



Air Force Life Cycle Management Center
Standard Process
for
Cost Capability Analysis (CCA)

Process Owner: AFLCMC/XP

Date: 21 June 2018

Version: 1.4

Supersedes: AFLCMC CCA Standard
Process, 18 May 2017

Summary of Changes

This directive supersedes AFLCMC Cost Capability Analysis (CCA) Standard Process, dated 18 May 2017, by updating the hyperlinks affected by the AFLCMC SharePoint Migration.

Record of Changes.

Record of Changes		
Version	Effective Date	Summary
1.0	19 Nov 2015	Basic document; Approved by S&P Board on 19 Nov 15
1.1	21 Dec 2015	Editorial change; changed Process Owner from XZ to XP
1.2	07 Apr 2016	Editorial changes; lexicon and clarification of roles & responsibilities
1.3	18 May 2017	Editorial changes; changed order of parallel Steps 7 & 8 (Figure 3. Figure 4, & Attachment 1), updated policy references, standardized lexicon across CCA products- Approved at 18 May 2017 S&P Board
1.4	21 June 2018	Administrative changes; updated hyperlinks affected by AFLCMC SharePoint Migration Approved at 21 June 2018 S&P Board

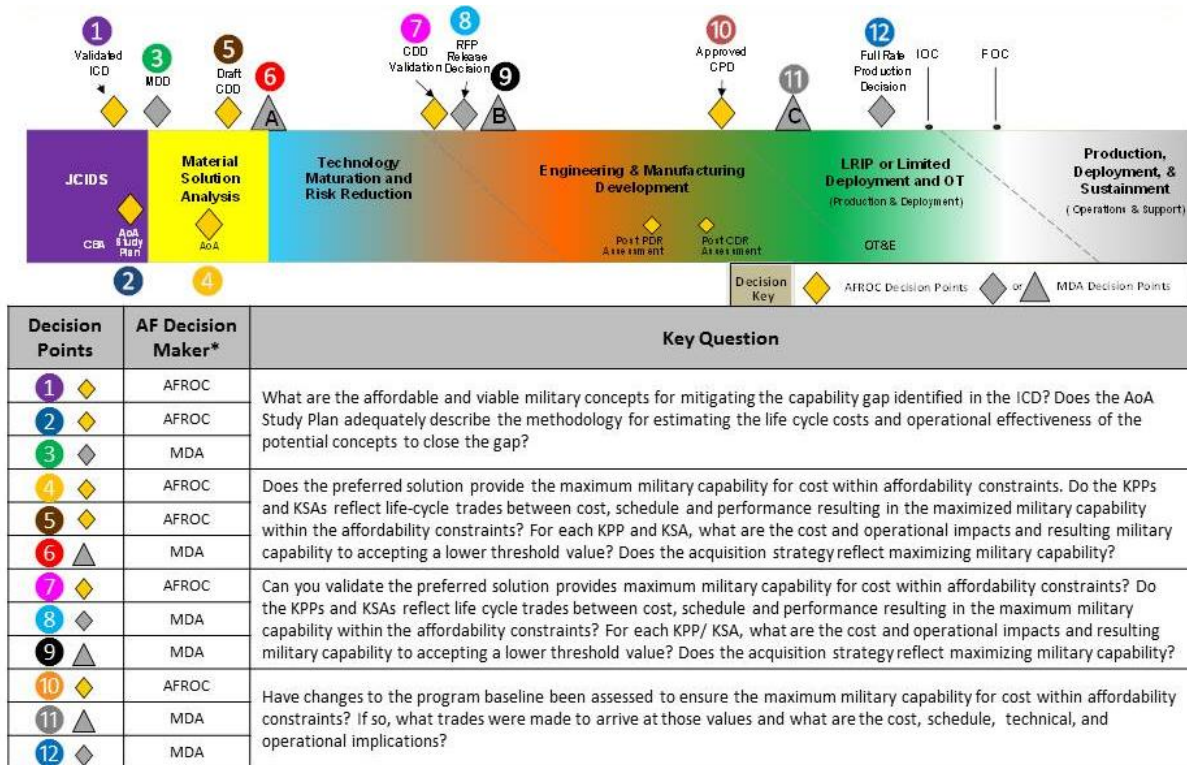
Cost Capability Analysis (CCA)

- 1.0 **Description.** The Air Force Life Cycle Management Center (AFLCMC) Standard Process for Cost Capability Analysis (CCA) provides a framework and a high level summary of the steps to conduct CCA at various decision points in a program life cycle.
 - 1.1 CCA is an analysis process that uses warfighter involvement, subject matter expertise, and a rigorous multi-attribute, multi-objective decision analysis methodology to define tradespace between cost and warfighting capabilities. The CCA identifies relative value of alternatives and integrates cost and capability to illuminate the tradespace. This analysis process can greatly benefit any program by highlighting the most valuable use of limited resources early in the life cycle, ultimately leading to the selection of an affordable, effective end product. The push for a value-based decision analysis originates from a 2011 CORONA decision, resulting in revisions to AFI 10-601. AFI 10-601 has since been redacted; however, analyzing cost and capability trades is still required as part of AFPD 10-6 which states that “SAF/AQ shall ensure life cycle cost and capability tradeoff analysis is used for all Air Force Review Boards and Configuration Steering Boards.”
 - 1.2 While there are many decision analysis methodologies that may be used in whole or in part to accomplish a Cost Capability Analysis, this standard process provides a Multi-Objective Decision Analysis (MODA) methodology. This methodology was first developed in the 1970s, and has come to be widely accepted and used in a multitude of domains where decisions are made with competing resources. MODA has been used to inform decisions in several Air Force programs, and the lessons learned from these efforts are used extensively to inform this process. One of the main strengths of the MODA methodology is the emphasis on user interaction early in the analysis process. CCA is not synonymous with MODA; rather, MODA is simply the method recommended to accomplish a CCA.
 - 1.3 AFLCMC’s standard CCA process consists of 11 steps that may be applied at any of the decision points in a program life cycle or on an as-needed basis to assist with complex decisions. The order and scope of the steps are tailorable to the particular requirements or constraints of the decision point and the unique needs of each analysis. For these reasons, the best practices described in this document are best used by appropriately trained facilitators. This document describes a modified form of decision analysis that has been tailored, where necessary, to facilitate the goals of a CCA. Process tailoring is encouraged, but use of alternative methodologies should be justified and well documented.
 - 1.4 The CCA process emphasizes capability and affordability discussions. CCA supports 12 distinct requirement and acquisition decision points, to include Initial Capabilities Document (ICD), Materiel Development Decision (MDD), Analysis of Alternatives (AoA), and at each requirements and acquisition forum through production. The 12 points are depicted at the top of the CCA Decision Framework (Figure 1), which shows the points grouped into three phases. The amount of work required to accomplish a CCA at these decision points will vary widely; however, it is important to note that CCA is not restricted to these decision points. A CCA may be conducted in conjunction with any number of other acquisition or requirement

reviews, or it may be conducted “ad hoc” to examine trades unrelated to acquisition decisions or requirements documents. Examples include should cost initiatives, budget drills, or technology insertion. In some cases, results of a previous CCA may be used in part or in whole.

- 1.5 While the process described in this document is at a high level, it references more detailed documentation, instructions, and the AFLCMC/OZA CCA Guidebook to assist in the actual analysis required at any particular decision point in the life cycle.

Figure 1. CCA Decision Framework



Note: The questions shown in Figure 1 are representative of the questions that should be asked at the various decision points across the life cycle. Specific questions for each of the 12 decision points are found in the AFLCMC/OZA CCA Guidebook.

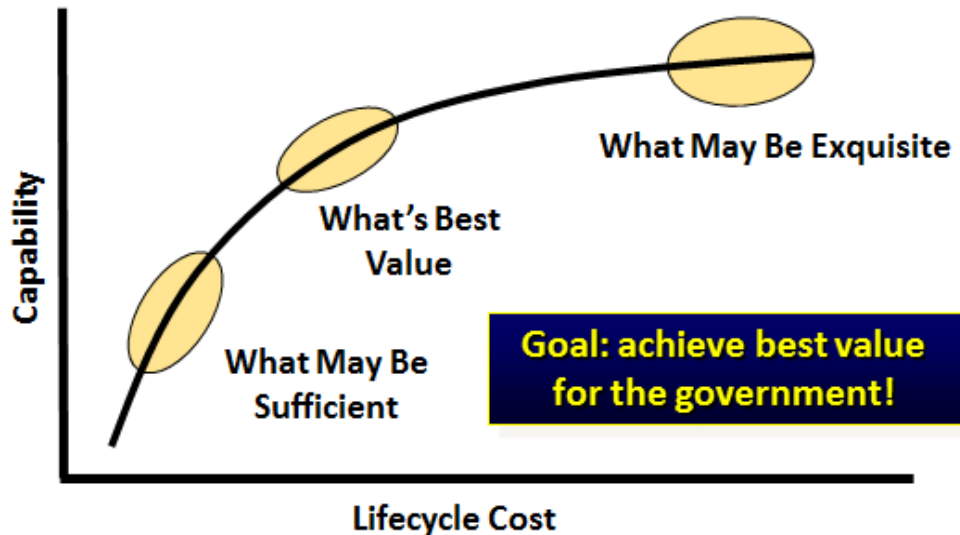
2.0 Purpose

- 2.1 The purpose of the CCA process is to support delivery of cost-effective solutions through deliberate tradeoff analysis between operational capability and affordability. The CCA improves the understanding of effects of requirements on cost to inform affordability decisions or tradeoffs throughout the life cycle, and to select solutions at the right point on the Cost Capability Curve, Figure 2.
- 2.2 The purpose of this high-level standard process is to emphasize and enforce the use of CCA to perform the necessary analysis at the key life cycle decision points.

