



# **U.S. Army Cost Benefit Analysis Guide**

12 JANUARY 2010

Prepared by Office of the Deputy Assistant Secretary of the Army (Cost and Economics)

Version 1.0



DEPARTMENT OF THE ARMY  
WASHINGTON DC 20310

DEC 30 2009

MEMORANDUM FOR PRINCIPAL OFFICIALS HEADQUARTERS, DEPARTMENT  
OF THE ARMY

SUBJECT: Cost-Benefit Analysis to Support Army Enterprise Decision Making

1. As Army leaders, we must be responsible stewards of the funds entrusted to our care. This is particularly true now, as we strive to meet the challenges of persistent conflict in an era of constrained resources. We must make the best possible use of our limited funds and ensure that no significant resource-related issue is decided without a thorough review of its costs, its projected benefits, and the trade-offs that might be required to pay for it. In our decision making, we need to supplement professional experience and military judgment with solid data and sound analytical techniques.
2. Toward this end, we are directing that each unfunded requirement and new or expanded program proposal submitted to the Secretary of the Army, Chief of Staff, Army, Under Secretary of the Army or Vice Chief of Staff, Army, be accompanied by a thorough cost-benefit analysis (CBA). This must identify the total cost of the proposal, the benefits that will result, the bill-payers that would be used to pay for it, and the second and third level effects of the funding decision. The net result of the CBA should be a strong "value proposition" – a clear statement that the benefits more than justify the costs and required trade-offs. CBAs will be prepared using the attached template and reviewed and approved by the Deputy Assistant Secretary of the Army for Cost and Economics (DASA (CE)).
3. These measures will enable us to make better resource-informed decisions and will contribute to the Army's overall mission effectiveness.
4. The POC for this action is Mr. Stephen Bagby, the DASA (CE). He can be reached at 703-692-1722.

A handwritten signature in black ink, appearing to read "P. Chiarelli", followed by a horizontal line.

Peter W. Chiarelli  
General, U.S. Army  
Vice Chief of Staff

A handwritten signature in black ink, appearing to read "Joe Westphal", followed by a horizontal line.

Joseph W. Westphal  
Under Secretary of the Army

Enclosure

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## Purpose

The *U.S. Army Cost Benefit Analysis Guide* is provided for use by analysts and agencies as they perform cost benefit analysis (CBA) to support Army decision makers.

The purpose of the CBA Guide is to assist analysts in identifying, quantifying, and evaluating the future costs and benefits of alternative solutions. Based on a structured process, this Guide will assist analysts in recommending the optimum course of action for decision-making purposes. CBAs are prepared because decision makers need reliable, objective assessments of alternative courses of action.

In some functional areas, such as the world of weapon systems acquisition, guidance has already been published regarding cost estimating and cost-benefit analysis. This Guide is intended for more general use, and is aimed at functional areas where guidance does not exist.

## Introduction

In today's resource-constrained environment, the Army must exercise wise stewardship of every dollar it manages. A key element in that stewardship is to develop and use sound CBA practices throughout all requirement/resourcing processes. For every proposed program, initiative or decision point that is presented to decision makers, it is important to provide an accurate and complete picture of both the costs to be incurred and the benefits to be derived.

The Senior Leaders of the Department of the Army have directed that any decisions involving Army resources be supported by a CBA. To support this objective, the Office of the Assistant Secretary of the Army (Financial Management & Comptroller (OASA (FM&C)) has developed this Guide. The Guide is applicable to a wide range of requirements, issues, tasks, and problems that require a deliberate analysis to arrive at the optimum course of action.

As stated above, the U.S. Army Cost Benefit Analysis Guide is designed to support the Army leadership decision-making process. The Guide separates the CBA process into eight major steps. The eight steps (which are discussed in detail in subsequent sections of this Guide) are:

1. Develop the Problem Statement, Define the Objective and the Scope
2. Formulate Assumptions and Identify Constraints
3. Document the Current State (the Status Quo)
4. Define Alternatives with Cost Estimates
5. Identify Quantifiable and Non-Quantifiable Benefits
6. Define Alternative Selection Criteria
7. Compare Alternatives
8. Report Results and Recommendations

A short description of each step may be found at the end of this section (Pages 8-9).

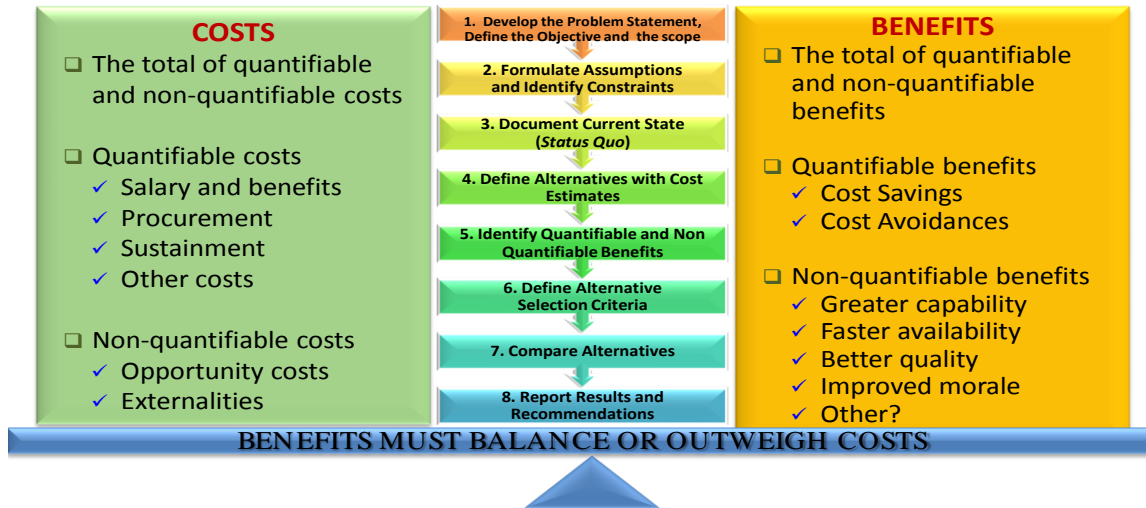


# Cost Benefit Analysis



## Cost Benefit Analysis—Making the case for a project or proposal:

Weighing the total expected costs against the total expected benefits over the near, far, and lifecycle timeframes from an **Army enterprise** perspective



*The Cost Benefit Analysis Process*

When we refer to the Army enterprise, we mean that initiatives should be evaluated based on the benefits they provide to the Army as a whole, not to any individual organization. Army elements are connected organizationally and what happens even at the lowest levels within the Army can impact/influence higher level organizations.

This Guide also provides a briefing template designed to present the CBA results to decision makers. To learn more about the template, see Step 8, “Briefing the Results of the CBA Using the Template” on page 44 of this Guide. Appendix E, beginning on page 68 of this Guide, contains an example of completed CBA and template that follows the 8-Step CBA process.

The template as well as this Guide may be found at the following location:

<http://asafm.army.mil/offices/LinksDocsOffice.aspx?OfficeCode=1400>

Our goal is to make this Guide and the CBA process as clear and as user-friendly as possible. In addition, OASA (FM&C) will review and update the CBA Guide as necessary. Comments and questions from users are encouraged and should be submitted to:

[cbaguidebook@conus.army.mil](mailto:cbaguidebook@conus.army.mil)

Finally, a CBA is a living document. A CBA should be updated as needed, especially as the recommendations it supports work their way through an organization's approval process and assumptions change. For example, from the time a CBA is initiated to the time it is scheduled to be briefed to a senior decision maker certain data elements, such as costs or funding trade-offs, may have changed. Therefore, it is important for the preparer to keep the CBA updated so that the ultimate decision maker can make an informed decision based upon the best available information.

### **What is a cost benefit analysis?**

All CBAs provide decision makers with facts, data, and analysis required to make an informed decision. In its most basic form, the CBA is a tool to support resource informed decision making. There is no prescribed length to a CBA. All that is required is that it fully supports the recommendation. Therefore, quality is genuinely more important than quantity.

A CBA:

- Is a decision support and planning tool that documents the predicted effect of actions under consideration to solve a problem or take advantage of an opportunity.
- Is a structured proposal that functions as a decision package for organizational decision makers. It defines a solution aimed at achieving specific Army and organizational objectives by quantifying the potential financial impacts and other business benefits such as:
  - Savings and/or cost avoidance
  - Revenue enhancements and/or cash-flow improvements
  - Performance improvements
- Considers non-financial or non-quantifiable benefits of a specific course of action (COA). This feature is important because although the financial data may favor one COA over another, there may be situations where the non-financial data/information is considered more important to the analyst or senior decision maker. Furthermore, the non-financial criteria and conclusions may support something other than what the financial data favors.
- Includes an analysis of business process performance and associated needs or problems, proposed alternative solutions, assumptions, constraints, a risk analysis. Is process oriented. It will not only develop a set of choices that will be analyzed but it will also lead the analyst to a recommended choice.
- Provides an evaluation and justification of a proposed solution (including any associated expenditures) before a significant amount of funds are invested.
- Documents the reasons for the investment and the options available and describes how the investment helps the organization reach its goals. Guides the decision maker to focus on the major issues surrounding the recommended solution and to not spend time on minor issues.



