

# **Analysis of Alternatives from a Cost Estimating Perspective**

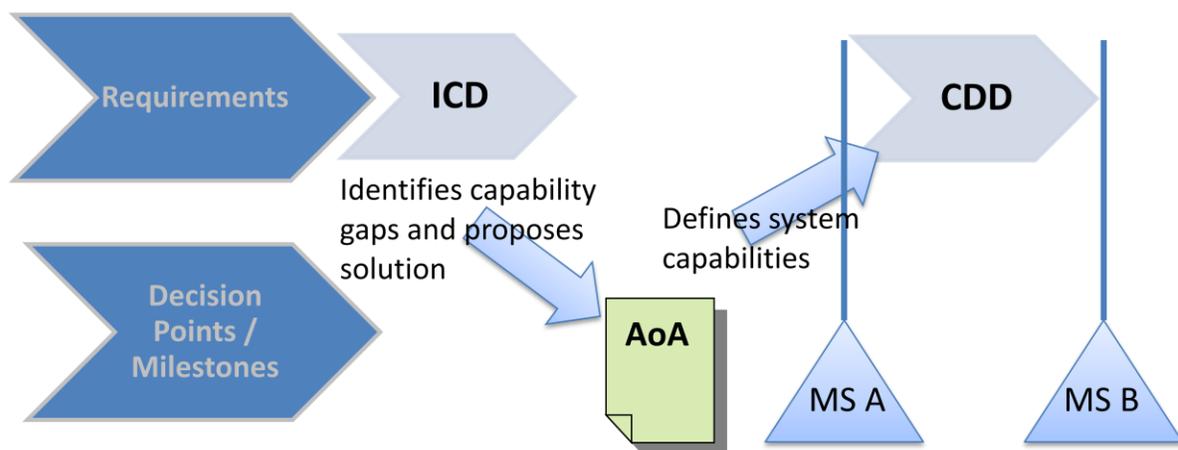
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## Background

In May of 2009, Congress unanimously passed and the President signed into law, the Weapon Systems Acquisition Reform Act of 2009 (WSARA). Among other significant organizational and policy changes, the Department of Defense (DoD) requires that service sponsors conduct an Analysis of Alternatives (AoA) prior to Milestone A (MS A). The AoA is an analytical comparison of multiple alternatives to be completed before committing and investing costly resources to the project. "About three-quarters of a program's total life cycle cost is influenced by decisions made before it is approved to start development"[U.S. Government Accountability Office, Pub. No. GAO-09-665, 2009, pp. "2]. The Early Cost Team within the Office of the Deputy Assistant Secretary of the Army for Cost and Economics (DASA-CE) has led the life cycle cost estimate (LCCE) development for many pre-milestone AoAs. This article will discuss from a cost estimating perspective, the study approach, overall study methodology, key insights from the studies, and lessons learned.



**Figure 1 AoAs within the Joint Capabilities Integration and Development System (JCIDS)**

## Study Approach

The AoA process is a key first step in the acquisition process. The AoA assesses the operational effectiveness, costs, and risks of potential materiel solutions to satisfy the capability need documented in the approved Initial Capabilities Document (ICD). Moreover, for each alternative, the analysis will produce comprehensive and substantiated results, detailing the implications for doctrine, organizations, training, leadership and education, personnel, and

facilities. Most of the Army's AoAs are conducted by the Army's Training and Doctrine Command Analysis Center (TRADOC) and comprised of study teams from various organizations in the Army. Both the Office of the Secretary of Defense (OSD) and the Army are responsible for issuing a study plan to scope the AoA. The plan will show how the study will apply the AoA guidance and describe the analytic approaches, methods, and resources to be employed in the AoA to address a series of study questions.

The focus of the study questions/issues for a MS A AoA is on identifying the attributes and requirements to mitigate the capability gaps, identifying and comparing the technologies that possess the attributes, assessing cost and the technologies that drive cost, conducting cost/performance/schedule trades (with respect to cost targets), and identifying risks in technology and integration. For a MS A AoA, the knowledge may be limited given that some of the candidates are still conceptual in nature.

The list of candidate solutions is based on a survey of programs of record and known government developmental efforts. To ensure consideration of the full scope of candidates, the study team reviews the results of the request for information (RFI) that the Program Manager released to industry. The study team will also interface with OSD Acquisition Technology and Logistics (OSD(AT&L)) to determine if any of OSD's science and technology investments might be viable for this mission. Before beginning the analysis portion of the study, the study director will present the team's recommended set of issues, alternatives, metrics, models/tools, and scenarios/vignettes to the study advisory group (SAG) for approval. During the course of the study, the Study Director will present updates to the SAG as laid out in the AoA schedule or as warranted for additional guidance or approvals.