2.3 The CCA process supports AFLCMC's FY17 Product Goal to deliver timely, agile and cost effective systems and solutions:

Objective 1.2 – Generate cost savings/avoidance by over \$700M per year through end of FY18. CCA is a major element of development planning that enables full life cycle affordability versus capability tradeoffs to ensure that we make informed decisions to balance life cycle cost versus operational requirements.

Figure 2. Cost Capability Curve



3.0 Entry/Exit Criteria and Inputs/Outputs

3.1 Entry Criteria. Entry Criteria may vary by specific decision point; however, there are entrance criteria common to all CCA efforts.

3.1.1 Requirement to perform a CCA. The requirement to perform a CCA will typically be driven by a decision point that requires this type of analysis. The initiating office (e.g., the Joint Requirements Oversight Council (JROC), Air Force Capability Development Council (AF CDC), Milestone Decision Authority (MDA)) should generate a memorandum (e.g., memorandum of agreement (MOA), memorandum for record (MFR), etc.) documenting the need for analysis and tasking the appropriate office within their control. This memorandum, once signed by the decision authority, grants the CCA team the authority to seek manpower and funding, conduct the analysis, and present their findings. See Section 6.3 for a definition and discussion of the roles of the decision authority.

3.1.2 Funding and Manpower. It is the responsibility of the study sponsor to secure the funding and manpower necessary to accomplish the CCA. The amount of manpower required will vary according to the scope of the effort and the similarity to previous work. Roles and responsibilities for team members are specified in Section 6 below, but there is no requirement for these team members to be drawn from any specific office or function.

- 3.2 Exit Criteria. In general, a standard process will end once the CCA is completed, documented, and the findings approved by the decision authority. While the specific outputs for different decision events may be driven by those decision authorities, most analyses are expected to contain the following exit criteria.
- 3.2.1 Stand-Alone Analysis Documentation. Since the analysis effort is likely to require the resources of a variety of personnel, the availability of the team will be limited once the analysis effort is concluded. For this reason, the CCA outputs should be documented in a format that stands alone. It is important to include enough information that allows a subsequent team to reproduce the results. This document may be reviewed by the decision authority but is not intended to be the only means of presenting the analysis to the decision maker.
- 3.2.1.1. In addition to specifics about parameters, assumptions and calculations, any unique or tailored methods developed throughout the analysis should be made available along with thorough instructions for the implementation of these methods.
- 3.2.2 Decision Authority Approval. Since the CCA is conducted with the intent of informing life cycle or requirements decisions, the decision authority (e.g., AF CDC or MDA) provides validation that the analysis is sufficient. Once validation is accomplished (thus analysis is deemed sufficient by the decision authority), the process is terminated.
- 3.3 Inputs. Specific inputs will depend on the decision point the CCA is supporting. General categories of inputs are shown below, along with specific examples.
- 3.3.1 CCA Analysis Plan and Approval. This document must be generated and approved as an entry criterion for the analysis; however, it is also an input as it contains the scope and direction for conducting the analysis..
- 3.3.2 Requirements Documents. These inputs will vary depending on the maturity of the acquisition. Examples include the ICD, Capability Development Document (CDD), and Capability Production Document (CPD) (draft where appropriate).
- 3.3.3 Previous Analyses and Program Documentation. For the sake of continuity and efficiency, it is crucial that any previous analyses and programmatic considerations (cost, performance, logistics, etc.) be included as initial data for the CCA. Examples of these include:
- previous CCAs
 - AoA report
 - Systems Engineering Management Plan (SEMP)
 - Acquisition Strategy
 - Test and Evaluation Master Plan (TEMP)
 - Cost Analysis Requirements Description (CARD)
 - Life Cycle Management Plan (LCMP)
 - Life Cycle Sustainment Plan (LCSP)

- 3.3.4 Existing Value Models. Some organizations have produced enterprise-level value models or architectural products. In some cases, these models may be compulsory for analyses performed in that organization.
- 3.3.5 Mission Definition. Mission definitions and operational scenarios are often provided by the user of the system. Analysts must ensure that for acquisition related studies these scenarios are compliant with the Office of the Secretary of Defense (OSD) approved scenarios. Such scenarios can greatly reduce the work of the analyst when attempting to connect system attributes to functional requirements. Examples include Concepts of Operation (CONOPS) and OSD-approved planning scenarios. If scenarios and/or vignettes are needed analysts can check with AFLCMC/EZJA for acquisition community standard articles.
- 3.3.6 Program Schedule with Key Milestones. Initial Operational Capability (IOC) and Full Operational Capability (FOC), for example, may assist the analyst with identifying technologies with appropriate readiness levels, and can inform the scope of the analysis if deadlines are mandated. This information may be found in the program Integrated Master Schedule (IMS), if available.
- 3.3.7 Guidance and Policy. Policy documents, from the OSD level down to local policy, may have specific requirements for CCAs that must be met for the analysis to be approved by the decision authority. Guidance applicable to all CCAs at the Air Force level are included in Section 10 of this document.
- 3.4 Outputs. Outputs from the analysis should be tailored to achieve the exit criteria listed above, and as directed by the decision authority. In general, outputs fall into two categories.
 - 3.4.1 Briefing Materials. Briefing material should conform to the template prescribed by the applicable decision authority (e.g., AF CDC, MDA) while also being focused to provide the decision maker with a thorough understanding of the analysis findings.
 - 3.4.2 Stand-Alone Analysis Documentation. The CCA should be focused on providing analysis that informs Senior Leader decision making and culminates in the production of the CCA Final Report which provides the analysis parameters, results, and analysis of those results. The customer may choose to accept an annotated briefing in lieu of a written report. Suggested contents for the CCA Final Report are as follows.
 - 3.4.2.1. Guidance and Direction
 - 3.4.2.2. Introduction (to include ground rules and assumptions)
 - 3.4.2.3. Methodology (description of each step in the 11-step standard process and their respective products and outputs)
 - 3.4.2.4. Analysis findings and lessons learned
 - 3.4.2.5. Description and operation of unique analysis methods (as Annex)

4.0 **Process Workflow and Activities.** This section provides a visual representation of the process with details of workflow and activities. It lays out the process from end-to-end and describes interaction between Air Force organizations and external organizations integral to the process.

4.1 Suppliers, Inputs, Process, Outputs, Customers (SIPOC). The high-level SIPOC in Table 1 provides a macro view of the process, the process environment, and boundaries for the process.

Table 1. SIPOC

Suppliers	Inputs	Process	Outputs	Customers
<ul style="list-style-type: none"> • Users/Operator • Requirements Sponsor • Approval Authorities • Decision Authorities • Review Authorities • Core Function Leads • Industry • Technologists, National Labs, Federally Funded Research and Development Centers (FFRDCs) • Academia • Other Stakeholders 	<ul style="list-style-type: none"> • CCA Analysis Plan (either document or briefing) and approval • Requirements documents (ICD, CDD, CPD) • Previous analyses and program documentation (CARD, LCMP) • Existing value models • Mission Definition (CONOPS and OSD approved scenarios) • Time frames (IOC, FOC) • Acquisition strategy • Guidance/Policy • Budgetary data/decisions 	<p>CCA</p> <ul style="list-style-type: none"> • Identify Problem and Scope Analysis • Create Value Hierarchy • Develop Measures • Develop Value Functions • Prioritize Measures/Develop Aggregation Method • Identify Alternatives • Determine Capabilities of Each Alternative • Estimate the Cost of Alternatives • Generate Outputs and Display Products • Analyze Sensitivity • Record Analysis 	<ul style="list-style-type: none"> • CCA Final Report or CCA Final Briefing (stand-alone, repeatable) to include: <ul style="list-style-type: none"> - Graphical depiction of results (i.e., Pareto Plot) - Tabular summary of alternative scores - Analysis Findings 	<ul style="list-style-type: none"> • Users/ Operators • Decision Authorities • Requirements/ Acquisition community • Approval Authority • Review Authority • Core Function Leads • Industry • Technologists

4.2 Process Flowchart. Figure 3 represents the CCA process at a high level and provides the goal of each step. Figure 4 shows the same process at a detailed level to demonstrate the interrelation between the Work Breakdown Structure (WBS) elements. It is important to note that this process flow may be tailored to the needs of the individual effort as indicated by the process tailoring step. This iterative process must be accomplished with frequent communication with stakeholders, including decision makers to ensure that the end product is appropriate for the decision at hand.