Some characteristics of a CBA are:

- It must be tailored to fit the problem.
- It will not produce a result that is more valid than the input data.
- It will not make a final decision; that will be the responsibility of the decision maker/leadership.
- It will not act as a substitute for sound judgment, management, or control.

### **Quick Review**

The primary objective of developing a CBA is to identify and obtain approval of the optimum way to solve a specific problem or capitalize on a specific improvement opportunity. The following should also be kept in mind to increase the chance of success.

- Keep it clear and concise.
- Minimize jargon and conjecture.
- Communicate all facts as part of the overall story.
- Demonstrate the value that the initiative will bring to the organization and the enterprise (key stakeholders).

## Cost Benefit Analysis Steps – A Short Summary

### 1. Develop the Problem Statement, Define the Objective and the Scope

*The problem statement clearly defines the problem, need, or opportunity that requires a solution and describes what the effort intends to accomplish.*

*The objective of the effort is to improve, reduce, or increase some aspect of a process, procedure, or program. Objectives should be measurable, realistic, achievable, and results-oriented. Simply put, objectives are measurable outcomes.*

*Scope defines the range of coverage encompassed by an initiative or proposal along specific dimensions like time, location, organization, technology or function.*

### 2. Formulate Assumptions and Identify Constraints

*Assumptions are factors or conditions that are essential to the success of the solution and are beyond the control of the organization. Assumptions define the ground rules and accepted statements in order to limit the scope of the CBA. They are explicit statements of conditions on which the CBA is based.*

*Constraints usually refer to limits placed on resources to be devoted to the project. Constraints or barriers are normally beyond the control of the analyst and provide limitations within which analyses take place.*

### 3. Document the Current State (the Status Quo)

*This defines and assesses the current state/ condition. This should include a presentation of the estimate of costs associated with the status quo.*

*The status quo alternative of the CBA is the “baseline” program or system against which the costs and benefits of all feasible alternatives are compared.*

### 4. Define Alternatives with Cost Estimates

*Alternatives are potential solutions to the problem statement which will be evaluated in the CBA.*

*Alternatives should reflect a review of the mission and strategic goals to verify that the alternative’s objectives are consistent with the problem statement.*

*A cost estimate captures the total cost of each alternative over its entire life cycle and is a summation of all relevant cost elements.*

### 5. Identify Quantifiable and Non-Quantifiable Benefits

*Benefits are results expected in return for costs incurred for a chosen alternative. They are the quantitative and qualitative improvements expected or resulting from the implementation of an alternative.*

*Quantifiable benefits are benefits that can be assigned a numeric value such as dollars, physical count of tangible items, or percentage change.*

*Non-quantifiable benefits are subjective in nature and can make a positive contribution to the analysis. Some examples of non-quantifiable benefits are improvement in morale and customer satisfaction.*

## 6. Define Alternative Selection Criteria

*Alternative selection criteria are those standards/bases on which a decision will be based. CBAs must contain documentation that outlines decision criteria and identifies the extent to which each alternative satisfies each of the criteria.*

## 7. Compare Alternatives

### a. Compare Costs and Benefits

*The essence of the CBA process is in comparing the costs and benefits of two or more alternatives (including the status quo) in order to select the preferred alternative.*

*As a general rule, the preferred alternative is the alternative that provides the greatest amount of benefits in relation to its cost.*

### b. Define Trade-offs and Billpayers

*Trade-offs / billpayers are the funding sources that have been identified which will cover (partially or entirely) the costs of an alternative.*

### c. Identify Second and Third Order Effects (Cause and Effect)

*Second and third order effects are the results (consequences and/or impacts) stemming from a decision. They include the opportunity costs of pursuing one alternative over another. Second and third order effects identify what a decision maker can do or not do as a result of a decision.*

### d. Perform Sensitivity Analysis and Risk Assessment

*Sensitivity analysis explains what the effect is on the cost/benefit model should assumptions change, risks become issues and/or dependencies not be met.*

*Risk assessment describes all risks that can impact the achievement of stated benefits or the cost of solving the business problem. Each risk has an associated mitigation strategy and an assessment of likelihood of occurrence.*

## 8. Report Results and Recommendations

*Results and recommendations summarize the findings of the analysis and make conclusive statements about the comparisons of alternatives.*

*The conclusions should demonstrate the cost/benefit relationships between each alternative.*

*The results address how the alternatives were ranked using the criteria developed in Step 6. Following a clear statement of the conclusions, there should be a firm recommendation regarding the preferred alternative.*

### • Identify Supporting Documentation

*All data and other information used in Steps 1-8 must be adequately documented. Supporting information should be identified so decision makers and analysts can understand how Steps 1-8 were developed.*

## STEP 1 – Develop the Problem Statement, Define the Objective and the Scope

This section discusses three areas:

- Define the initiative or proposal using a problem statement
- Define the objective/goal
- Define the scope of the analysis

### **Problem Statement**

The first step of the CBA process and one of the most important is defining the initiative or proposal using a problem statement. The problem statement clearly defines the problem, the mission need, or required capability. When developing a problem statement, the key is to state the problem in terms of the organization's mission.

- What required performance or outcome is not being achieved?
- Who and what are impacted by this problem?
- Specifically, who are the customers or stakeholders?
- Briefly describe the process for providing the procedure, product or service where the problem or improvement opportunity occurs and how and why it occurs.

The following two examples were adopted from the Lean Six Sigma Green Belt program of instruction (July 6, 2009):

Example of a weak problem statement:

*The CAC, Common Access Card, Issuing Process needs to be improved. We've received numerous complaints from DA Civilians and Soldiers. Why? It is vague and does not identify the problem and it includes a goal.*

Example of a strong problem statement:

*The DA Civilians and Soldiers expect the CAC Issuing Process lead time not to exceed 2 hours and the current process lead time has averaged 6.2 hours. The CAC process has shown a steady increase in lead time since January 2006 at Ft. Washington. Why? It identifies a problem in real terms. It states when and where the problem started and who is impacted.*

### **Objectives**

The objective describes what the effort intends to accomplish. The objective should address why the issue is important to the organization and who will benefit from the courses of action. The objective/goal of the effort may be to fill a capability gap or improve some aspect of a process, procedure, or program. In defining objectives, various elements must be considered:

mission needs, costs, level of effort, time schedules, allowable operational changes, and ease of future modification and expansion.

Objectives should be defined in a clear, specific, and measurable manner. Objectives should be realistic, achievable, and results-oriented. The more precisely the objective can be defined, the greater the likelihood that the analysis will meet the needs of the decision maker.

The objective statement sets the tone and expectation for the CBA.

- The statement of objectives should be carefully developed and clearly stated because it will become the authoritative source for lower-level (derived) requirements. It should discuss the goals of the proposal and its relationship to the Army's strategic goals.
- Some objectives may be related to the correction or improvement of a specific challenge or difficulty which the Army has encountered. Other objectives may involve improvements in the quality, accuracy, and/or timeliness of programs and processes.

Some examples of objectives that may be appropriate:

- Reduce number of man-hours of effort required for a mission by a minimum of X%.
- Increase output produced by the organization by no less than X units per month.
- Improve product quality against a given standard of X or less errors per page.
- Provide a new, previously unavailable product or service at a reasonable cost.

The objective statement in the CBA can and should be short and succinct. It is important to ensure that the descriptions for all objectives are easily related to the goals of the CBA.

The objective should be evaluated to ensure that it aligns with the mission and strategic goals of the organization. While defining initiative goals, ensure that they are verifiable through formal measurement.

### **Scope**

The scope of the analysis defines the range of coverage encompassed by the project along specific dimensions such as time, location, organization, technology or function. Defining the scope of the CBA is critical because it keeps the CBA focused on the things that matter.

### **Quick Review**

- The problem statement focuses the CBA.
- The problem statement describes the symptoms that the CBA is to diagnosis and treat.
- Four attributes of a good problem statement:

- Defines the problem
- Identifies where the problem is appearing
- Describes the size of the problem
- Describes the impact the problem is having on the organization
- Objectives should be specific and measurable.
- The Scope should consider dimensions such as time, location, organization, technology or function.