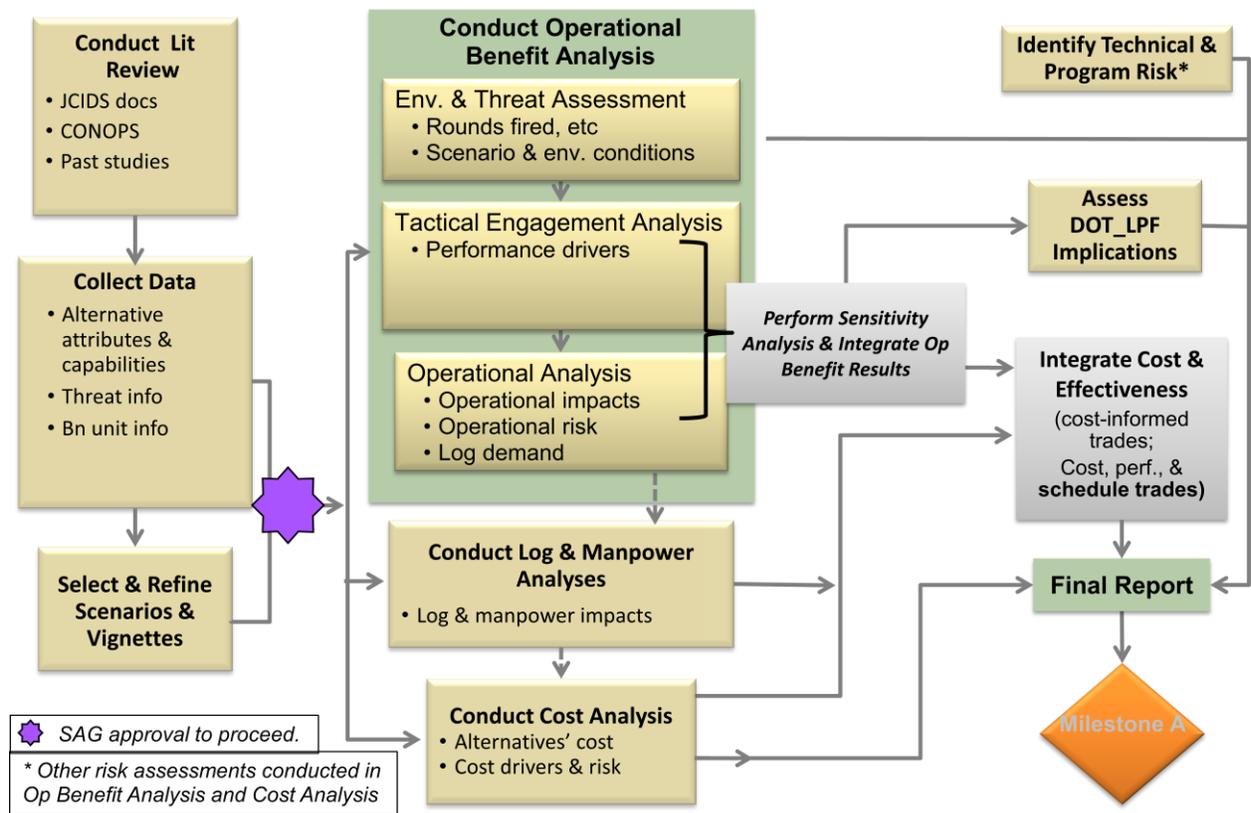
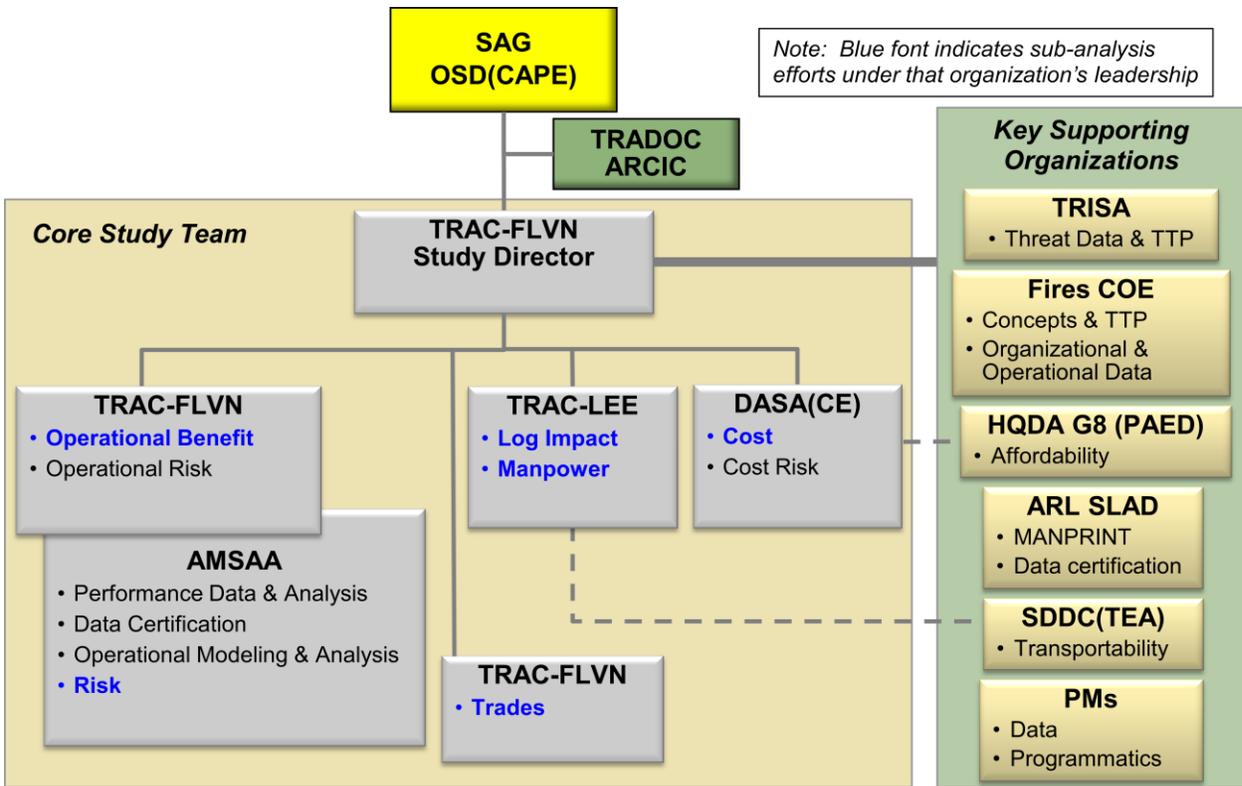