Figure 3. High-Level Process Flowchart—Cost Capability Analysis

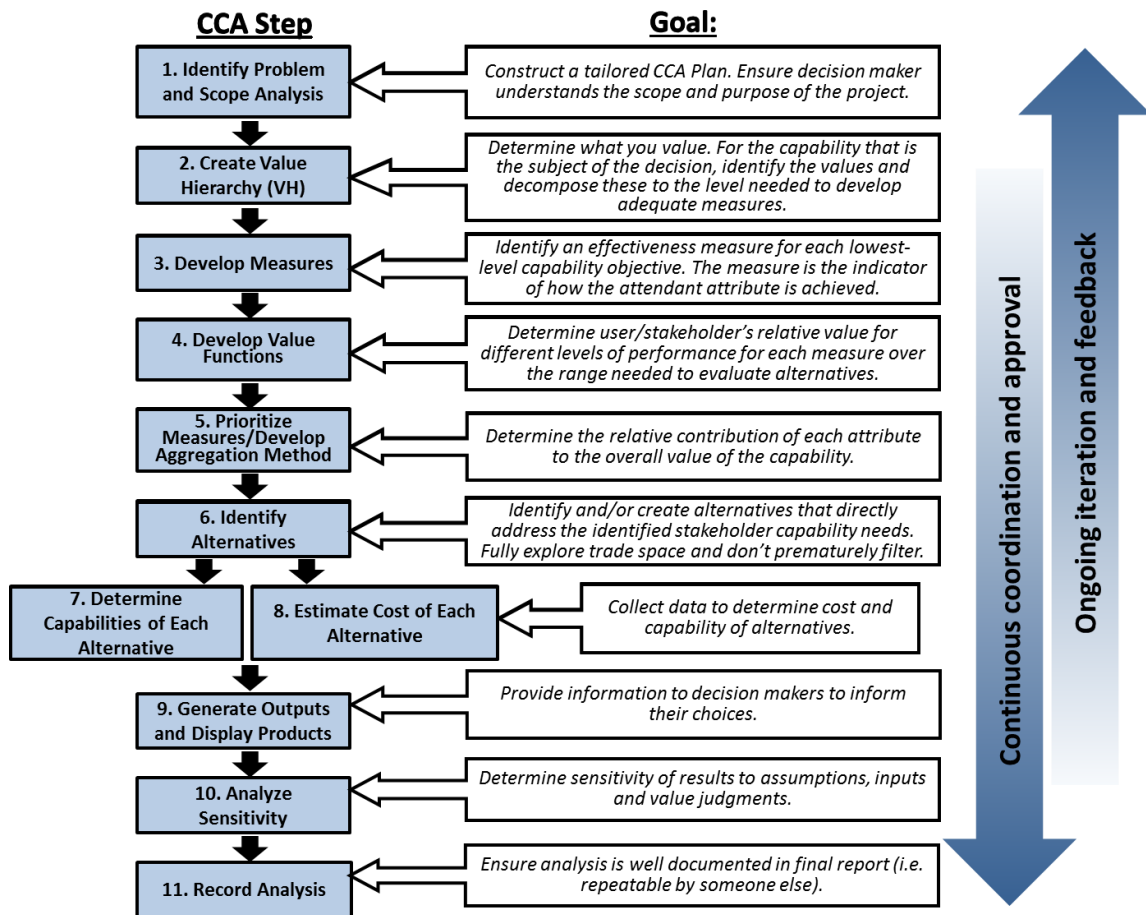
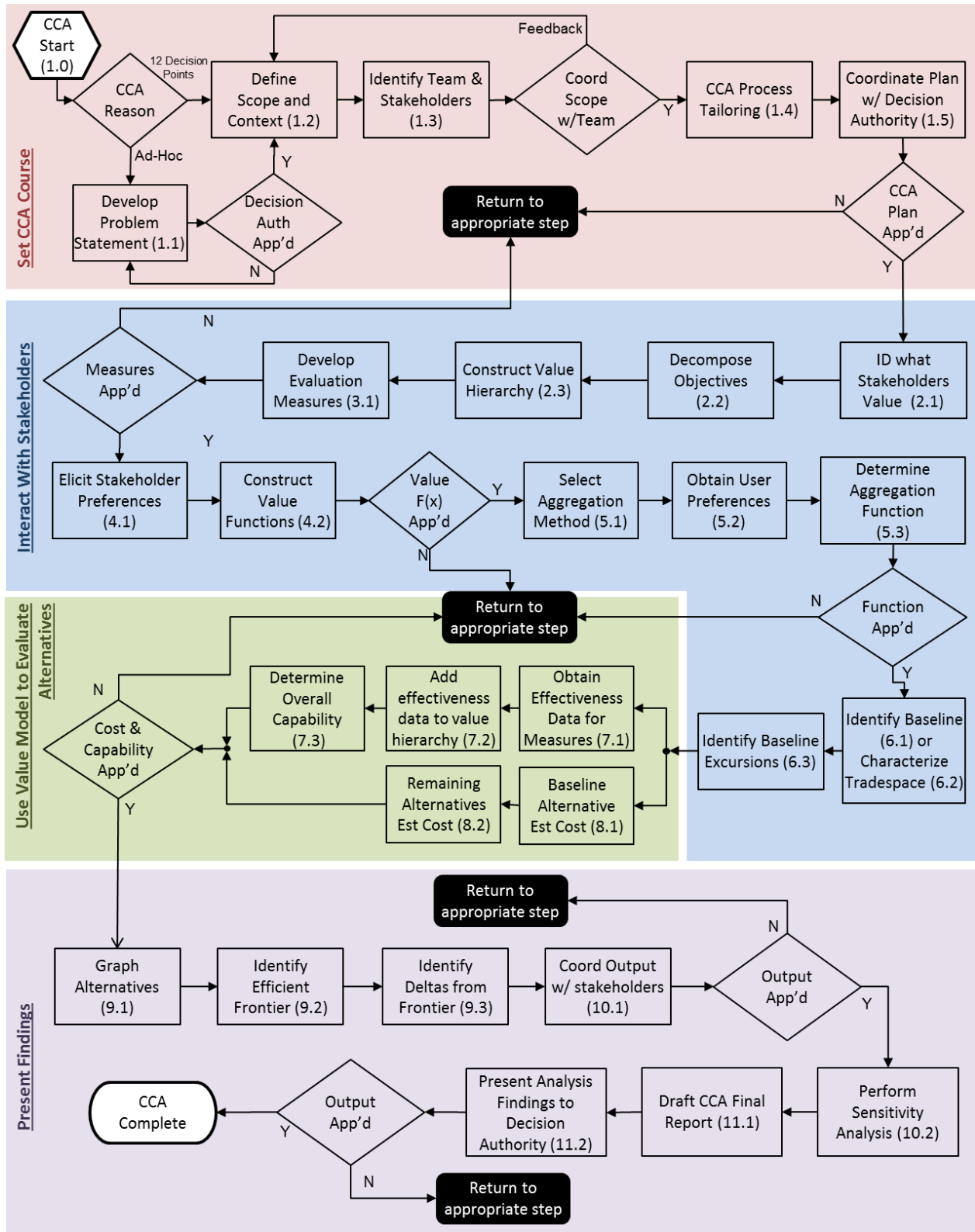


Figure 4. In-Depth Process Flowchart—Cost Capability Analysis



4.3 Work Breakdown Structure (WBS). The WBS (Table 2) provides additional detail for the flowchart activity boxes. See Attachment 1 for an MS Excel version of the WBS with more detail. For each activity in the WBS, the responsibility for completion falls to the CCA Study Lead (coordinated by the CCA facilitator or overall Study Lead, where applicable). The amount of time to complete each step will vary with the scope of the overall effort and deadlines imposed for the relevant decision. All outputs should be approved by the decision maker at the appropriate level.

