJCS). The JCIDS process is initiated through the execution of a Capabilities Based Assessment (CBA). The objective of the CBA is to validate capability gaps by providing the following: identification of the mission; the capabilities required and their associated operational characteristics and attributes; capability gaps and associated operational risks; an assessment of the viability of non-materiel solutions; and a potential recommendation on a type of solution to be pursued. If a non-materiel solution is recommended, or can be implemented independent of proposed materiel needs, a joint doctrine, organization, training, materiel, leadership and education, personnel, or facilities (DOTMLPF) Change Recommendation (DCR) is produced. However, if a materiel solution is required, an Initial Capabilities Document (ICD) is produced. When the ICD is approved as having the potential to satisfy the capability need with a materiel solution (i.e., hardware and/or software system acquisition), the Milestone Decision Authority (MDA) directs initiation of an AoA.

The AoA Study Plan, in conjunction with the ICD, helps to guide the Materiel Solution Analysis (MSA) phase of the acquisition life cycle. For potential and designated Acquisition Category (ACAT) I and IA programs, the AoA Study Guidance is approved by the Director, Cost

Assessment and Program Evaluation (D, CAPE). Following the Materiel Development Decision, the organization responsible for conducting the AoA develops the AoA Study Plan, coordinates it with the MDA, and submits it to the D, CAPE for approval prior to the start of the AoA. A study plan will typically contain the following sections, although it can (and should) be tailored or streamlined to support the given situation:

- Introduction
- Ground Rules
- Range of Alternatives
- Effectiveness Measures
- Effectiveness Analysis
- Cost Analysis
- Cost-Effectiveness Comparisons
- Organization and Management

The AoA shall assess the critical technology elements associated with the various concepts, including technology maturity, technical risks, and, if necessary, technology maturation and demonstration needs. If an existing system (i.e., the *status quo*) is a feasible alternative for obtaining the desired capability, this should also be evaluated in the AoA. The MSA phase ends when the MDA approves the materiel solution resulting from the AoA and approves the associated Technology Development Strategy (TDS). Later in the acquisition process, the initial AoA may be updated or superseded, as warranted, by then-existing circumstances.

Ideally, a system's operational effectiveness enables it to meet or exceed capability needs identified by the JCIDS process. Operational effectiveness is achieved if the system satisfies operational requirements (thresholds and objectives) specified in the Capability Development Document (CDD), which builds upon the ICD by detailing the operational performance parameters necessary to design the proposed system. As stated in CJCSI 3170.01 (the Joint Chiefs of Staff instruction that describes the JCIDS process), a capability is "the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways … to perform a set of tasks to execute a specified course of action." The description of a capability should be "general enough so as to not prejudice decisions in favor of a particular means of implementation, but specific enough to evaluate alternative approaches to implement the capability. Achieving a stated capability is possible only if the system meets specified design, performance and Measures of Effectiveness (MOE) thresholds. For example, a vehicle's operational effectiveness might be described by its weight, accuracy, speed, range, horsepower, survivability, etc.

Design, performance, and MOE parameters commonly serve as the basis of a system's life cycle cost estimate. For example, a designer must specify vehicle engine horsepower and fuel consumption rate to enable a cost analyst to estimate vehicle engine life cycle cost. A less traditional AoA scenario exists when cost is fixed (i.e., cost as an independent variable (CAIV)). In a CAIV scenario, the AoA design and performance trade space are constrained by a pre-determined cost threshold. For example, the program manager (PM) specifies a vehicle engine life cycle cost threshold and objective *prior* to the designer proposing horsepower and fuel

consumption rates. The designer must then work closely with cost estimators to ensure that each vehicle engine design meets the PM's designated CAIV levels.

When necessary, lessons learned from conducting an AoA could form the basis for modifying one or more key performance parameters (KPPs) of a desired capability. For example, an AoA might produce unacceptably high life cycle costs for all alternatives. Such a result might indicate the originally conceived capability, as reflected in the AoA and KPPs, is driving life cycle cost to the point that achieving the capability is unaffordable. Consequently, it might be necessary to reduce requirements in order to contain life cycle costs at an acceptable level.