Figure 2. AoA Methodology Example

### Study Team Organization and Cost Analysis Working Group

A study director is appointed to lead a study team in performing the AoA. With most of the AoAs that DASA-CE has been a part of, the study director is appointed by TRADOC. The study director assembles a core study team that consists of leads for each of the sub-analyses. Typically, Army Materiel Systems Analysis Activity (AMSAA) is the lead for the operational benefit analysis and Risk Assessment, DASA-CE for the cost analysis, and TRAC-Ft. Lee for logistics and manpower analysis. Other organizations that provide key support to the team could include the centers of excellence, HQDA G8, Army Research Laboratory, the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASAALT), and Program Manager (PM) offices.



**Figure 3. Example of a Study Team Organization**

The cost analysis working group (CAWG) is lead by the individual tasked to develop the life cycle cost estimates for each alternative and the subsequent cost analysis report. Independence of the CAWG lead cannot be over emphasized. The resulting cost analysis report for the AoA must be developed with objectivity and not be influenced by stakeholders who prefer one alternative over the other. This is true for the entire core study team and issues may arise since the AoA study relies on data, documentation, and subject matter experts from the program offices. CAWG members from the PM should expect their input be discussed by the entire working group instead of being accepted at face value. The cost analysis report does not recommend a preferred alternative, but rather the results inform the acquisition executive’s selection of an alternative.

**CAWG Study Methodology**

Before the CAWG can begin the development of the LCCEs for the alternatives, the alternatives need to be defined with enough detail to support the analytic approaches used. With pre-MS A AoAs, defining the alternatives can be an arduous task since they are new development initiatives and conceptual in nature. Not having details on the alternatives make estimating the costs more difficult. Details provided later in the study results in possibly selecting a different cost estimating method that will take time to be implemented in the cost model.

