

April 2016



EM-53 Lessons Learned Bulletin

Contact: Johnnie Newson, johnnie.newson@em.doe.gov

Date: 4/25/2016

Lessons Learned on Analysis of Alternatives

STATEMENT:

An Analysis of Alternatives (AoA) is a process that guides an analytical comparison of multiple alternatives that should be completed before committing resources to a project. The reason for performing an AoA is to allow decision makers to understand the choices and the various approach options for executing projects, or for evaluating new technologies that might be applied to an existing project. The goal is to achieve the most effective solution from a cost and risk standpoint in order to be able to deliver a successful project.

Many government agencies require that AoAs be performed on new procurements. Some of these agencies include the Department of Defense, Homeland Security and the Treasury Department. The DOE Office of Environmental Management (EM) process for reviewing alternatives is discussed in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. The AoA will be conducted for projects with an estimated TPC greater than or equal to the minor construction threshold prior to the approval of CD-1 and may also be conducted when a performance baseline deviation occurs or if new technologies or solutions become available. In addition, the Project Management Oversight and Assessment (PM) office was instructed to develop a DOE 413.3 series guide consistent with published General Accounting Office (GAO) best practices.

Recent formal reviews conducted by DOE Office of Environmental Management on current projects moving toward CD-1 and CD-2 have assessed this new criteria for performing an AoA independent of the contractor organization responsible for the project and in accordance with best practices.

DISCUSSION:

The current version of DOE Order 413.3B has the following main requirements for reviewing alternatives:

- As part of the pre-conceptual design (CD-0) approval process, the mission need and functional requirements must be identified. The mission need must be independent of a particular alternative, and the program office responsible for the capital asset project must explore a variety of alternatives.
- During the conceptual design (CD-1) approval process, reliable cost and schedule range estimates for the alternatives considered must be developed, and whatever figure or range is provided at the CD-0 and CD-1 stages must explicitly note relevant caveats concerning risks and uncertainties inherent in early estimates. In addition, a conceptual design report must be developed that includes, among other things, a clear and concise description of the alternatives analyzed, the basis for the selected alternative, how the selected alternative meets the mission need, the functional requirements that define the alternative and demonstrate that the alternative can be successful, and life-cycle cost assumptions.
- During the CD-0 and CD-1 approval process, several independent reviews must be conducted, depending on the estimated cost of the project, related to two aspects of the AoA process: validation of (the mission need statement and the cost estimates.
- As a project moves toward approval of CD-2, if the top end of the approved CD-1 cost range for the selected alternative grows by more than 50 percent, the program office must reassess alternatives by conducting another AoA and obtaining another CD-1 approval.

In the June 8, 2015 memo from the Secretary of Energy, further direction was provided on conducting AoAs. This prompted an addition to DOE 413.3B (which is currently in the process of being released). The change regarding AoA found in Appendix C is as follows:

- The responsible program office is required to conduct an analysis of alternatives (AoA) that is independent of the contractor organization responsible for managing the construction or constructing the capital asset project. The AoA will be conducted for projects with an estimated TEC greater than the current GPP threshold prior to the approval of CD-1 and may also be conducted when a performance baseline deviation occurs or if new technologies or solutions become available. This determination will be made by the PME. The AoA will be consistent with published GAO best practices. Refer to GAO-15-37, DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices.
- For projects with an estimated TPC less than \$50 million (i.e., representing the upper end of the cost range), the AoA shall be commensurate with the project cost and complexity.

ANALYSIS:

Recent reviews of projects by DOE EM have included assessments of the effectiveness and independence of AoAs. An Independent Project Review (IPR) of a project conducted in June 2015 found that a State agency, one of the project's regulators, convened a group of scientists to review the alternatives presented in the Preliminary Draft of the Environmental Impact Statement. The IPR concluded that this review provided an alternatives analysis that was independent of the current site contractor and that the methodology used substantially addressed the GAO's 24 best practices as specified in the GAO Report 15-37.

In addition, an IPR was conducted on a facility upgrade construction project to evaluate readiness for CD-1 approval which also included evaluation of the Analysis of Alternatives. The DOE office contracted with an independent team to perform the "Independent AoA" in accordance with the GAO 15-37 Report. AoAs are currently in progress on other new projects that are in CD-0 stages and some that are in the process of preparing for CD-2. These projects are using independent teams to conduct the alternatives analysis. In projects that have already received approval from a state regulatory agency through a Record of Decision (ROD), EM accepted the ROD process which includes a series of treatment options as the alternative analysis since the approach is approved by the Regulatory body as well as stakeholders. EM uses a tailored approach to determine how the analysis of alternatives is in conformance with the DOE Order 413.3B and the S-1 memorandum.

The direction from the Secretary of Energy to develop DOE 413.3 series guidance based on the GAO best practices refers to GAO report, GAO-15-37, "DOE and NNSA Project Management: Analysis of Alternatives Could Be Improved by Incorporating Best Practices" dated December 11, 2014. This report describes their set of best practices which they developed since there was no one single set of practices recognized by government and private section entities.