## **STEP 2 – Formulate Assumptions and Identify Constraints**

This section discusses two areas:

- Formulate Assumptions
- Identify Constraints

### **Formulate Assumptions**

Assumptions define and reasonably limit the scope of a CBA. They are explicit statements of conditions on which the CBA is based. An assumption refers to an event or condition that is essential to the success of the proposed solution but is beyond the organization's control. Because an assumption is a hypothesis related to unknowns (as opposed to a "fact") or to a future occurrence, it involves a degree of uncertainty. Assumptions play a critical role in explaining the business case results, in building credibility for the case, and in reducing and measuring uncertainty in projections. For this reason, regardless of the impact on the analysis, identify all pertinent assumptions. Do not confuse assumptions with facts or statements that, with research, could be presented as factual data.

Here are two examples of assumptions:

- If a landfill is being considered as an alternative to solving a disposal problem stemming from increased waste, the study might include the assumption that, "sufficient land for the operation is available within a 20-mile radius of the installation." In this particular instance, however, there may have been no reason why this assumption could not be verified with research and presented as a fact.
- If the organization is considering a solution that would require a change to a federal law, the analysis might include an assumption that any required legislative changes would be approved by higher headquarters and enacted by Congress. This is something that is clearly beyond the local organization's ability to control or to know for certain.

### **Identify Constraints**

All managers are faced with certain constraints within which they operate. Constraints usually refer to limits placed on resources to be devoted to the project. Constraining organizational policies or procedures, funding considerations, physical limitations, and all time-related considerations need to be addressed in the CBA. External constraints or barriers are normally beyond the control of the analyst and provide limitations within which analyses take place.

Assumptions and constraints should be established and fully documented early in the process, in order to preclude a recommendation that is not feasible or cannot be implemented due to

factors beyond the control of the implementing organization. An alternative is feasible only when it satisfies all the restrictions.

### **Quick Review**

- Assumptions are statements used to describe conditions over which the organization has no control and which are essential to the success of a given solution.
- Constraints are factors that limit the number of potential alternatives (i.e. solutions to the problem statement). Constraints may come from outside the organization or may be established by the organization's leadership. .
- A CBA should formulate assumptions and identify constraints before defining alternatives.



## **STEP 3 – Document the Current State (the Status Quo)**

This section discusses two areas:

- Define the Status Quo Alternative
- Document the Status Quo Alternative

### **Define the Status Quo Alternative**

Defining the current state (hereafter referred to as the status quo) is the method of identifying system characteristics (current process or state of operations), users, and stakeholders, as well as problems with the current system. The definition should be detailed to a level where all stakeholders can understand and support conclusions drawn from the analysis. Additionally, definition of the status quo must be detailed enough to assign costs and link performance measures.

The status quo alternative of the CBA is the “baseline” program or system against which the costs and benefits of all feasible alternatives are compared. The status quo is the existing operational capability as of the program start date. All expenditures (such as managing, supporting and maintaining day-to-day operations) for the existing operational capability will be included in the status quo cost estimate. The cost estimate for the status quo is an extrapolation of the current level of costs and effectiveness that would accrue without changes.

### **Document the Status Quo Alternative**

Identify and document the status quo alternative and all resources that have been required to meet the mission objective. Some potential sources of documentation are historical Government/contractor cost data, programmatic, financial and budgetary data/reports, tables of distribution and allowances (TDA), tables of organization and equipment (TOE), and modernization plans. Other sources are audit reports, operating procedures, field manuals, and Army publications. Review procedures and identify tasks and critical decision points within all appropriate organizations. Note that the parameters identified for the status quo must directly relate to, or closely parallel, those defined by the statement of objectives.

If enhancement of the status quo to meet all or part of the objective is an alternative, estimate costs for the enhanced status quo as an alternative, in addition to the status quo.

The cost of operating the status quo until the new system or project is fully operational (known as parallel operations) will be a part of the cost of all other alternatives in the cost-benefit analysis. These costs are referred to as Phase-out costs.

A cost benefit analysis that does not include the status quo (with applicable cost estimates) must be fully justified to the organizations reviewing the documentation. Usually, the status quo alternative is used to compare costs with other alternatives and to determine the quantifiable benefits. Without the status quo costs, it is very difficult to evaluate the benefits associated with the new program. Where a status quo exists, omitting it from the cost benefit analysis will reflect negatively upon the analysis and the credibility of realizing any proposed quantifiable benefits.

Generally, the only time that a status quo does not exist is when a solution is being proposed to address a new requirement or mission. When programs/projects are totally new (new start) to the Army, there are no benefits, financial or otherwise, compared to the status quo. In such a case, the alternative with the lowest nonrecurring investment cost will be used as the basis of comparison with other alternatives.

### **Quick Review**

- The current process and/or situation presents the case and helps establish expectations for what is to follow.
- The current state must be developed enough to understand the impact the alternatives will have on it.
- The current state or status quo is the standard that will be used to evaluate alternatives.
- When a comparison is made between the current state and the future state (where you want to be), the status quo allows for the identification of shortcomings which the CBA should address.

## STEP 4 – Define Alternatives with Cost Estimates

This section discusses three areas:

- Define Alternatives
- The Cost Analysis Process
- Data Sources
- Organizing Cost Data

### **Define Alternatives**

CBA alternatives should reflect a review of the mission and strategic goals to verify that the alternative's objectives are still valid and have not been overcome by events or changed by legislation or administrative direction. The status quo alternative is always the first alternative. As stated in Step 3, the status quo alternative of the CBA is the "baseline" program or system against which the costs and benefits of all feasible alternatives are compared.

The number of alternatives can be controlled by avoiding similar but slightly different alternatives (variations on a theme) and by early elimination of non-viable alternatives. The reasons for eliminating potential alternatives should be included in the CBA documentation. Some of the criteria used as a basis for eliminating non-viable alternatives are listed below.

- Unacceptably high cost
- Non-compliance with cost and benefit analysis guidance
- Lack of compliance with established constraints
- Dependence on assumptions that are considered unrealistic
- Non-compliance with law, regulations and/or policy (not only acquisition)
- Unacceptable performance
- Inability to meet Initial Operation Capability (IOC) or full operational capability (FOC) requirements
- Political considerations such as environment, world opinion, treaty compliance, etc.

Because each project requiring a cost benefit analysis is different, the evaluator will have questions and concerns which impact specific aspects of that particular project. The following list of questions was developed as a tool to assist in the preparation, review, and validation of cost benefit analyses:

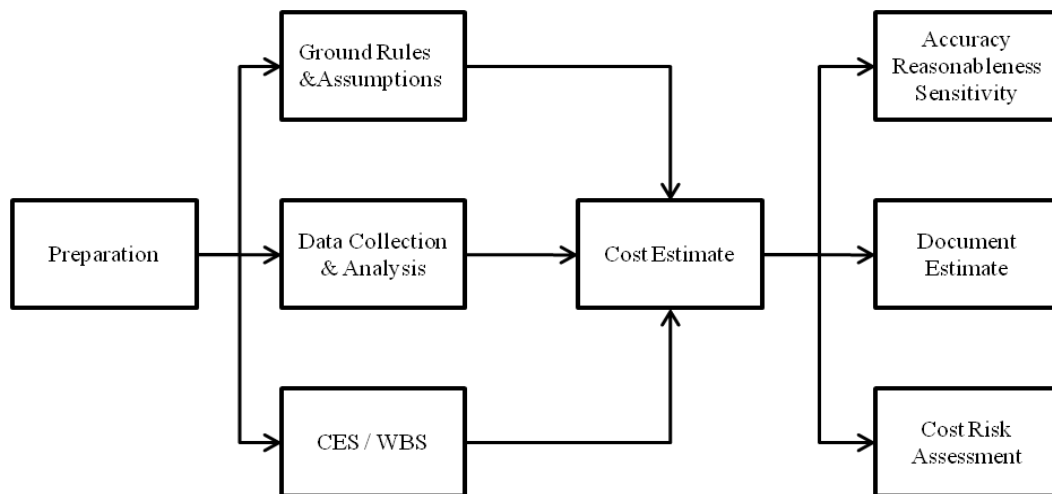
- Have all feasible alternatives been considered?
- Is the status quo presented as an alternative? If not, this needs to be explained in the documentation.

- Are all alternatives presented feasible?
- Are the alternatives distinctly different, rather than restructuring a single course of action?
- Have the alternatives that were eliminated from the analysis been clearly identified and has a rationale been provided for their elimination?
- If other Government organizations can provide the desired product or service, have they been identified as alternatives?
- If the project increases productive capacity, has a contracting alternative been examined?
- Are the alternatives well defined?
- If the alternatives overlap one another, are there sufficient differences between them to make them distinctly different, or are they just variations on a theme?