Table 2. CCA Process WBS

WBS	Activity	Description	References/Tools
1.0	Identify Problem and Scope the Analysis		
1.1	Develop Problem Statement	In many cases, this is pre-defined or mandated from the decision authority; however, in the case of ad hoc analyses or studies, it is imperative that the problem be well-defined. The problem should be that a capability or knowledge gap exists with scarce resources to fill it. In the case of a military capability gap, the gap should be formally documented in a Capability Based Assessment (CBA) or like document. In the case of an acquisition decision, the gap is that the optimum--or "best value"--strategy is unknown. The objective should be to fill the gap with the optimal mix of cost and usefulness to the government. <u>Input:</u> Capability or knowledge gap <u>Output:</u> Problem Statement and Objective Statement	CBA
1.1.1	Review Study Guidance	Appropriate authority provides study guidance to study lead for execution. Determine the motivation. What questions do we need to answer? What decision are we supporting? Again, in the case of ad hoc analyses, this may need to be explored and explicitly stated.	
1.1.2	Develop Problem Statement	The problem statement should be developed here. Coordination through the stakeholders will be required once they are established in Step 1.3. below.	
1.2	Define Scope and Context	In the case of early materiel or system definition (as defined in Appendix A), the CBA should include the necessary information on the scope and mission context (including CONOPS, scenarios) of the problem being assessed. Regardless of the subject of the CCA, the scope and decision context must be established to determine appropriate resourcing and focus the effort. In some cases, a decision authority may determine that a CCA is not required or that the available time is insufficient. <u>Input:</u> Documented scope and mission context where available (from CBA or like document). <u>Output:</u> An understanding of the scope and mission context of the problem, documented in the Analysis Plan.	CBA, CONOPS
1.2.1	Understand the Mission/Acquisition Environment (Things External to the Analysis)	Determine the pertinent documents and regulations that impact the CCA. It is important that non-materiel elements be considered (for example, policies or product support considerations). It is also important to understand the mission that the material solution is going to meet.	JCIDS Documents, ADM

1.2.1.1	Conduct Research to Establish Decision Baseline	Previous analyses and program documentation (CCA or otherwise) may be pertinent to the current effort, and should be sought. In some cases, whole steps of previous CCAs, such as the value hierarchy, may be re-useable. This work, in conjunction with policy and regulations, provides valuable insight that allows the team to scope the parameters of the current analysis.	Bending the Cost Curve Government-Industry Engagement Guide
1.2.1.2	Set up Life Cycle Context	The CCA Process supports the development of tradeoff analyses across the program acquisition life cycle. However, the nature of the CCA varies across the life cycle and needs to be characterized. These variations are a result of the level of maturity of the acquisition as tradeoffs of capability or performance attributes become more focused and narrowed around a defined solution. The information and/or data needed to portray cost vs. capability are based upon the conditions and state of the requirements, design, and the life cycle cost (LCC) baselines. This step will influence the creation of the value hierarchy (CCA Step 2). Characterize, socialize, and obtain approval. This may also include "snapping" baselines for requirements, design, and cost for the current point in the life cycle.	
1.3	Identify Team Members and Stakeholders	Team Members should include anyone who will provide input or analysis in support of the cost capability effort. In contrast, stakeholders should include all who have equity in the capability requirement and the acquisition of the requirement. This will be a much larger list than the team members and needs to include appropriate members of the requirements community, the acquisition community, and all approval authorities. The Stakeholder Issues Identification Matrix is a useful product for this step. <u>Input:</u> Problem statement and mission context <u>Output:</u> Documented list of all resources required to support the effort	Stakeholder Issues Identification Matrix
1.3.1	Assign Study Lead and Facilitator(s)	The CCA Study Lead will be responsible for coordinating the efforts of several different teams and it is preferable for the Study Lead to be knowledgeable of CCAs. Also, the Study Lead should possess subject matter expertise in the domain under consideration. The Facilitator is responsible for conducting value elicitations with the customers and stakeholders, which requires background in decision analysis/operations research. For this reason, these execution-level interactions are best left to an experienced "Facilitator" who understands the methods and techniques used in this process.	
1.3.2	Identify the Stakeholders	The mission context and decision environment are crucial in determining what stakeholders should be involved in the analysis effort. Even if these are not regularly-participating members at the working level, advocacy and oversight for all of the different elements of the analysis is crucial in generating a credible and complete product. At a minimum, the Study Lead should consider engaging stakeholders in the operational, technical, product support and maintenance communities. Examples include: CCMD, MAJCOM, HAF/A5R, SAF/AQ, OSD-CAPE, OUSD (AT&L)	
1.3.2.1	Train CCA Team	The process for conducting a robust CCA can be challenging, especially to those with no background or experience with this type of analysis. It is useful to provide team members and stakeholders with an overview	AFLCMC/OZA CCA Guidebook, AFIT Certificate, AFLCMC/OZA training

		of the CCA process, perhaps using a notional example. Subject Matter Expert (SME) understanding of the overall process allows them to see how they fit into the “big picture”—this will aid with the process tailoring effort and allow participants to properly scope their participation. Training resources are available to support this step.	programs. See Section 8 for more information.
1.3.3	Identify Engagement Considerations	Consider timing, access, sensitivities, and associated ramifications. For example, the processing of classified information across geographically distributed teams and stakeholders can pose challenges that must be mitigated early. It may also be necessary to ensure that each team member has the support of their organization and is able to commit the resources necessary to make the analysis effort successful.	
1.4	CCA Process Tailoring	Given the research and preparation described above, it may be necessary to eliminate or add to the following steps. Ultimately, it is the goal of the analysis to provide meaningful information to the decision maker. The team should tailor the analysis process to best accomplish this goal. <u>Input:</u> Research materials, stakeholder assessment, resource availability, and schedule constraints. <u>Output:</u> A tailored analysis process, documented in the Analysis Plan Document or Briefing	
1.5	Coordinate Plans with Decision Authority	The data generated in the above steps should be documented and approved before proceeding with the analysis. <u>Input:</u> Draft CCA Plan <u>Output:</u> Approved Analysis Plan Document	
1.5.1	Draft CCA Analysis Plan	The tailored analysis process and the outputs of all previous steps must be documented in a format that will allow decision makers to understand the way forward, to include the resources required, the scope, the involved parties, and the questions the CCA will answer. In some cases, this becomes part of another document, such as an AoA Plan. A suggested format for this plan is specified in Section 3.4.2 in this Standard Process.	
1.5.2	Gain Approval from Decision Authority	The intent of this activity is to gain approval from the decision authority and to proceed with the CCA.	
1.5.3	Understand the Decision Environment and Document the Ground Rules and Assumptions	Scope the effort by deciding what decisions or decision elements are "givens" and what decisions are too low-level or should be deferred.	Decision Hierarchy (ref. AFLCMC/OZA CCA Guidebook)
2.0	Create Value Hierarchy		
2.1	Identify What the Stakeholders Value	Identify the high-level objectives/tasks that the stakeholders value. Describe these objectives in terms of capabilities, not performance metrics or design specifications. These objectives/tasks will serve as the top level of the value hierarchy. Often, OSD-CAPE will identify Mission Tasks (MTs) in the AoA Study Guidance, or CONOPS early in program documentation. Since the military enterprise is composed of systems-of-systems, it is important to consider the effect that one objective will have on the dependent systems. For this reason, it is important that the stakeholders maintain the broadest focus practical when discussing their values. It is the Study Lead’s responsibility to ensure the team is	Mission Tasks, AoA Study Guidance, CONOPS

		structured appropriately to facility this level of discussion. <u>Input:</u> Documented capability or knowledge gap <u>Output:</u> Documented objectives/tasks required to close the gap	
2.2	Decompose High-Level Objectives/Tasks into Sub-objectives/Sub-tasks	Further decompose the top-tier objectives/tasks into sub-objectives/sub-tasks until enough detail is reached to distinguish the contributions of the alternatives you will compare. <u>Input:</u> Documented Objectives/Tasks <u>Output:</u> Objectives/Tasks decomposed to the lowest level necessary	
2.3	Construct Value Hierarchy	Select the most appropriate way to display the value hierarchy. Typically a tree-like structure intuitively depicts the relationship between objectives and aids the objective comparison performed in later steps. <u>Input:</u> Lowest-level objectives/tasks <u>Output:</u> Product that depicts these objectives/tasks and their relationship to one another	
3.0	Develop Measures	Each CCA should be as objective as possible. In this step, the team determines how to acquire data and uses it to assess, or numerically score, alternatives according to the objectives defined in Step 2.2 above.	
3.1	Develop Evaluation Measures	Determine one measure for each of the lowest-level objectives/tasks in the hierarchy. These measures should be as objective as possible (for example, "time to locate threat, measured in seconds"). They may be a continuous (e.g., "range in miles") or categorical (e.g. "technology readiness level"). They can be subjective if no objective measure is appropriate (e.g. "high/medium/low"). What is most important is that these measures represent how well the task or objective is accomplished. If the measures are not generated in coordination with stakeholders, it is essential that the stakeholders vet them. This will ensure that the measures are appropriately focused on key aspects of each objective and that it is possible to collect data in the manner specified. <u>Input</u> – Value Hierarchy <u>Output</u> – At least one measure for each lowest-level objective	
4.0	Develop Value Functions	Use stakeholder preferences to convert different levels of performance into "value" that can be compared against other objectives. This method is preferred over using specific thresholds for performance levels.	