Tangential benefits of an AoA include: (a) modeling and simulation inputs for the Test and Evaluation Master Plan (TEMP) and the Life Cycle Management Plan (LCMP), and (b) key information for the ICD.

An AoA analysis is intended to:

- *Enhance and document decision-making by showing the risk, uncertainty, and relative advantages and disadvantages* of the considered alternatives. The WSARA calls for full consideration of all possible trade-offs (cost, schedule, and performance objectives) for each alternative. The analysis should show the sensitivity of each alternative to changes in key assumptions (e.g., threat) or system variables (e.g., selected performance capabilities). Where appropriate, it should include discussion of interoperability and commonality of components/ systems that are functionally similar to other DoD programs or Allied programs. The analysis shall aid decision-makers in judging whether or not any of the proposed alternatives offer sufficient military and/or economic benefit to warrant the cost. There should be a clear linkage between the AoA, capability needs, and MOEs used to evaluate the system.

- *Foster joint ownership and afford a better understanding of subsequent decisions* via early identification and discussion of reasonable alternatives. The analysis should be quantitative in nature, generating discussion of key assumptions and variables.

The AoA will normally include the following sections, although it can (and should) be tailored or streamlined to support the given situation:

- Capability Need, Deficiencies and Opportunities
- Program Description
- Threats
- Operational Environments
- Operational Concept
- Operational Requirements
- Status Quo (Baseline) and Alternatives
- System Design, Performance and Measures of Effectiveness
- Life-Cycle Costs of Baseline and each alternative
- Life Cycle Cost per unit system
- Life Cycle Cost per specified quantity of systems
- Analysis of Alternatives
- Trade-off Analysis
- Sensitivity Analysis

- Conclusions and Recommendations

PREPARATION RESPONSIBILITIES

DoD Instruction 5000.02 establishes the basis for developing an AoA to support milestone and decision reviews. These policies and procedures apply specifically to ACAT I and ACAT IA programs. Component Acquisition Executives (CAEs) may tailor the underlying principles as needed for ACAT II and III programs.

In accordance with Section 201 of WSARA, the OSD Director of Cost Assessment and Program Evaluation (D, CAPE) formulates AoA study guidance for all joint military requirements on which the Chairman of the Joint Requirements Oversight Council (JROC) is the validation authority. Under D, CAPE's cognizance, the DoD Component responsible for the mission area normally prepares the AoA for ACAT I weapon systems. For ACAT IA programs, the OSD Principal Staff Assistant (PSA) office responsible for the functional area to be impacted normally prepares the AoA. The Component Head or PSA is responsible for determining the independent activity to perform the analysis. Pursuant to DoDI 5000.02, the PM may not be designated as the party responsible for performing the AoA.

For potential ACAT ID and ACAT IAM programs (where the milestone decision is made at the DoD level), the Component Head or PSA (as applicable) should coordinate with key OSD officials and staffs early in the AoA process. This coordination is required to increase the likelihood that the full range of alternatives is considered; that organizational and operational plans for the alternatives are consistent with U.S. military strategy; and that joint-service issues such as interoperability, security, and common use are addressed in the AoA.

REVIEWS OF AoAs

An AoA must be prepared and considered for ACAT I and ACAT IA systems at Milestones A, B, and C. The MDA may direct updates to the analysis for subsequent reviews, if conditions warrant. The Defense Acquisition Guidebook (DAG) (available at www.dau.mil) provides discretionary, not prescriptive, best practices and guidance that may be tailored to the needs of each program. The DAG should be used as a complement to regulatory and statutory requirements. The CAE has the authority to decide on the need for, and extent of, AoAs for programs classified as other than ACAT I or ACAT IA.