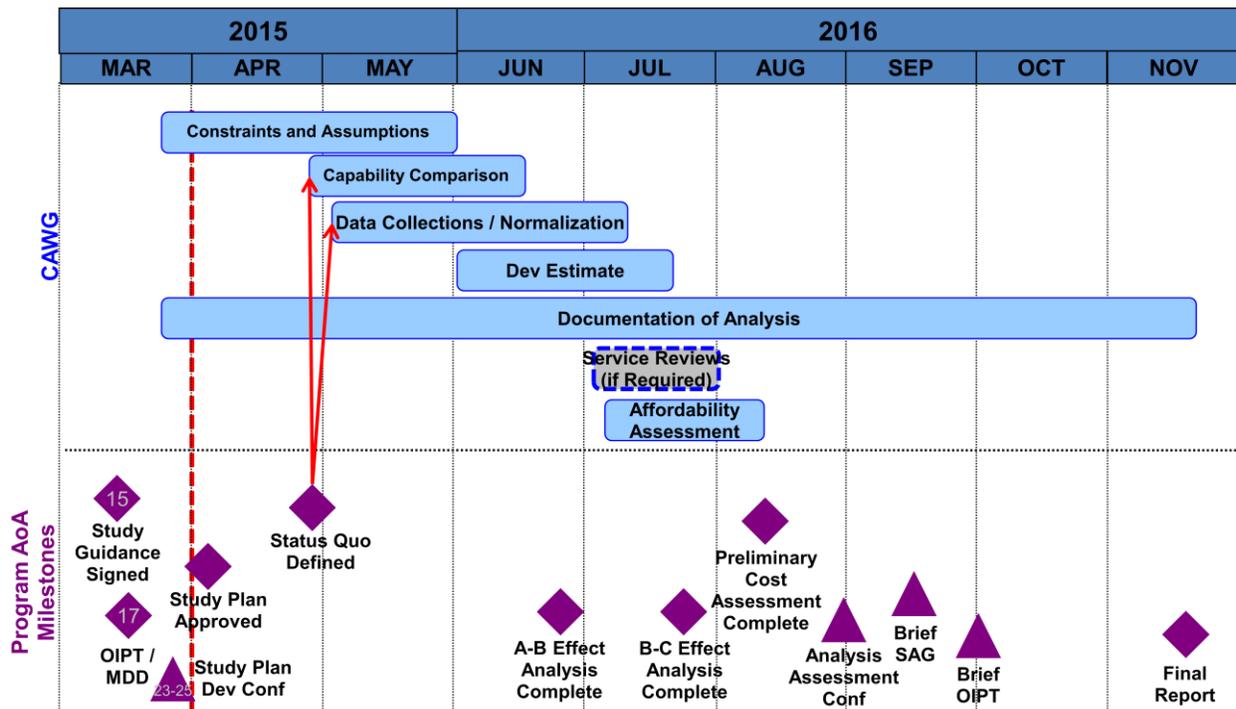


Figure 4 CAWG Notional Plan of Action and Milestones

The first tasks for the CAWG is to establish a point of contact (POC) list of team members, meeting schedule, and establishment of a document sharing site. The CAWG should decide upon a work breakdown structure (WBS) that defines the scope into manageable groups. The WBS could be revised and refined when additional details are learned. Once the alternatives are known, the data collection phase begins with a thorough literature and data search. The CAWG should determine what attributes of the alternatives should be captured. These attributes should be shared with the entire study team and be part of a data call.

The LCCs of the alternatives are estimated using cost estimating techniques including but not limited to analogy; parametric (statistical); engineering (bottoms up); and actual costs. Every CAWG member should also be familiar with Automated Cost Estimating Integrated Tools (ACEIT). Any analogous systems used for the development of the LCCs should be shared with AMSAA as they use analogy for the schedule risk assessment. It is critical to ensure that consistent ground rules, assumptions, and methodologies are applied across all alternatives to the fullest extent possible and practical. A running list of ground rules and assumptions should be shared to facilitate the development of the LCCs.

During the course of the AoA, a risk assessment workshop takes place with results that inform the trade space analysis. AMSAA served as the lead organization on an Army Risk

Integrated Product Team (IPT), which was established at the direction of Senior Army analysis leaders, to develop standard methodologies for assessing technical and schedule risk as part of acquisition studies. The technical risk assessment methodology measures the risk that a technology relevant to an Army acquisition system is not sufficiently developed (i.e., technology maturity, integration characterization, and manufacturing processes maturity) within the desired timeframe. Technical risk is reported as three levels (low, moderate, high) based on the standard DoD Risk Reporting Matrix for Acquisition. The risk level is determined by likelihood (probability) and consequence of event occurrence. The schedule risk assessment methodology measures the likelihood that each system alternative will meet a program’s estimated schedule, based on historical analogous programs. Cost risk and uncertainty analysis offers several options for improving the likelihood that the estimate of an unknown cost will be correct.

Once the methodologies are selected and the development of the LCCEs are underway, the methodologies should be briefed to the CAWG lead’s management and the study director. If needed, a cost review board type of meeting could be conducted with the core study team to go over line by line of the LCCEs.