4.1	Elicit Preferences from Stakeholders/Users	<p>Specific methods for eliciting this data are discussed in the CCA Guidebook. A trained facilitator with experience in decision analysis is crucial to success in this step, and on-going dialogue with the customers/stakeholders is vital to obtaining accurate value functions. Data points and shape of functions should come directly from the associated subject matter expert (user, stakeholder, etc.). Note that different stakeholders may value performance differently! The effect of these differences must be adjudicated using sensitivity analysis (Step 10). Value functions do not include cost, but capture what the user values. For operational capability, the primary source of input will be the user or the requirements sponsor speaking on their behalf.</p> <p><u>Input</u>: Measures sub-divided to the lowest level needed <u>Output</u>: Data used to construct functions (typically, discrete data points and inflection/curvature)</p>	
4.2	Use Preferences to Construct Value Functions	<p>Value functions may take many forms but common ones include exponential or "S" curves (indicating diminishing value), linear or piece-wise linear, and discrete (necessary for non-continuous measures). Once a function is constructed, test the stakeholder using a few other points to ensure you have properly captured their preferences.</p> <p><u>Input</u>: Data from stakeholder elicitation (Step 4.1, above) <u>Output</u>: One value function for each lowest-level measure</p>	
5.0	Prioritize Measures/Develop Aggregation Method	<p>Because it is uncommon for all competing aspects of a decision to carry equal importance, it is necessary to determine the relative importance of objectives to allow aggregation of the measures into a single capability score. This aggregation is crucial to informed decision making since it allows direct comparison of alternatives according to a common scale. Without aggregation, it is often too difficult to simultaneously and objectively consider alternatives with multiple decision criteria. One common way to accomplish aggregation is to assign weights to the objectives. The higher priority objectives (and the measures associated with them) will have a higher numerical weight assigned to them. This method aids in the sensitivity analysis (Step 10). Select an appropriate weighting methodology to apply to the prioritized objectives in the value hierarchy.</p>	
5.1	Select Aggregation Method	<p>Selection of most appropriate aggregation methodology is critical. Priority and weightings should reflect stakeholder preferences but avoid individual biases. The team will select an appropriate aggregation methodology to apply to the objectives (or mission tasks) in the value hierarchy. If weighting is appropriate, some commonly-used and widely-accepted weighting methods are 100 point method, ratio method, swing weighting, and the rank order centroid method. Methods other than weighting exist but are uncommon. In some rare cases it may be difficult or inappropriate to aggregate results for mathematical or political reasons. In these instances, it is essential to aggregate to the highest level possible and present these sub-capability scores to the decision maker in a clear fashion to facilitate comparison. However, an inability to aggregate measures may indicate a poorly constructed value hierarchy or a need for further coordination with SMEs.</p>	AFLCMC/OZA CCA Guidebook

		<p><u>Input</u>: Value Hierarchy and measures created in Steps 2 and 3, Trained Facilitator</p> <p><u>Output</u>: Selected weighting method</p>	
5.2	Obtain Stakeholder Preferences	<p>In this step, the facilitator uses the selected weighting methodolog(y/ies) to elicit weighting preferences from the stakeholders. In some cases this results directly in weighted objectives, but in some methodologies the stakeholder considers subsets of the total hierarchy (such as with pairwise-comparison) and the end result is used to determine the overall weights in the next step.</p> <p><u>Input</u>: Selected weighting method, trained facilitator, and value hierarchy</p> <p><u>Output</u>: Weighting preferences or weighted objectives</p>	
5.3	Use Preferences to Determine Aggregation Function	<p>If weighted objectives were not determined in Step 5.2, the facilitator uses the selected weighting methodolog(y/ies) and any information provided in the previous step to determine the weights of each objective in the hierarchy.</p> <p>Facilitation Note: If the decision maker has not been involved or informed in the creation of the Value Hierarchy, Aggregation Function, and Value Curves, now is an opportune time to present these and seek approval.</p> <p><u>Input</u>: Stakeholder preferences</p> <p><u>Output</u>: Weighted objectives</p>	
6.0	Identify Alternatives	<p>Determine alternatives to score. Alternatives can be generated by various means and can be found in a broad range of documentation (i.e., OSD-CAPE may document alternative categories and Concept Characterization Technical Descriptions). If the concept/program does not have an AoA Study Plan, the team will have to generate alternatives on their own. Eliminate alternatives that are not feasible but do not be too heavy handed with screening--too few alternatives won't produce an efficient frontier. Rationale for removing alternatives during screening should be captured and provided in the analysis documentation.</p>	
6.1	Identify "Baseline" Configuration or Analogies	<p>"Alternative 0" represents the baseline and represents the decision to "doing nothing." In many cases, this may be the least time-consuming from a performance scoring perspective, but determining the baseline cost may be the most time consuming from a cost perspective. In the case of early materiel efforts, there may be no "baseline" and analogies may be used for cost and capability estimates.</p> <p><u>Input</u>: Value Hierarchy</p> <p><u>Output</u>: Current "as-is" features for each objective in the Value Hierarchy</p>	
6.2	Characterize Tradespace	<p>Tradespace analysis is useful for identifying the bounds of the technical parameters for each alternative. This effort will be informed by the value functions identified by the stakeholders and will directly drive the generation of alternatives that fill the tradespace (in cases where alternatives must be generated) or a selection of pre-defined alternatives.</p>	

6.3	Identify Other Alternatives or Excursions from the Baseline	<p>In analyses where alternatives are pre-defined (such as an AoA) this step consists of identifying the existing alternatives. For analyses without existing alternatives, the team may vary system attributes at different levels to generate alternatives.</p> <p><u>Input:</u> All sources documenting alternatives to consider and tradespace characterization.</p> <p><u>Output:</u> Comprehensive listing of all alternatives whose cost and capability will be evaluated. It may be helpful to identify the features that differentiate alternatives</p>	Bending the Cost Curve Government-Industry Engagement Guide
7.0	Determine Capability of Each Alternative	Each alternative must now be scored using the objectives, weights, and value functions established in the steps above.	
7.1	Obtain Performance Data for Lowest-level Measures	<p>For each alternative, assess each applicable lowest level objective. This data can be an engineering quantity (such as range, power, or targets destroyed) or it may be a subjective rating (how survivable is the system on a scale 1-5). The data may be obtained via modeling and simulation, collected/extrapolated from fielded systems, or provided by SME input.</p> <p><u>Input:</u> Value Hierarchy created in Steps 2-3</p> <p><u>Output:</u> Assessment (performance) of each lowest-level objective for each alternative</p>	
7.2	Enter Performance Data into Value Hierarchy	<p>For each alternative, use the data collected in the previous step to determine the overall value. These value scores are directly comparable against one another.</p> <p><u>Input:</u> Data collection results from Step 7.1</p> <p><u>Output:</u> Overall capability associated with each alternative</p>	
7.2.1	Translate Measure Scores into Value	For each measure tested, translate the objective assessment (e.g., speed of Mach 2) into a value score between zero and one (e.g., value of 0.5) using that measure's value function.	
7.3	Determine Overall Capability	Use the selected aggregation function (determined in Step 5.3) to determine the overall capability of each alternative.	AFLCMC/OZA CCA Guidebook