### The Cost Analysis Process

Cost analysis is a critical element in the CBA process. The cost estimates support management decisions by translating resource requirements (equipment and personnel) associated with programs, projects, or processes, into dollar values.

A systematic approach is necessary to develop accurate and timely cost estimates. The figure below shows the steps in completing a cost estimate. Cost estimating is an iterative process that may require reevaluating previous steps.



Cost Analysis Process

CES = Cost Element Structure

## **Cost Analysis Preparation**

Preparation includes knowing the purpose of the estimate, understanding the program/system and establishing a plan to complete the estimate. The purpose of the estimate is to evaluate alternative courses of action. Once the purpose is understood, it is important to agree on the end product (deliverable) to the customer.

The following are examples of documents that could be used to understand program requirements and their material solution:

- JCIDS documents/memo's outlining requirements (CDD, ICD, CPD etc)
- Operational Requirement Document (ORD)
- Acquisition Decision Memorandum (ADM)
- System Training Plan (STRAP)
- Manpower Estimate Report (MER)
- Test and Evaluation Master Plan (TEMP)
- Acquisition Strategy (AS)
- Acquisition Program Baseline (APB)
- Selected Acquisition Report (SAR)
- Defense Acquisition Executive Summary (DAES)
- Technical definition, characteristics, design features, and technologies
- Cost Analysis Requirements Description (CARD)
- Risk assessment
- Schedule

Once all available documents are reviewed, analysts should meet with subject matter experts (program office and contractor) to review and clarify any questions they may have.

## **Ground Rules and Assumptions (GR&A)**

GR&A establish the boundaries of the estimate by clarifying what the estimate includes and what it excludes. It can also be used to highlight issues of importance to decision makers. The cost estimator should work with the technical team to establish GR&A. Listed below are examples that should be established in the GR&A.

- Whether the financial data is shown in constant or current dollars and, if in constant dollars, what base year was used in the estimate
- Inflation indices used
- Scope of the estimate
- Maintenance concept

- Training strategy
- Support concept
- Acquisition strategy
- Procurement/fielding schedules
- Sparing concept
- Long lead items/procurement lead time
- Quantity of development units or prototype units
- Fee structure
- Development and production, O&S start and stop dates
- Commonality among components and other systems
- Technology assumptions
- Hardware refresh cycle
- Software assumptions
- Specific items or costs excluded from the cost estimate
- Government Furnished Equipment (GFE)
- Sunk costs
- Funding appropriation(s) for potentially contentious items

### **Data collection and analysis**

This step includes the process of identifying, collecting, and analyzing data before applying cost estimating within the analysis process. Prepare a formal data collection plan, which may consist of the following data collection tasks:

- Prepare a data collection schedule/plan
- Identify the types of data needed (e.g., cost, programmatic, schedule, technical)
- Determine and locate sources of data
- Collect cost data and program documentation
- Determine the sample size of data to be collected for each cost element
- Determine which estimating methods, tools, and models will be used with which data sets
- Verify, validate and adjust (normalize) the data
- Collect data continuously throughout the pre-cost estimating process

Adjusting for inflation is the most common form of normalization of data. It is also important for predicting annual budget requirements for funding multi-year activities, analyzing program alternatives (for a cost benefit analysis), and normalizing data for other uses. When adjusting

for inflation, make certain all dollar/cost data is adjusted in the same way so that it is comparable. In all cases, inflation should be applied by using OMB inflation rates, which are available at:

<http://asafm.army.mil/Documents/OfficeDocuments/Budget/Guidances/inflate//indices.xls>.

## **Work Breakdown Structure (WBS)**

A work breakdown structure defines in detail the work necessary to accomplish an initiative/proposal's objectives. A typical WBS reflects the requirements, what must be accomplished to develop the initiative/proposal, and provides a basis for identifying resources and tasks for developing a cost estimate. A WBS deconstructs an initiative/proposal's output (deliverables) into successive levels with smaller specific elements (cost elements) that can be analyzed. Cost elements are the lowest level of a cost estimate, and the cost estimate total is the sum of all the cost elements. A well-developed cost element structure helps ensure that no costs are missed and that there is no double counting. For example, a common cost element is personnel costs. This element can be further broken down into military and civilian personnel costs which in-turn can be analyzed as to what grade or rank makeup these two cost sub-categories.

## **Cost Estimate**

Once the GR&A are established, the data has been collected and analyzed, and the WBS structure established; it is time to build the estimate. Keep in mind that this is an iterative process and the GR&A data and WBS need to be continually reviewed to see if changes are needed. Normally, a cost estimate contains all costs from the start through implementation, operation, and disposal for a program or project. Collectively, these costs are the life cycle cost (LCC). The Army LCC is phased by the five appropriation groupings — Research, Development, Test and Evaluation (RDT&E), Procurement, Military Construction (MILCON), Military Personnel, and Operations and Maintenance (O&M)-each of which has its own inflation indices. Identify those costs which are recurring and those costs that are one time only. It is important not to confuse the two as it may lead to double counting which in-turn will cause costs to be overstated.

## **Accuracy/Reasonableness**

Checking the cost estimate for reasonableness will help identify potential errors and highlight cost estimating methodologies that may need to change. For instance, if contractor system engineering and program management (SEPM) cost doubles from one year to the next there may be a valid reason it increases; there could be an error in the estimate; or you may be using a Cost Estimating Relationship (CER) or factor that does not reflect what is going on in the

Program. The analyst needs to review each WBS element and ask the question, “Based on everything known about this program/product, does the cost of this WBS element pass the common sense test (i.e. should it be costing this much by year)?”

### **Data Sources**

Below is a list of some potential data sources for cost estimates. Regardless of the nature of the data used, identify the source and date of the data in the documentation of the CBA.

- Army material Command (AMC) Major Subordinate Commands (MSCs)
- Budget and Program Objective Memorandum (POM) submission
- Contract performance data
- Contractors and manufacturing plant visits
- Cost Analysis Requirements Document (CARD)
- Cost libraries
- Historical cost data reports
- Management Decision Evaluation Package (MDEP)
- Manpower utilization records/reports
- ODASA-CE
- Program Management Offices (PMOs)
- Program Office Estimate (POE)
- Research Development and Engineering Centers (RDECs)
- Subject matter experts
- Trade Studies

In addition to evaluating available data for its utility in cost estimating, the analyst must look for relationships among data. A basic premise is that relationships among data may continue to exist in the absence of known facts and conditions. The presence of these relationships provides the analyst with indicators that can form the basis for assumptions, cost factors, and CERs.

Cost factors and CERs may be expressed in dollars, physical quantities, ratios, or percentages.

Various methods may be used to develop them; whatever method is chosen should be relevant, valid, verifiable, and reasonable.



## **Cost Strategy**

The expected approach to costing is to ensure that an alternative under consideration is fully costed. The question of cost is separate from and must precede the question of budget. The cost question is: What is the full cost of the alternative? The budget question is: What impact will the alternative have on the budget? For example, an analyst is told to prepare a cost estimate for the establishment of a new maintenance facility to be staffed by 50 Soldiers and 50 Civilians. The analyst is further told that all Soldiers will transfer from other units and of the 50 Civilians, 30 will come from existing allocations. This means that the remaining 20 are brand new hires. The *cost* of this initiative includes the funding for 50 Soldiers and 50 Civilians. But *budget* impact is limited to the cost of the 20 Civilian new hires, because the costs of the 50 Soldiers and 30 Civilians are already reflected in the budget. The budgetary impacts will be addressed in Step 7 of this Guide under the heading called “Define Trade-Offs and Billpayers.”

## **Organizing Cost Data**

When an analyst is organizing and evaluating cost data, it may be helpful to build tables for identifying and aggregating costs. Using tables to display costs will also help identify those costs that will require trade-offs (which is discussed in Step 7 of the Guide), particularly costs that appear in the years of execution (current year and budget year before the next POM). These tables may also be used to prepare briefing charts for decision makers (which is discussed in Step 8 of the Guide).

The example below is a simple table that displays cost elements along the left side of the table and years which the cost analysis covers across the top. The analyst must determine the specific time period the CBA covers (e.g. the execution and POM years or something longer). The analyst would create a table for each alternative. While the focus of this Step (6) is on costing alternatives, a summary table may be built for use in Step 7 which will include both the costs and quantifiable benefits for each alternative to facilitate their comparison. The analyst can insert formulas that include the effects of inflation as well as discounting on the cash flows. The structure and content of the table are primarily influenced by the CBA itself and the needs of the decision maker and/or analyst.

Example of a table that aggregates cost by cost element and by year.