The GAO best practices are divided into four categories and are described below:

1. General Principles

- The customer:
 - defines the mission need and functional requirements without a predetermined solution
 - defines functional requirements based on the mission need
 - provides the team with enough time to complete the AOA process to ensure a robust and complete analysis
- The team conducting the AoA:
 - includes members with diverse areas of expertise including, at a minimum, technical expertise, project management, cost estimating, and risk management
 - creates a plan, including proposed methodologies, for identifying, analyzing, and selecting alternatives, before beginning the AOA process
 - documents all steps taken to identify, analyze, and select alternatives
 - documents and justifies all assumptions and constraints

- conducts the analysis without a predetermined solution
- 2. Identifying Alternatives
 - The team:
 - identifies and considers a diverse range of alternatives to meet the mission need
 - describes alternatives in sufficient detail to allow for robust analysis
 - includes one alternative representing the status quo to provide a basis of comparison among alternatives
 - screens the list of alternatives before proceeding, eliminates those that are not viable, and documents the reasons for eliminating any alternatives
- 3. Analyzing Alternatives
 - The team:
 - develops a life-cycle cost estimate for each alternative, including all costs from inception of the project through design, development, deployment, operation, maintenance and retirement
 - presents the life-cycle cost estimate for each alternative as a range or with a confidence interval
 - expresses the life-cycle cost estimate in present value terms
 - uses a standard process to quantify the benefits/effectiveness of each alternative
 - quantifies the benefits/effectiveness resulting from each alternative over that alternative's full life cycle
 - explains how each measure of benefit/effectiveness supports the mission need
 - identifies and documents the significant risks and mitigation strategies for each alternative
 - tests and documents the sensitivity of both the cost and benefit/effectiveness estimates for each alternative to risks and changes in key assumptions
- 4. Selecting a Preferred Alternative:
 - The team:
 - defines selection criteria based on the mission need
 - weights the selection criteria to reflect the relative importance of each criterion
 - compares alternatives using net present value
 - An entity independent of the AOA process reviews the extent to which all best practices have been followed

ACTIONS:

The following are lessons learned that elaborate and highlight some of the best practices used to develop a good analysis of alternatives:

1. Develop a good plan – creating a well-considered plan is a major step to conducting a successful AoA. It provides a roadmap for how the analysis proceeds by considering technology gaps, developing viable alternatives and evaluating data.
2. Applying sufficient resources is critical – allocating the proper number of staff to execute the plan will assist in getting a good AoA performed.
3. Understand the existing capabilities before starting analysis – alternatives should include an upgrade from the status quo, therefore, the baseline must be clearly understood. Ensure that sufficient effort is planned to capture fully so that alternatives to the baseline can be clearly compared.
4. Utilize existing analyses – if a technical analysis was required by a regulator, for example, then this can be a viable approach as long as there is sufficient justification and documentation.
5. Understand the project's stakeholders – knowing the political, operational, economic and technical motivations of the stakeholders and decision-makers involved will assist in determining objectives and metrics to identify best solution.
6. Ensure there is no pre-conceived solution – a premature focus on a particular solution can cause the AoA to fail. If stakeholders are enamored of a particular solutions, completing the analysis will be difficult and biased.
7. Utilize an independent team that has strong technical credentials and experience – the expertise and experience of the AoA team is vital. Select appropriate SMEs rather than just adding someone from a particular organization.

8. Use reasonable technical criteria – it is essential that technical knowledge of alternatives is well understood otherwise time and resources can be wasted reviewing technologies that are not feasible.
9. Allocate sufficient schedule – an inadequate timeframe to conduct an AoA can render its conclusions ineffective. AoAs need enough time to assess a broad range of alternatives and their risk in order to be effective.
10. Incorporate data from risk analyses – technical programmatic, or operational uncertainties associated with each of the various alternatives should be considered in finding the best approach.

Critical Decision(s): CD-0 to CD-2
Facility Type(s): All
Work Function(s): Project Management, Technical
Technical Discipline(s): All

REFERENCES:

1. “Performing Analyses of Alternatives”, Mitre Systems Engineering Guide.
<https://www.mitre.org/publications/systems-engineering-guide/acquisition-systems-engineering/acquisition-program-planning/performing-analyses-of-alternatives>
2. GAO-15-37, “DOE and NNSA Project Management: Analysis of Alternatives could Be Improved by Incorporating Best Practices”, December 2014.
3. GAO-16-22, “Amphibious Combat Vehicle, Some Acquisition Activities Demonstrate Best Practices; Attainment of Amphibious Capability to be Determined”, October 2015.
4. DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, November 29, 2010.

Questions about the EM Lessons Learned Program? Contact Johnnie Newson at johnnie.newson@em.doe.gov