8.0	Estimate the Cost of Each Alternative	<p>Since it is important to keep a Life Cycle focus, Life Cycle Costs must be used in this analysis (not just acquisition costs). For the cost of each alternative to be properly estimated the cost estimators will have to spend considerable time engaging with the engineers and sustainment community to understand the technical content of the program. <u>The tight coupling between the engineering, logistics and cost estimating communities is absolutely critical to ensure the cost estimate reflects the technical baseline.</u> The fidelity of the cost estimates is directly correlated to the level of technical detail provided by the technical team and available data. Based on the maturity of the alternatives, what is known about the system design and production requirements, the time allotted to conduct the estimates, and the data available, the cost estimator will select the appropriate methodology for performing the cost estimate. Refer to the <i>GAO Cost Estimating and Assessment Guide</i> for more detail on cost estimation techniques, though a more complete list of references should be provided by the cost estimating professional on the team. Just as the CCA process may be tailored to fit the needs and scope of the analysis, so too may the cost estimates be scoped to the level of detail appropriate to meet the needs of the decision maker. In many cases, previously developed cost estimates may be used.</p>	GAO Cost Estimating and Assessment Guide, AFI 65-501, AFI 65-508, AFI 65-509, AFMAN 65-506, AFMAN 65-510, and many others
8.1	Estimate the Cost of the Baseline Alternative	<p>In the case of generated alternatives (based off of excursions from Alternative 0), the analyst must first estimate the cost of the baseline alternative, or obtain the previously developed estimate. Excursions may be calculated using deltas from this baseline.</p> <p><u>Input:</u> Lowest level technical descriptions of the baseline alternative <u>Output:</u> Life-Cycle Cost Estimate (LCCE) for Alternative 0</p>	
8.2	Estimate the Cost of the Remaining Alternatives, or Excursions (where applicable)	<p>Compute the cost of the remaining alternatives, or the delta-costs when alternatives are generated, using excursions from the baseline.</p> <p><u>Input:</u> Lowest level technical descriptions (and baseline cost estimate for excursions) <u>Output:</u> Life-Cycle Cost Estimate (LCCE) for Alternatives 1 through N</p>	
9.0	Generate Outputs and Display Products	<p>There are many different ways of illustrating capability relative to the cost of each alternative. This section should be tailored to fit the needs of the stakeholders and decision makers. More output products are described in the AoA handbook.</p>	AoA Handbook
9.1	Graph Alternatives	<p>Construct a graph plotting data points for overall value versus the life cycle costs for each of the alternatives. This is a typical product for a CCA and is helpful to demonstrate capability versus cost. In addition to this simple plot, there are many other ways to graph alternatives to show important trends or relationships. Fully exploring these subsets of the analysis is key to properly representing the results and informing the decision maker.</p> <p><u>Input:</u> Overall capability scores generated in Step 7, life cycle cost estimates from Step 8</p>	

		<u>Output:</u> A cost capability chart with each alternative plotted as a separate data point	
9.2	Identify the Efficient Frontier	<p>Identify the set of alternatives not dominated (i.e., no other alternative has both lower cost and higher value). This region represents the “efficient frontier,” where the government receives the greatest “bang for the buck.” It is important to note that dominated alternatives may appear unpromising, but might be retained when we consider other factors (e.g., sensitivity or risk preference).</p> <p><u>Input:</u> Cost Capability curve from Step 9.1 <u>Output:</u> Cost Capability curve with the efficient frontier identified</p>	
9.3	Identify Deltas from Frontier	<p>By examining the "distance" from the efficient frontier, and identifying the greatest shortfalls for each alternative, it is possible to conceive better alternatives or suggest ways to improve existing ones. In some cases, this may lead to further analysis using new or modified alternatives.</p> <p><u>Input:</u> Capability deltas for each alternative <u>Output:</u> Suggestions for improved or new alternatives identified</p>	
10.0	Analyze Sensitivity	Demonstrate how robust the results are to changes in the stakeholder’s preferences and assumptions.	AFLCMC/OZA CCA Guidebook
10.1	Coordinate Outputs with Stakeholders.	<p>After sharing the capability and cost results from Step 9, survey the stakeholders to see if there is a desire to examine alternative weights, or other inputs, developed in Steps 4 or 5 to see what the effect would be on the overall results of the alternative scoring.</p> <p><u>Input:</u> Operator desire to examine alternative weights to determine sensitivity <u>Output:</u> New weights for Objectives/Tasks and Measures</p>	
10.2	Perform Sensitivity Analysis	<p>Based on the results of Step 10.1, analyze the alternative weights accordingly and re-score the alternatives to determine the sensitivity of the model to measure weighting. This same type of analysis may also be conducted by analyzing alternative shapes of particular value functions to determine their impact.</p> <p><u>Input:</u> Objectives with uncertain weights or value functions <u>Output:</u> Insights into sensitivity of the model parameters and indications of which parameters warrant closer examination</p>	AFLCMC/OZA CCA Guidebook
11.0	Record Analysis and Present Findings	Provide conclusions and recommendations to the decision authority in a format best suited to aid comprehension. Also, provide a complete and detailed report that documents the basis of the analysis and results, as described in Section 3.4.2 of this document.	Section 3.4.2, above
11.1	Draft CCA Final Report	<p>The CCA Final Report must include enough detail that the results could be replicated by another team. In addition to establishing credibility of the analysis, this detail may be essential to a team conducting follow on work.</p> <p><u>Input:</u> Analysis assumptions, inputs, methodology(y/ies) and products <u>Output:</u> Vetted Analysis Report (Document or Briefing)</p>	

11.1.1	Record Basis for Analysis	The discussions that take place throughout Step 1.0 make up the basis for the analysis and should be thoroughly documented to explain the rationale for decisions about analysis scope and focus.	
11.1.2	Record Analysis Parameters and Decisions	The final report should be useful to subsequent analysts attempting to understand or recreate the CCA. For this reason, analysis parameters such as the raw inputs to the analysis (e.g., lowest-tier alternative performance values), equations resulting from value curve elicitation, and factors used in modeling and simulation must be documented.	
11.1.3	Record Conclusions and Recommendations	Document all recommendations and final decisions as well as the rationale behind both. Archive all materials to include working level details completed in each of the steps, final recommendations and decisions, and lessons learned. The goal of a CCA is not to come up with "the answer," but rather to provide insights to the decision maker. However, it is often useful to make recommendations based on the analysis. Usually the recommendations will be one or few of the alternatives that are on the efficient frontier and deemed to be affordable. The recommendation should be supported by a description of the tradeoffs that were evaluated between cost and capability requirements. The recommendations should also be supported by all the lower level results of Steps 1-10 of the MODA methodology presented in this WBS. Simply presenting a single capability score and touting an alternative as "best" does not achieve the goal of providing decision makers with insights. Rather, these "best" alternatives should be used to reduce the tradespace and focus recommendations.	
11.1.4	Coordinate Report with Stakeholders	Before taking the analysis forward to the decision authority, coordinate the final report and ensure that all key stakeholders agree with the assumptions and conclusions. Non-agreement should be well documented and discussed with the decision authority when appropriate.	
11.2	Present Analysis Findings to Decision Authority	An organization might use a standard template to brief. In the case that no template is available, care should be taken to provide decision makers with an appropriate depth of understanding of the material. It is crucial that decision makers understand what makes the best alternatives come out ahead of other options, and that they understand the assumptions that went into these alternatives. Decision Authority approval signifies the exit from the CCA process. <u>Input</u> : Analysis products and recommendations <u>Output</u> : CCA Presentation in approved format (where applicable)	

5.0 Measurement.

5.1 This section will be developed as part of the CCA Standard Process maturation as metrics for process performance and effectiveness are developed.

6.0 **Roles and Responsibilities.** This section identifies and describes the internal and external roles along with key personnel involved in the execution of a CCA.

- 6.1 **Process Initiator or Decision Maker.** Usually, the study sponsor (decision maker) is the one who initiates (per Section 3.1.1) and provides funding for the CCA. Note that the decision maker often differs from the decision *authority* in that the decision maker advocates for the warfighter and seeks the decision. The decision authority is the senior-level person or panel with the authority to enact the decision maker's decision (think AF CDC, MDA, etc.). Frequent CCA Team interaction with the decision maker is essential, while interaction with the decision authority may be less frequent.
- 6.2 **Requirements Owner.** The office of the requirements owner is critical to every CCA. Typical responsibilities of the requirements owner might include early planning for the CCA, funding portions of the analysis, formal staffing of requirements documents, and reporting CCA results to the AF CDC or other decision authorities. Specific steps (including sub-steps) of the CCA methodology recommends that the requirements sponsor will be heavily involved in several process steps, to include: Identify Problem and Scope the Analysis (1.0), Create Value hierarchy (2.0), Develop Measures for each objective (3.0), Develop Value Functions (4.0), Develop Aggregation Method (5.0), Identify Alternatives (6.0), Record Analysis and Present Findings (11.0). Note that it is possible for the Requirements Owner to reside in a different organization from the Decision Maker. In this case, the Requirements Owner would have representatives on the CCA team that perform the role of SMEs.
- 6.3 **CCA Study Lead.** The sponsoring organization may direct a Study Lead, or may delegate this task if another organization is conducting the CCA. The Study Lead will work with the decision maker and facilitator to set the course of the CCA. The Study Lead is also responsible for building and advocating for the team, and ensuring that cost, schedule, and performance requirements are met. The Study Lead will typically be the primary interface between the team and the decision maker. For this reason, the Study Lead should be reasonably senior (FGO+ or civilian equivalent) with experience leading large, multi-discipline teams and managing analyses. CCA experience is preferable, but not required. The CCA Study Lead may employ the services of a separate contracting officer, contracting officer's representative, or program manager to assist them with their duties, if necessary.
- 6.4 **CCA Facilitator.** The CCA Facilitator is the working-level technical lead for the CCA effort. While the CCA Facilitator will serve as an advisor and facilitator, they will not lead the team. They are responsible for, among other things, assisting the Study Lead and decision maker with setting the course for the effort, guiding and facilitating the team throughout the CCA process, and synthesizing the CCA outputs into a useful product that informs the decision at hand. The skill and experience of the CCA facilitator is highly correlated to the quality and usefulness of the analysis. Therefore, it is essential that the facilitator is appropriately trained on CCA best practices (see Section 8.0).
- 6.5 **Subject Matter Experts.** Since the CCA utilizes a flexible methodology that can be brought to bear on a variety of problems, the Study Lead should ensure that the appropriate SMEs are represented on the team. This list will change depending on

the nature of the problem or decision, but most teams will include at least the following people.