**Alternative A**

Cost Elements	Time Period								
	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Total
Personnel									
Facilities									
Equipment									
Contracts									
Training									
MILCON									
Maintenance									
Supplies									
Etc.									
Etc.									
Etc.									
<b>TOTAL</b>									

The cost elements shown to the left reflect some possible ones/ideas and not what must be used. The analyst should consider using more specific cost elements if possible. For example, if an initiative will be staffed with both military and civilian personnel, then show the break down between them. The cost elements selected will depend on the cost data used in

*A "Best Practice" would be to organize cost elements in the table by appropriation type (MPA, OMA, OPA, MILCON, and etc.) if possible.*

**Quick Review**

- All reasonable ways of satisfying the objective should be documented and discussed.
- Alternatives dismissed as infeasible should be noted in the backup CBA documentation.
- The quality of the solution to the problem statement is no better than the alternatives used in the CBA. Therefore, generating alternatives is an important step in the process of preparing a CBA.
- Alternatives do not need to be functionally identical as long as they fulfill the objective.
- Data is the foundation of every CBA. How good the data is affects the CBA's overall credibility.
- The data plan supports collection of the necessary data.
- Knowing the things that influence an alternative's costs and benefits will help you in capturing the right data.
- Data collection can be a lengthy process and continues throughout the development of the cost estimate. Emphasis should be placed on gathering data that demonstrates the costs and benefits of the identified alternatives.
- The analyst should acquire the most recent data available. Old data may be dated/obsolete.
- It is common practice to adjust your data through a process called normalization, which is ensuring that the data is consistent (e.g. keeping units the same \$/hr vs. \$/Day – use one or the other, not both, in the analysis).
- Differentiate the nonrecurring (one- time costs) and recurring costs.

## **STEP 5 – Identify Quantifiable and Non-Quantifiable Benefits**

This section discusses five areas:

- Benefits Analysis Overview
- Types of Benefits
- Identify, Estimate, and Evaluate Benefits
- Quantitative and Qualitative Benefit Categories

### **Benefits Analysis Overview**

Benefits are results expected in return for costs incurred for a chosen alternative. They are the quantitative and qualitative improvements expected or resulting from the implementation of a project/initiative (which may include but are not limited to the following: equipment, facilities, hardware, systems, etc.).

The following definitions or measurements describe benefits: effectiveness, physical yield, products, morale, quality of life, and timeliness. Benefits are either quantifiable or non-quantifiable. The purpose of benefit analysis is to identify, measure, and evaluate the benefits of proposed alternatives. Benefits may be expressed in non-dollar terms such as improved performance, operational effectiveness, or more rapid fielding of equipment.

When preparing a CBA identify all benefits, whether quantifiable or non-quantifiable. Benefits justify the costs identified in the CBA. Where possible, benefits should be quantified in dollar values. Benefits not assigned a dollar value can sometimes be quantified in other terms. All included benefits must be relevant to the analysis. Each benefit must be clearly and distinctly identifiable, and should not duplicate or overlap any other measure. This evaluation will determine the level of the risk to the Army if the alternative is not implemented, partially implemented, or delayed.

Benefits should be framed in the context of how they support the Army in meeting its missions, functions and responsibilities. The benefit analysis should consider the DOTMLPF construct (Doctrine, Organization, Training, Materiel, Leader and Education, Personnel, and Facilities).

## Types of Benefits

### Quantifiable Benefits

Quantifiable benefits are benefits that can be assigned a numeric value such as dollars, physical count of tangible items, or percentage change.

- Financial benefits are always quantifiable and are measured in dollars.
  - *Cost reduction.* A reduction in the number of dollars needed to meet a customer-established requirement by improving a process or function.
  - *Savings.* A cost reduction that permits a manager to remove dollars from the program or budget.
  - *Cost avoidance.* Any cost reduction that is not savings.
  - *Revenue generation.* An increase in the dollars that flow into the Army, over and above appropriated funds, or over and above the expected amount of customer funding received through a revolving fund.
  - *Productivity improvements.* A reduction in personnel time and effort requirements associated with a function or assigned task. In most cases, a productivity improvement will also result in a savings or cost avoidance.

Examples of other quantifiable benefits and methods of measurement include but are not limited to:

- Increased number of commodities or items produced for each alternative (such as the number of meals served, hours flown, or components manufactured).
- Increased number of items produced per a given period of time (such as flight hours per month, number of items per man-hour, or number of trucks serviced per year).
- Improved system reliability in terms of reduction to its probable failure ratio (such as mean-time-between-failure, or number of repairs per item per year).
- Reduced number of errors per operating cycle or period (such as the number of errors per card punched, errors per 100 records, or errors per 100 items produced).
- Improved maintainability/supportability measures (such as increased mean-time-to-repair or reduced average downtime).
- Improved accuracy, timeliness, and completeness of data produced by a system, resulting in efficient utilization of the Army's resources through more effective decisions made upon more accurate data.
- Improved performance and operational effectiveness.

## **Non-Quantifiable Benefits**

Some benefits do not lend themselves to direct, quantitative measures. These benefits, though difficult to assess, should be addressed qualitatively. Although subjective in nature, qualitative statements can make a positive contribution to the analysis. Despite being difficult to assess, the CBA preparer should attempt to use best analytical practices in order to include non-quantifiable benefits in the analysis. Some examples of non-quantifiable benefits are improved morale, compatibility, improved quality and security, and improved readiness.

## **Military Benefits Analysis (MBA)**

Military worth or Military Benefits Analysis (MBA) of new concepts demonstrates value or a technology payoff to the warfighter. Systems or systems analysts traditionally conduct MBA to evaluate the warfighter benefits resulting either from new asset development and implementation or from the establishment of new employment concepts for existing assets. The payoff or benefit must consider a clear interest of the user community in making an informed investment decision; therefore, determining the MBA for particular technologies is vitally important.

The scope ranges from the campaign to mission level and thus differs in magnitude, time frame, and level of detail. MBA typically includes parameters such as time to accomplish objectives, number of targets neutralized, amount of collateral damage, and volume of resources consumed (including dollars). It includes facilities, maintenance, resource reduction, and other parameter considerations.

If a new concept is similar to an existing in its performance and use, analysts can easily employ existing MBA tools and approaches to establish the concept weapon's warfighter benefit. However, most new concepts are radically different from existing. New concepts call for additional varying parameters and metrics. Evaluating the new concept military benefit is becoming increasingly difficult because existing analytical tools and techniques were not built to address these complex applications.

New concepts, constructs, technologies, and other developments cause the need for cooperative systems designs with multiple parameters sets against multiple mobile targets and intercepts while operating autonomously, cooperatively, and synchronously. These require high level analysis using stochastic, non-parametric, inferential, and statistical approaches including propagations of Markovian processes.

Effective MBA mission level constructs provide detailed insight to the scaled scenarios generated by compressed time, weapons effects (e.g., expected kills per \_\_\_\_\_), weapon's performance, and desired warfighter outcomes in a controlled space. MBA performed at the mission level effectively provides analysts with insight not attainable at the campaign level. Performing this dual (campaign and mission level) approach gives clarity for appropriate

comparisons to refine parameters to the expected benefit range. This process enables interpretation of the benefit by providing a potential performance picture. Force structure, force mix (array), target mix, and performance in designated scenarios (must be operationally relevant) define and shape the warfighter benefits.

MBA is crucial for evaluating the warfighter technology benefits and, consequently, for making informed technology investment decisions. As a result, MBA capability to support investments decisions is a necessary and sufficient collaborative tool for future technologies and integrating concept acquisition.

### **Identify, Estimate, and Evaluate Benefits**

All significant benefits must be included in the benefit analysis portion of the CBA, whether quantifiable or non-quantifiable. Benefits that cannot be quantified should be described in narrative form. Ensure that the benefits are validated by the functional proponent (or the organization responsible for the basic requirement) and coordinated with all appropriate activities. It is strongly recommended that identification and documentation of benefits begin early in the evaluation process.

### **Identifying Benefits**

The following steps are recommended to identify benefits and establish quantitative measures for benefits where possible.

- Identify all resources flowing into the project and the resulting benefits flowing out of the project.
- Determine and list the benefits of each alternative, both quantifiable and non-quantifiable.
- Define each benefit in relation to the alternatives in the CBA. All benefits included must be relevant to the analysis. Each benefit must be clearly and distinctly identifiable from all other benefits; it should not duplicate or overlap any other measure.
- Develop a quantitative measure for each benefit where possible. This will allow direct comparison of alternatives for each benefit.

Be consistent. Benefits should not be evaluated one way for one alternative, and a different way for another alternative.

## Benefit Categories

The following list of categories may help define benefits. This list is not all inclusive, nor is it intended to provide precise definitions of the benefits listed. It is only meant to be illustrative of benefits categories that could be applicable to program objectives.