ACAT I programs: At program initiation, the analysis focuses on broad trade-offs available between a number of different concepts as determined by the MDA. The analysis normally presents a "Go / No Go" recommendation. It demonstrates whether a new system is better than upgrading/modifying an existing system. Cost estimates at this point may be only a rough order of magnitude. However, the affordability of the proposed new system shall be addressed, and an affordability target (initially, average unit acquisition cost and average annual operating and support cost per unit) shall be established which is to be treated by the PM like a KPP. At subsequent milestone reviews, if the AoA is required to be updated, the analysis would be more focused. Hardware alternatives present a more narrow range of choices. The analysis is more detailed than previously as the system is better defined and more cost data are available. Point estimates are given with uncertainty ranges. At the production commitment, an updated AoA is

unlikely to be required unless the program or circumstances (e.g., threat, alliances, operating areas, technology, etc.) have changed significantly.

ACAT IA programs: The AoA for an ACAT IA program will be incorporated into the cost-benefit element structure and process agreed upon by that program's IPT. At program initiation, the Component may conduct a sufficiency review of the PM's life-cycle cost estimate and life-cycle benefits in lieu of a full analysis. Normally, the IPT will establish the content for the sufficiency review. The AoA is usually updated at subsequent milestone reviews in conjunction with the program's life-cycle cost-benefit analysis update.

SERVICE PREPARATION PROCESSES

Each Service conducts the AoA preparation process in its own unique fashion:

Navy: The Office of the Assistant Secretary of the Navy (Research, Development and Acquisition) (ASN (RDA)) released guidance on the preparation of AoAs. An AoA proposal prepared by ASN(RDA) in coordination with the program sponsor, program manager (PM) and appropriate System Command/Program Executive Office initiates the AoA for ACAT I programs. An appointed oversight board frames issues for ASN (RDA) and OP-08/DCS (RP) decision when consensus cannot be readily obtained. A study team prepares the AoA. The PM is represented on the study team and the oversight board. Funding for AoAs is separately identified through the PM with funding from resource sponsors. The PM provides information and support as necessary to the study team.

Air Force: The Air Force Requirements Oversight Council (AFROC) and the Air Force Council review AoAs and draft final results. Either the MAJCOM or the AFROC may request a formal technical assessment by the Technical Review Group (TRG). The AFROC may direct AoA products be presented to the Air Force Group or Board. This action would normally be accomplished to promote advocacy or enhance corporate understanding of the particular program supported by the AoA. If an AoA midterm status report is not required outside of Air Force channels, and the AoA study is proceeding as originally intended in the approved study plan, the study team may request the AFROC waive the requirement to present the midterm status report. AF/XOCA will help the Study Director schedule reviews with the TRG, AFROC, and AF Council. All ACAT I and selected ACAT II study plans, midterm reviews, and final results for Air Force or Joint AoAs, for which the Air Force is the lead service, must have AF/CV approval before being briefed to the OSD working level IPT, Overarching Integrated Product Team (OIPT), or equivalent higher bodies. The AF/CV through AF/CVS is the approval authority for modifications to this review process (e.g., for special access programs). The Department of the Air Force published two documents to provide guidance for conducting an AoA, AFPD 10-6 and AFI 10-601. AFPD 10-6 touches briefing on the Cost and Operational Effectiveness Analysis (COEA) Report which summarizes the cost and performance analyses of the alternatives. The originator, or lead MAJCOM of the new system identifies, explores and evaluates the alternatives and develops requirements in the CDD. AFI 10-601 covers the AoA in more detail.

Army: In the Department of the Army, the Training and Doctrine Command (TRADOC) and the user community bear the responsibility for preparation of the AoA. The PM is a contributor of information and participates in the preparation process. AR 71-9 and the Army Acquisition Handbook provide information on AoA preparation.

SUMMARY

Both the WSARA and DoD Instruction 5000.02 set forth requirements for AoAs, specifically for ACAT I and ACAT IA programs. The AoA is a documented analysis of the performance, operational effectiveness, operational suitability, and estimated costs of alternatives to meet a mission capability, to include assessing the advantages and disadvantages of those various alternatives being considered. An AoA is required early in the defense acquisition process –prior to formal initiation of a program – to ensure that all potential alternative means of satisfying the stated capability are considered. Thereafter, throughout the defense acquisition process, the AoA is either updated or a new one conducted in preparation for the next milestone decision point, depending on then–existing circumstances.

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