- 6.5.1 **Warfighter or User.** The warfighter or user brings a wealth of knowledge and expertise to the CCA team. The user will be the primary source of information for communicating how the operational capabilities will be employed and operated on a tactical level. The operator/user also will play a critical role in describing the military value and importance of the objectives, mission tasks, measures, and different levels of performance for each objective. It is expected that the operator/user will work together closely with the requirements sponsor on the initial steps of the CCA. Often the requirements sponsor may speak on behalf of the operator/user. The operator/user will remain engaged throughout the CCA 11-step process.
- 6.5.2 **Operations Research (OR) Analyst.** This team member fills the role of the facilitator. This analyst should be skilled in conducting Decision Analysis and, preferably, experienced in facilitation. However, it is left to the discretion of the Study Lead to employ the services of an additional OR analyst to assist the facilitator and to advise the Study Lead on team structure and analysis practices.
- 6.5.3 **Systems Engineer.** The Systems Engineer brings specialized engineering expertise and experience to the team that will be critical to the CCA. The Systems Engineer will translate operational capability requirements into technical requirements, participate in the generation of a broad list of potential solutions, address integration and engineering issues, and provide input to analytical efforts such as cost analysis and operational effectiveness analysis. The Systems Engineer will remain engaged throughout the CCA 11-step process.
- 6.5.4 **Cost Estimators.** The Cost SMEs bring specialized cost estimating and analysis expertise and experience to the team. This discipline is required since even early materiel alternatives must be evaluated on a life cycle cost basis. Specific responsibilities of the cost analyst include but are not limited to: develop cost estimates for each of the alternatives, identify cost drivers, analyze/validate contractor estimates, perform what-if drills, and risk and sensitivity analysis. The Cost Estimators will remain engaged throughout the CCA 11-step process.
- 6.5.5 **Modeling and Simulation (M&S) Engineers.** The Modeling and Simulation Engineers bring specialized modeling and simulation expertise to the CCA team. M&S may be used heavily or sparingly depending on the analysis, but when used correctly it has the ability to provide a wealth of defensible data to support alternative evaluation. It is important to note that a CCA does NOT replace robust modeling activities; rather, it supports and enhances these activities by evaluating M&S results against operator preferences in a repeatable, measurable way. Specific responsibilities of this team include but are not limited to: developing the Measures of Effectiveness (MOEs) and Measures of Performance (MOPs) in

collaboration with the user/operator, confirming technical feasibility of meeting performance metrics through design analysis, and performing mission effectiveness analysis used to evaluate the measures (MOEs/MOPs) for each of the objectives or mission tasks. The Modeling and Simulation Engineers will remain engaged throughout the CCA 11-step process.

- 6.5.6 **Functional Subject Matter Experts, as required.** Depending on the unique aspects of the CCA being performed, it is highly likely that other functional SMEs will be members of the team, or at least called upon for input. Core CCA team members should think critically when it comes to other functional expertise that could be solicited for input on this analysis. Just because a certain functional discipline is not listed in this section of the process standardization documentation does not mean it could not be sought to improve the CCA. Functional SMEs can provide input to any one of the 11 steps in the CCA methodology, and where appropriate, will remain engaged throughout the CCA 11-step process. Examples of other frequently included SMEs are: logistics personnel, financial management personnel, contracting personnel, Environment, Safety and Occupational Health (ESOH) personnel, scientists, intelligence professionals, and engineers (for platform, sensor, and ground system).

7.0 **Tools.** N/A

8.0 **Training.**

- 8.1 AFLCMC/OZA, in conjunction with the Air Force Institute of Technology, has developed a range of training curricula tailored to the level of involvement with CCA activities. This training is maintained by AFLCMC/OZA, and more information is available upon request.

8.1.1 **Executive Level Course.** This one hour course is designed to assist senior leaders (i.e., General Officers (GO)/Senior Executives Service members (SES)) and those who support senior level reviews (e.g., AF CDC, Air Force Capabilities Development Working Group (AF CDWG), Air Force Requirements Oversight Council (AFROC), Air Force Gatekeeper (AFGKs), Configuration Steering Boards (CSBs), Milestone (MS), etc.) in understanding the opportunities CCA provides. The intent of the training is for senior-level decision makers to understand CCA concepts, appreciate the challenges CCAs provide, and to be prepared to ask discerning questions. They will also be prepared to interpret and understand responses from briefers enabling them to make informed decisions. The course is tailored (where appropriate) to Senior Leader needs. The course will be taught by personnel in AFLCMC/OZA and is available on an as-needed basis. Those interested in receiving this training should contact the OZA Decision Analysis branch chief. While not mandatory, this training is highly encouraged for senior leaders who are not familiar with the CCA process.

8.1.2 **CCA 101 Course.** This 1.5 hour course is designed to provide action officers with an understanding of the background, purpose, general methodology, and outputs of a CCA. The course also takes students through

a Case Study to showcase the execution of the CCA methodology in a real world problem. This course is taught by personnel in AFLCMC/OZA and is available on an as-needed basis. Those interested in receiving this training should contact the OZA Decision Analysis branch chief.

- 8.1.3 **CCA Team Course.** This two day course is for the CCA Study Lead and those personnel identified as team members (i.e., AoA Working Group Leads, Systems Engineers, Warfighters, Cost Estimators, Maintainers, Program Office Personnel, among other identified stakeholders) by the CCA Study Lead. This training introduces the team to CCA concepts, the CCA decision framework, and recommended methodologies for conducting the CCA. This course also describes the benefits of the CCA and relates them to their team's current programmatic phase. Exercises are used to reinforce CCA steps and apply those concepts to the teams' current work. At the end of the two day training, it is expected that the CCA team will have developed a framework and some introductory products that apply to their work. Some tailoring of the training material may be necessary based on a program's current life cycle phase. The course will be taught by personnel in AFLCMC/OZA and is required training for the CCA Study Lead and the appointed team members. This course is offered at the request of the CCA Study Lead and can be scheduled at the convenience of the CCA Team. Continuous Learning Points (CLPs) will be awarded to all participants who complete the training. Funding for attendance will not be provided by OZA and must be secured by the student's organization.
- 8.1.4 **CCA Certificate Program.** This 15 month program is a subset of the Decision Analysis curriculum currently taught by the Department of Operational Sciences at AFIT. This course is designed for Operations Research (OR) analysts (61A/1515 job series) who have been identified as CCA Facilitators by the CCA Study Lead and typically work for AFLCMC/OZA. The program consists of four OR classes (OPER 543 - Decision Analysis, OPER 643 - Multiobjective Decision Analysis, OPER 645 - Risk Modeling and Analysis and OPER 638 – Assessing Operational Cost and Risk) and OPER 743 – Decision Analysis Practice. This last course will reinforce concepts learned during the previous four quarters. Personnel complete coursework alongside students attending the graduate program at the Wright-Patterson AFB campus. Students who successfully complete the program are awarded a CCA certificate. The CCA Certificate Program begins January of each calendar year. All five courses must be completed within a 48 month time period.

9.0 **Definitions, Guiding Principles and/or Ground Rules & Assumptions.**

- 9.1 **Definitions.** For a complete list of definitions that relate to CCA, reference the attached CCA Lexicon guide.
- 9.2 **Tailoring Principles.** The CCA is a tailorable methodology that may be applied to any decision where cost must be balanced against multiple objectives. The process described above must be adjusted to suit the decision at hand. For acquisition and

requirements decisions, analyses may be grouped into three different categories to provide more specific best practices. These groupings are shown in in Table 3. Note that these CCA types are functionally related to the phases identified in Figure 1. As a program grows more mature, the tradespace will typically shrink and activities will shift from System or Materiel Definition to more Key Performance Parameter /Key System Attribute (KPP)/(KSA) definition and program definition. Note that this emphasis on tailoring should not be taken as a justification to overly constrain the analysis to reduce level of effort. Since no decision is made in a vacuum, it is crucial that the scope of the analysis is sufficient to resolve the effects that changes may have upon dependent systems and communities.