- *Acceptability* - Does the alternative contribute to the operation of parallel or higher level organizations? Does it improve the quality of the process?
- *Accuracy* - Does the alternative reduce error rates or improve the accuracy of information?
- *Adaptability* - Is the system/project adaptable to existing DoD, industry, national, or international standards?
- *Availability* - When can the system/project be delivered or implemented; when is it needed to meet proposed output schedules? What is the mean time between failures?
- *Functionality* - How well does the system perform; how quickly can it process data or calculations, or other functions?
- *Compatibility* - How will existing operations, facilities, equipment, data requirements be affected? How much initial training will be required? How will work methods and procedures be altered?
- *Maintainability* - Is the system difficult to repair? Are parts readily available? How much staff will be required to maintain the software/hardware? What is the anticipated down time for maintenance? Is the maintenance downtime longer for any alternative?
- *Manageability* - Will the system/project decrease the involvement/need for supervisors or quality inspections? Will a different type of personnel than currently assigned be required? Are trained personnel available?
- *Morale* - will the system/project contribute to a positive employee attitude towards work?
- *Production* - Will the number of products produced be increased?
- *Productivity* - Will the rate of production increase? Will the system/project decrease the number of staff resources previously needed to produce the same product, or will the system/project allow more items to be produced with existing staff resources?
- *Quality* - Will a better product be produced? Will better service be provided? Will quality of products be more consistent? Is customer satisfaction improved?
- *Reliability* - how many (how often) system failures will occur over time?
- *Security* - Will more or less precautions be needed?
- *Service life* - How long will the equipment be able to support the operation? Will the equipment be obsolete before it reaches the end of its useful life?
- *Upgradeability* - How compatible will additional equipment, such as memory, terminals, workstations, or other equipment, be with existing equipment or users of the system?
- *Versatility* - Will the equipment in any alternative provide additional capacity or capability beyond that required for the system?

## **Estimating Quantifiable Benefits**

Every effort should be made to quantify benefits to the maximum extent possible. Sub-divide quantifiable benefits into those that are dollar quantifiable and those that are quantifiable in other terms. The methods of measurement for quantifiable benefits are as follows, in order of desirability:

- Dollar quantifiable terms.
- Physical count of tangible items (for example, units of output).
- Index or ratio (for example, 40 percent or greater).

The benefit estimating process is similar to that for cost estimating discussed in Step 4. Data must be collected from appropriate sources and analyzed; relationships among data must be identified; inflation and discounting must be applied to annual dollar values via standard methods. Cost estimates should apply inflation indices and then benefits should be computed by comparing the status quo (with applied inflation indices) with the cost of the alternative(s). The economic life (the period during which the alternative provides benefits) of the alternatives and the fiscal years (FY) when benefits accrue must be carefully considered. Identify all benefits by the appropriation and the FY in which they are expected to occur.

Upon decision approval, savings in the year of execution and budget year shall be retained by the command. Savings in the program years are considered in the Planning, Programming, Budget and Execution (PPBE) process. Savings beyond the Program Objective Memorandum (POM) period, as well as cost avoidances and productivity improvements, are treated differently.

Consider the limitations of benefit analysis carefully when using benefits in the decision making process. During the quantifying and analysis process, assumptions and judgments are made which influence the results. The analyst must make value judgments and trade-offs, and any uncertainty that exists about the information must be made clear to the decision maker.

## **Evaluating Non-Quantifiable Benefits**

The following are techniques for evaluating non-quantifiable benefits:

- Enumeration is a "simple listing" of the non-quantifiable benefits associated with each alternative for comparison purposes.
- Ranking non-quantifiable benefits by their relative importance to the goals and objectives is another useful technique. Such a ranking describes the degree to which each alternative achieves a given objective. The ranking provides a description of all benefits and how each contributes to the project's goals; it explicitly identifies the differences among alternatives. An example would be the quality of a report prepared



automatically or manually. The judgment of which alternative yields the best quality report would assist in the overall ranking of alternatives. In addition to relative ranking, weights may be assigned to each benefit, so that a point total may be calculated for each alternative. Even if numeric scores are calculated, this analysis is by nature very subjective; it requires a consensus on the relative importance of the benefits.

### **Types of Quantifiable and Non-quantifiable Benefits**

The following is the most likely or most probable benefits listing (see below). This list should not to be construed as all-inclusive or exhaustive in nature. It only serves as a basis for establishing potential types of quantifiable and non-quantifiable benefits.

<b>Quantitative</b>	<b>Non-quantitative</b>	<b>Benefit Classification</b>
Lower cost for future projects through shared infrastructure and knowledge	Better information to facilitate policy making	Enhancement
Reduce need for future capacity expansion	Allows more, greater and new data collection	Enhancement
Improved security and fewer breaches	Improved security	Enhancement
Reduce demand for service	Policy alignment and outcomes	Enhancement
	Additional tools and functions	Enhancement
Reduced processing through common standards and processes	Customer service, service integration	Improvement
Reduced error rates, re-work, complaints	Service consistency and quality	Improvement
Reduced need for multiple data collection	User satisfaction, involvement, and participation	Improvement
More flexibility, Reduce Time Required	Communication, More Flexibility	Improvement
More accurate, up-to-date, cleaner, and reliable	Reputation, increased user trust and confidence	Improvement
Additional capacity	Integrated view of customers	Improvement
Improved management	Increased user involvement, participation, contribution and transparency	Improvement
Increased productivity	More reliable and up-to-date	Information
Decrease in manual functions	Greater use, Faster and easier access	Information
Reduce redundancy through integration	Transparency and empowerment	Information
Additional capacity, accuracy, up-to-date, cleaner, and reliable	Access range and increased choice	Information
Reduced error rates	Reduced error rates	Reliability
Capacity waste reduction	Greater confidence and transaction certainty	Reliability
More effective use of existing infrastructure	Service consistency	Reliability
Travel	Reduced processing time	Response
Services (Consultation, software, equipment, etc.)	Improved response time	Response
Revenue generating activities (Soldiers, business, intermediaries, contractors, etc.)	Improved communications	Response
Increase adoption of e-services	Reduced user time	Time
Reduced services pricing, avoid future price increases	Reduced travel time	Time
Reduced information transmission (phone, post, paperless, etc.)	Reduced need for multiple data submission for services and events	Time
Reduced processing through common standards and processes	Reduce redundancy through integration	Time

### **Quick Review**

- Benefits should exceed costs where possible
- Benefits can be quantifiable or non-quantifiable
- MBA is vital for evaluating the warfighter technology benefits and investment decisions
- Quantifiable benefits will often carry more weight with decision makers
- Each alternative or COA will be evaluated primarily on its benefits

## STEP 6 – Define Alternative Selection Criteria

This section discusses one area:

- Alternative Selection Criteria

### Alternative Selection Criteria

After data for the proposed alternatives to be compared is collected and analyzed, and cost estimates have been completed, the decision criteria for selecting the “preferred” alternative must be determined. Cost benefit analyses must contain documentation that defines decision criteria and their impact in making the recommendation of the preferred alternative. It is important that the criteria used should be customized/tailored to the CBA. For example, if an organization wishes to buy a new passenger vehicle for their fleet, some of the criteria that would go into the evaluation of the alternatives could include size, mpg, number of seats and etc.

**This section describes several common alternative selection quantitative methods (criteria) available to the analyst. The analyst must determine which of the following selection methods is most appropriate, if any, to support their CBA. In the Quick Review summary at the end of this section there is a table that will assist the analyst in selecting the most suitable method(s).**

### **Quantitative Methods**

There are a variety of quantitative methods for project selection criteria that provide a definitive basis for ranking alternatives. Quantitative analysis of costs and benefits and the resultant ranking of alternatives can be performed using discounted and undiscounted dollars. Quantitative methods in a cost benefit analysis typically use an applied discount rate. The discount rate used by the Federal Government is based on the Treasury Department cost of borrowing funds, and will vary depending on the period of analysis (as stated in OMB Circular A-94).

Some of the most common quantitative methods for project selection are described below.

- *Net Present Value (NPV)*

When the alternatives to satisfy a mission have the same economic life (time over which the benefits to be gained from the alternative may reasonably be expected to accrue), a NPV comparison can be used to determine the optimum alternative based on costs and benefits. With the NPV technique, all future cash flows are converted to present equivalent values then summed (also known as discounting). The alternative with the **greatest** NPV is the preferred alternative. In those cases where benefits do not exceed

cost, the preferred alternative is the one with the **lowest** NPV. The effects of inflation discussed in Step 4 of this Guide and discounting must be accounted for when performing current dollar analysis. Current dollars are expressed in the value of their year of occurrence (i.e. actual or projected amounts) Current dollars must be deflated and discounted to derive the present value of future cash flows.