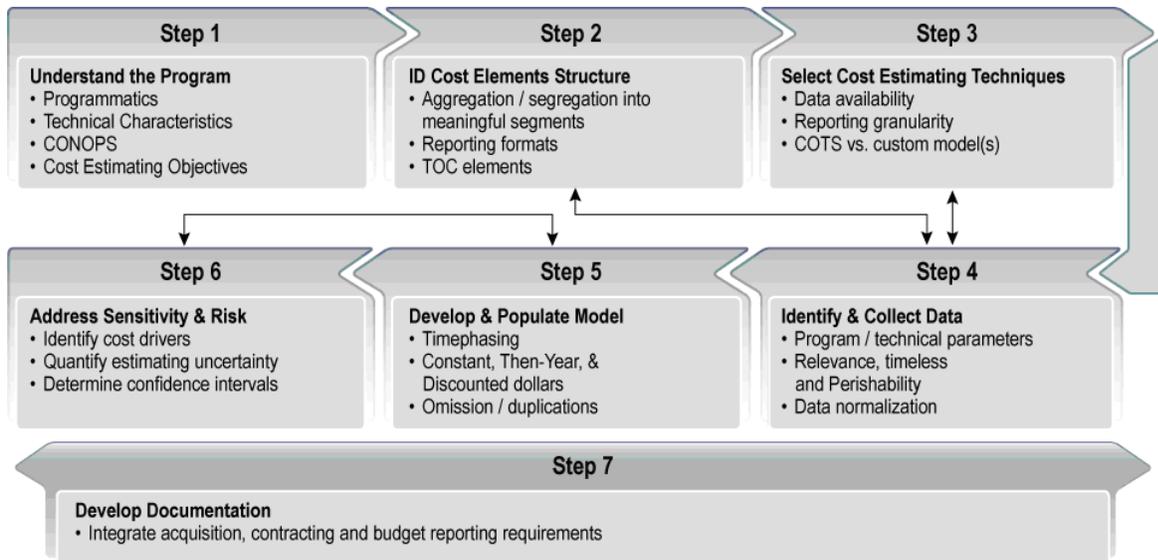


Figure 5 Cost Analysis Approach

### Key Insights and Lessons Learned

As more AoAs are conducted especially in these times of budget uncertainty, lessons learned from previous studies streamlines the process and enables the CAWG to be more efficient with the time provided for the development of the LCCE. The following are insights on the AoA process from a cost estimating perspective that are useful for any CAWG in developing LCCEs for an AoA study.

- **CAWG.** The CAWG should be assembled with cost analysts from key supporting organizations and include the study director. Send CAWG members' POC information to team members. Establishing regular teleconferences keeps everyone informed and focused. Prepare an agenda to be sent to CAWG members prior to teleconferences.
- **ACEIT.** The use of ACEIT to develop the cost models is far superior to using Microsoft Excel. Changes made in one area of an Excel worksheet don't always get incorporated in another area. It is easier to trace a calculation in ACEIT and performing sensitivity analyses with the case function.
- **Identify goals, objectives, and requirements.** Working with the study director, identify what work products are expected from the CAWG. Create a SharePoint or file sharing site to facilitate collaboration between team members. With team members spread out around the country and maintaining version control of documents, placing documents on a file sharing site ensured that everyone was working off the same set of documents. Obtain a CARD-like document or detailed technical descriptions for each alternative at the onset of the AoA study. Create a running list of ground rules and assumptions.
- **Interaction with other working groups.** It is important that the AoA study working groups interact with each other and to obtain the buy-in from all stakeholders. The working group studying operational benefit and performance and the group studying logistics and manpower do not always realize that what comes out of their studies impact the LCCs. The entire study team should know the data that each working group is seeking. With representatives from various PM offices who will directly or indirectly be impacted by the AoA study, each group or person will have economic and political motives. The study director needs to remind everyone that the objective is to prepare the best AoA report to senior leadership to assist in their decision making process.
- **Meetings.** Face to face meetings within the CAWG and the larger study team are more productive than teleconferences. The deliberation process is more efficient and effective in addressing member issues. With advancing technology for high-speed internet, videoconferencing is an alternative for face to face meetings, but this only works well when the size of the group is manageable.
- **Risk Assessment.** Technical and schedule risk are more interdependent to each other than it is with cost risk. Many do not realize that cost risk is not described in terms of likelihood and consequence, but rather is described statistically. At one workshop, participants thought cost risk was the cost to reach a certain TRL in a specified period of time.
- **Trades Analysis.** Ahead of the trade analysis workshop, a survey should be sent out to the technical team requesting a description of the major components of each alternative. The major components usually are the major cost drivers. A read ahead survey will save time and will serve as the basis of the trades analysis discussion.