- 9.2.1 System or Materiel Definition. This activity may range from a multi-year effort with hundreds of generated alternatives to relatively short studies with a handful of predetermined alternatives. Typical examples of this type of CCA are those supporting the MDD or the AoA. More information on this specific CCA type is found in Appendix A.
- 9.2.2 KPP or KSA Definition. While the CCA uses value functions that map to every possible value of an attribute, the Defense Acquisition System still relies on KPPs and KSAs to differentiate between capabilities of greater and lesser importance. Furthermore, these KPPs and KSAs are only evaluated relative to the threshold and objective values (i.e., continuous measures are assigned subjective measures, such as “Red, Yellow, or Green”). A CCA may be used to set these KPPs and KSAs, as well as to determine the threshold and objective levels such that the outcome best represents the users’ preferences and the best value to the government. Typical examples of this type include supporting the CDD development or validation.
- 9.2.3 Program Definition. A CCA need not be constrained to materiel-related decisions. Decisions about the acquisition strategy or the product support strategy are examples of products that could benefit from an evaluation of cost versus benefit of requirements.

Table 3. CCA Decision Types

	System/Materiel Definition	KPP/KSA Definition/Change	Program Definition/Change	Examples of Products or Decisions Supported
ICD Validation	X			ICD
Approve AoA Study Plan	X			AoA Plan
Materiel Development Decision	X		X	MDD
Approve AoA Results	X		X	Preferred System Concept, CCTD Update, Acquisition Strategy
Approve Draft CDD		X		CDD
Approve Milestone A		X	X	TEMP, Acquisition Strategy, Product Support Strategy
Approve CDD		X		CDD
Approve Release of RFP		X	X	TEMP, Acquisition Strategy, Low-Rate Initial Production Quantity
Approve Milestone B		X	X	TEMP, Acquisition Strategy
Approve CPD		X		CPD
Approve Milestone C			X	Acquisition Strategy, Full-Rate Production Quantity
Approve FRP			X	FRP Decision
Ad-Hoc	X	X	X	Technology Insertion, Budget "Drills," Enterprise Optimization

10.0 References to Law, Policy, Instructions or Guidance. This section lists applicable reference material that governs, guides, or constrains the process or any activity used in the process.

10.1 AFPD 10-6 Capability Requirements Development

10.1.1 Lead Command/Core Function Lead (CFL) Integrator shall: Ensure life cycle cost assessments, cycle times, and requirements tradeoffs are addressed in acquisition decision forums, to include Configuration Steering Boards and AF Review Boards (AFPD 10-6 dated 6 Nov 2013, Para. 3.14.6.).

10.1.2 Implementing Command (AFMC, AFSPC, or AFCEC) shall: Ensure life cycle cost assessments, cycle times, and requirements tradeoffs are addressed in acquisition decision forums, to include Configuration Steering Boards and AF Review Boards (AFPD 10-6 dated 6 Nov 2013, Para. 3.15.5.).

10.2 SAF/AQ and AF/A5/8 Dual Signature Memo dated 16 Nov 2012 titled *Implementation of Contractual and Requirements Sufficiency*. “AF requirements and acquisition processes must be complimentary and aligned with fiscal realities. Affordability discussions must take place at all GO-level requirements and acquisition forums. Presentation of life cycle cost versus capability tradeoff analysis is required for all AFROCs, AFGKs, and CSBs. The Implementing Commands (AFMC and AFSPC) will support the requirements sponsor by providing cost and capability analysis for all analysis of alternatives (AoA) final reports, CDDs, and CPDs. This requirement for the mandatory use of life cycle cost estimates is intended to ensure affordability is used to inform decisions throughout a program’s acquisition life cycle.”

- 10.3 [AFLCMC/OZA CCA Guidebook](#) – This guide provides a brief overview of CCA history, introduces the AFLCMC standard process for CCA, and provides a framework for conducting CCAs within the Center.
- 10.4 [Analysis of Alternatives \(AoA\) Handbook: A Practical Guide to the Analysis of Alternatives](#) (4 August 2017) – Includes discussion of the CCA in Section 5.13.
- 10.5 [GAO Cost Estimating and Assessment Guide](#). This document presents best practices and techniques for “developing and managing capital program costs” and is a valuable reference for estimating the costs of alternatives.

Attachment 1. CCA Process WBS



CCA WBS.xlsx

Attachment 2. CCA Lexicon



Cost Capability
Analysis (CCA) Lexicc

Attachment 3. AFLCMC/OZA CCA Guidebook, 30 Sep 2017 V1.0



AFLCMC CCA
Guidebook V1.0_Fin

Appendix A: CCA in Support of Materiel or Systems Definition

- 1.0 CCA in support of Materiel or Systems Definition involves the characterization of the configuration tradespace in order to inform cost versus capability tradeoffs for system specification. Of the three CCA types identified in this process document, materiel definition is likely to be the most time consuming, as well as the most beneficial to decision makers.
 - 1.1 At one extreme, materiel definition may involve generation of concepts for alternatives for which no analogous systems may exist. Such analyses are typical of early pre-acquisition efforts, such as MDD support, and may require the generation of hundreds of distinct alternatives in order to properly characterize the tradespace. The cost and capability estimates of these alternatives are typically high-level, but the cumulative time required for modeling and simulation can spread such analyses out over years of effort. The clustering of “promising” alternatives can inform investment decisions and areas for further study.
 - 1.2 At the other extreme, a materiel definition effort might require an in-depth analysis of only a handful of alternatives. Such analyses are typical of AoA support, where alternatives may be pre-defined and well characterized. These cases where data is available typically demand more in-depth cost estimates and more rigorous capability assessment. In both extremes, the same amount of care must be taken to properly evaluate stakeholder’s preferences and avoid “solutioneering”—the practice of modifying the analysis to promote the desired technology.
- 2.0 Example: CCA in Support of an AoA. This example draws upon the general process described in the main body of this document and adds specificity to assist in the conduct of CCA specifically for the purpose of generating the AoA Final Report.
 - 2.1 From DoDI 5000.02, “The AoA assesses potential materiel solutions that could satisfy validated capability requirement(s) documented in the Initial Capabilities Document, and supports a decision on the most cost effective solution to meeting the validated capability requirement(s). In developing feasible alternatives, the AoA will identify a wide range of solutions that have a reasonable likelihood of providing the needed capability.” More in-depth AoA procedures are described in DoDI 5000.02, enclosure 9.
 - 2.2 CCA is especially relevant to the AoA activity, since it involves the analysis of alternatives against cost, to fill the capability gap(s) as described in the approved ICD. Depending on specific MAJCOM requirements or practices, CCA may represent a relatively small increase in effort over the existing AoA activities since alternatives are already being identified and analyzed for cost and capability. It is likely that significant effort will still need to be spent coordinating with stakeholders to develop a value model and generating CCA-specific output products.

2.3 Process Workflow and Activities. AoA Suppliers, Inputs, Process, Outputs, Customers (SIPOC), Table A1. This high-level SIPOC provides a macro view of the process, the process environment, and boundaries for the process.

Table A1. AoA SIPOC

Suppliers	Inputs	Process	Outputs	Customers
<ul style="list-style-type: none"> • User MAJCOM (Operators, Requirements Sponsor, Core Function Leads) • Approval Authorities (AFROC, JROC, CAPE) • Decision Authorities (MDA) • Reviewers (OAS, AFRRG) • S&T Community 	<ul style="list-style-type: none"> • JCIDS items (CBA(s), validated ICD) • CCTD(s) • AoA Study Guidance • Acquisition Decision Memorandum • Existing CCA Products (existing value model) • Mission definition (CONEMP, architectural views, use cases) • Core Function Master Plan • Threat Assessments • Policy/Guidance (see below) 	<p>CCA</p> <ul style="list-style-type: none"> • Identify Problem and Scope Analysis • Create Value Hierarchy • Develop Measures • Develop Value Functions • Develop Aggregation Method • Identify Alternatives • Estimate the Cost of Alternatives • Compute the Capability of Alternatives • Generate Outputs and Display Products • Analyze Sensitivity Record Analysis 	<ul style="list-style-type: none"> • Completed AFROC template • Copies/instructions of purpose-built tools • AoA Final Report to include: <ul style="list-style-type: none"> - Documented basis for analysis - Analysis assumptions, omissions - Graphical depiction of results (i.e. Pareto Plot) - Tabular summary of alternative scores - Analysis Findings 	<ul style="list-style-type: none"> • CAPE • AFROC • Requirements Sponsor • MDA • PEO/Program Director