*Example of Net Present Value (NPV)*

Year	Alternative 1 Expenditures	Alternative 2 Expenditures	Discount Factor	Alternative 1 Discounted Costs	Alternative 2 Discounted Costs
1	\$100,000	\$150,000	.926	\$92,600	\$138,900
2	\$5,000	\$8,000	.857	\$4,285	\$6,856
3	\$5,000	\$8,000	.794	\$3,970	\$6,352
4	\$5,000	\$8,000	.735	\$3,675	\$5,880
5	\$5,000	\$8,000	.681	\$3,405	\$5,448
Total NPV	-	-	-	\$107,93	\$163,436

Summary: Net Present Value (NPV):

- Used when all alternatives meet the mission requirement over the same period of analysis
- Value of future earnings in “today’s money”
- Calculated by applying a discount rate % to future costs

- *Benefit/Cost Ratio (BCR)*

The BCR compares the present value of the total benefits associated with an alternative with the present value of its total costs. Alternatives that have a BCR greater than one (1) are considered viable. All other things being equal, projects with greater BCRs are usually given priority over those with smaller BCRs. A BCR provides the decision maker with the total benefit obtained per unit of cost, thus making it easier to compare different alternatives.

*Example of Benefit/Cost Ratio*

Alternative	Discounted Costs (C)	Discounted Benefits (B)	Discounted Net (B-C)	Benefit Cost Ratio (B/C)
1	\$1,800,000	\$2,200,000	\$400,000	1.22
2	\$1,850,000	\$1,750,000	(\$100,000)	0.95
3	\$2,000,000	\$2,100,000	\$100,000	1.05
4	\$2,200,000	\$2,100,000	(\$100,000)	0.95

Summary: Benefit/Cost Ratio

- Calculated by dividing discounted benefits by discounted costs
- Alternatives with ratios greater than one are cost effective
- The alternative with the highest discounted net benefits could be considered the best alternative

- *Break-even Point*

The break-even point is the point at which the cumulative costs of two alternatives are equal to the cumulated benefits. At this point the savings in current dollars from the comparison of alternatives will equal the investment in current dollars. The break-even point is computed for each alternative. Break-even analysis is normally performed using undiscounted current dollars. Break-even analysis is not sensitive to the overall individual alternative benefits or streams of costs or benefits that occur after the break-even point is reached.

*Example of Break-even Analysis (In Thousands of Current Dollars)*

Year	STATUS QUO		ALTERNATIVE ONE				
	Recurring	Non-recurring	Recurring	Non-recurring	Status Quo Costs	Alternative One Costs	Savings
1	\$10,251	\$0	\$10,251	\$10,666	\$10,251	\$20,917	(\$10,666)
2	\$10,588	\$33,045	\$10,588	\$44,060	\$53,884	\$75,565	(\$21,681)
3	\$10,936	\$0	\$5,468	\$0	\$64,820	\$81,033	(\$16,213)
4	\$11,291	\$0	\$5,646	\$0	\$76,111	\$86,679	(\$10,568)
5	\$11,652	\$0	\$5,826	\$0	\$87,763	\$92,505	(\$4,742)
6	\$12,025	\$0	\$6,013	\$0	\$99,788	\$98,517	\$1,271
7	\$12,410	\$0	\$6,205	\$0	\$112,198	\$104,722	\$7,476
8	\$12,807	\$0	\$6,404	\$0	\$125,005	\$111,126	\$13,880
9	\$13,217	\$0	\$6,609	\$0	\$138,222	\$117,734	\$20,488
10	\$13,640	\$0	\$6,820	\$0	\$151,862	\$124,554	\$27,308

**NOTE:** Break-even point occurs in the 6<sup>th</sup> year.

Summary: Break-even Point

- Constant dollars are converted to current dollars using inflation indices
- Savings are determined by calculating the difference between cumulative costs
- Break-even point is the year where the savings become positive

- *Rate of Return (ROR)*

The ROR is that discount rate at which the present value of the savings is equal to the present value of the investment cost through the remaining life cycle of the alternative being evaluated. The ROR technique for comparing alternatives is particularly useful when the total dollar value of potential investments exceeds the available funds. Thus,

the ROR can act as a single value for each investment, permitting the ranking of alternative with respect to their economic desirability. The ROR can also assist in determining whether or not proposed investments will provide at least a predetermined minimum return.

- *Internal Rate of Return (IRR)*

The IRR is the discount rate at which the NPV of a project becomes zero (0). Any discount rate higher than the IRR will mean that the alternative will have a negative NPV. For example, if the IRR of a project is 3%, the analyst should ask whether it is likely that the actual discount rate is likely to be higher than 3%. If it is, then they should not undertake the alternative because its NPV will be negative. The higher the IRR, the more likely the alternative will result in a positive NPV.

*Example of IRR*

To determine IRR for an alternative with investment cost of \$200 in year 1 and annual savings of \$50 in years 2-9, perform an iterative computation, varying the discount rate until the total present value of the investment is approximately equal to the total present value of the savings. Begin with the basic present value formula;  $PV = F_n * 1 / (1+i)^n$  Where PV = Present Value,  $F_n$  = dollar amount of investment or savings in year n, n = number of periods (in years), and i = interest rate. For this scenario, the IRR is determined when  $PV_{inv} = PV_{sav}$ , where  $PV_{inv}$  is the present value of investment and  $PV_{sav}$  is the present value of savings. Thus,  $200 * 1 / (1+i) = 50 * 1 / (1+i)^2 + \dots + 50 * 1 / (1+i)^9$ . At  $i = .186$ ,  $PV_{inv} = PV_{sav} = 168.6$ . Hence, the IRR for this example is .186, or 18.6%.

Annual investments and savings with 18.6% IRR				
Project	FYXX Constant \$		Present Value \$	
Year	Investment	Savings	Investment	Savings
1	\$200	\$0	\$168.3	\$0
2		\$50		\$35.5
3		\$50		\$29.9
4		\$50		\$25.2
5		\$50		\$21.3
6		\$50		\$17.9
7		\$50		\$15.1
8		\$50		\$12.7
9		\$50		\$10.7
Total	\$200	\$400	\$168.3	168.6

## Non-Quantitative Methods

Some of the non-quantitative (subjective) methods for alternative selection are described below.

- *Subjective Reasoning*

The subjective reasoning method uses one or more of the following informal criteria for alternative ranking: urgency in attaining the alternative objective, filling a gap in existing mission requirements, maintaining existing mission objective levels, or whether or not the proposed alternative meets emergency needs.

- *The Point System*

The point system is another method used to rank alternatives based on evaluation of both quantifiable and non-quantifiable factors. Under this method, an attempt is made to evaluate non-quantifiable benefits and intangible factors by subjectively developing point scores based on preferences for obtaining certain benefits.

The following steps are used:

1. Identify each of the decision criteria that will be used to evaluate the alternatives.
2. Assign rankings to each of the criteria to identify importance relative to each other. This can be done using any desired scale. For example, if cost is considered to be twice as important as processing time, and processing time is considered to be just as important as error rate, using a scale of 1-10 you could assign a score of 8 to cost and 4 to processing time and error rate.
3. For each alternative, determine the extent to which it satisfies each of the criteria, using a scale of zero to one.
4. Multiply the sets of numbers in order to determine a total score for each alternative.

In theory, the alternative with the highest score will be selected as the preferred alternative. However, because this process is by its very nature subjective, complete precision is not possible. In most cases, this approach will identify the top two or three alternatives and will narrow the range of alternatives that must be considered by decision makers.

Here is a simplified example.

We have identified three decision criteria: achieving mission requirements, cost, and response time. Our assessment of their relative importance is that achieving mission requirements is twice as important as cost, and cost is 1.5 times as important as response time. We assign them scores of 6, 3, and 2, respectively. (These could be any numbers, as long as the relative importance is maintained.) We are considering three

alternatives. Based on our professional judgment, we determine that the extent to which each alternative satisfies the three criteria is as follows:

	Mission	Cost	Response Time
Alternative A	0.8	0.8	0.5
Alternative B	0.4	0.2	0.3
Alternative C	0.7	0.7	0.7

Our evaluation and ranking of the alternatives is captured in the following table:

Relative importance of criteria	Mission	Cost	Response Time	Calculation	Sum
	6	3	2		
	Extent to which each Alternative Satisfies the Criteria				
Alt A	0.8	0.8	0.5	$6*0.8 + 3*0.8 + 2*0.5$	8.2
Alt B	0.4	0.2	0.3	$6*0.4 + 3*0.2 + 2*0.3$	3.6
Alt C	0.7	0.7	0.7	$6*0.7 + 3*0.7 + 2*0.7$	7.7

This analysis clearly eliminates Alternative B from consideration, and enables decision makers to focus their subjective consideration on Alternatives A and C.

- *A Fortiori Analysis*

An “a fortiori” analysis is applicable to decision problems where generally accepted intuitive judgment strongly favors one alternative. The a fortiori analysis involves the deliberate attempt to formulate assumptions that tend to uniformly favor or disfavor a particular alternative. The rationale is that if the assumptions uniformly favor an alternative and the alternative still does not rank above other alternatives, then any other set of assumptions would only tend to reduce the alternative's ranking. For example, a decision maker realizing personal bias to the status quo counteracts this bias by purposely formulating new assumptions that favor the competing alternatives. If the comparison of the alternatives still indicates the status quo is the most cost effective, the decision maker can be assured that the bias did not affect the decision process.

### **Quick Review**

- The financial results as evidenced by the quantitative methods discussed in this step are essential to building a persuasive CBA.
- The user must determine what criteria should be used to support the CBA. Basic rule: select the alternative that maximizes the net present value of benefits (measured in current, then-year dollars).



The following table summarizes the alternative selection criteria discussed in this section.

Method	Description	When Used
Net Present Value (NPV)	Converts future cash flows into present equivalent values and then adds them together.	When alternatives have the same economic life.
Benefit/cost ratio (BCR)	Compares present value (PV) of benefits with present value of costs.	When competing alternatives have unequal costs and unequal benefits
Break-even Point	Identifies point at which cumulative cost of two alternatives equal the cumulative benefits.	When projects are high-risk, to show when investment costs need to be recovered quickly
Rate of Return (ROR)	Identifies the discount rate at which the PV of the savings is equal to the PV of the investment through the remaining life cycle.	When the total dollar value of potential investments exceeds the available funds.
Internal Rate of Return (IRR)	Identifies the discount rate at which the NPV of a project becomes zero.	Used to explain and justify investment decisions
Subjective reasoning	Applies professional judgment as a complement to, or to the exclusion of, quantitative data.	When professional judgment is considered to be more important than quantitative data.
Point System	Applies objective values to subjective criteria.	When decision makers wish to narrow the list of alternative solutions to the few that are most suitable.
<i>A Fortiori</i> Analysis	Determines whether a strongly favored alternative is still the best choice even when assumptions are formulated that put that alternative at a disadvantage.	When generally accepted intuitive judgment strongly favors one alternative.

## STEP 7 Compare Alternatives

This section discusses four areas:

- Compare Costs and Benefits
- Identify Trade-offs and Billpayers
- Describe Second and Third Order Effects
- Perform Sensitivity Analysis and Risk Assessment

### Compare Costs and Benefits

The essence of the CBA process is comparing the costs and benefits of two or more alternatives (including the status quo) in order to select the preferred alternative. As a general rule, the preferred alternative is the alternative that provides the greatest amount of benefits in relation to its cost. In situations where it is difficult to quantify benefits and measures of effectiveness, it is important to provide as much useful information as possible so that a decision can be made as to which alternative yields the most benefits.

### Alternative Comparison Decision Matrix

Costs Comparison – All alternatives	Benefits Comparison – All alternatives	Selection Criteria
Equal	Unequal	Alternative that provides greatest benefits for given level of costs
	Equal	Based on other factors: subjective reasoning and/or other analysis
Unequal	Unequal	Alternatives ranked in order of benefit/costs ratios, or largest to smallest net present value
	Equal	Least costly alternative

One of the best tools or techniques for comparing and prioritizing a list of alternatives is the decision matrix. It is able to include and effectively evaluate most quantitative and non-quantitative factors using in the CBA (especially the selection criteria identified in Step 6)

### Example of a Decision Matrix

The following is a simple example that assumes all criteria are equal in value with no weights being applied. Analysts may use a more sophisticated decision matrix by incorporating weights for the criteria. The user example located in Appendix E contains such a decision matrix

Criteria	Alternative 1		Alternative 2		Alternative3	
	Data	Rank	Data	Rank	Data	Rank
Total LC Cost	\$12,500	3	\$13,300	2	\$14,800	1
NPV	\$10,400	2	\$9,900	3	\$11,600	1
Break -even	15 years	1	14 years	2	12 Years	3
Criteria XYZ	Very Good	2	Excellent	3	Good	1
Criteria Etc.	Average	2	Low	3	Average	1
<b>SCORE</b>		<b>10</b>		<b>13</b>		<b>7</b>

#### Rating scheme:

- Data values: Lower quantifiable data values are preferable; Better subjective ratings for non-quantifiable data values are preferable
- Rank values are assessed by the analyst with a **higher number** representing better performance or value

### Define Trade-Offs and Billpayers

Trade-offs or billpayers are required in any situation where resources are limited, requiring the pursuit of one action over another. This situation will apply in virtually all cases, since decision makers rarely find themselves with excess funds. To the contrary, most often they almost always must make “zero-sum” decisions, taking funds from an existing program to pay for a new initiative. The trade-off or billpayer for an initiative is what you give up to obtain that item. Each of the alternatives in a CBA should be evaluated in terms of what must be given up in order to be pursued. Rarely are there sufficient resources, financial and otherwise, to satisfy each and every requirement. As part of the CBA process, analysts and decision makers must explore the issue of how an alternative will be supported financially. The question is simple: if we decide to approve this new action who or what will pay the bill? Billpayers must be internal to the organization preparing the CBA unless the analysis has been coordinated with other affected organizations. An analyst preparing a CBA cannot assume that other organizations will pay for the recommended alternative. Finally, any new requirements must support the Army Campaign Plan and include trade-offs in terms of forces, capabilities, systems, programs, and

funding. **A best practice is to ensure a resource manager is engaged early in the CBA development process to assist and advise the CBA analyst and his/her leadership in the identification of the appropriate billpayers to use in offsetting the costs of the alternatives under consideration.**

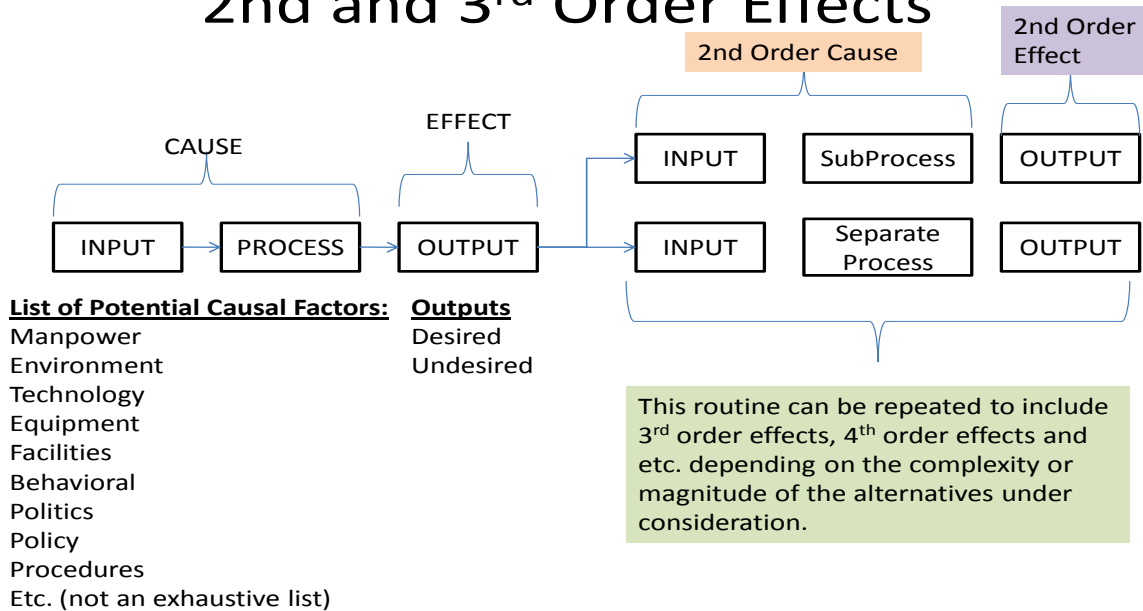
### **Describe Second and Third Order Effects (Cause and Effect)**

In addition to the primary intended result of consequence of a decision, there can be second- and third-order effects. The concept of second- and third-order effects is based on a sequential cause and effect relationship. When a decision is made, it is the cause of effects A, B, and C. Each of these effects can in turn become the cause of other effects, and so on as the full impact of the decision is felt. An alternative should be analyzed in terms of its second- and third-order effects. To identify second- and third-order effects, the analyst should ask this question: “If we do this, what will happen? And what will happen as a result of that?” This question is asked until all relevant effects have been identified. Because decisions have consequences, analysts must understand what those consequences are and assess their impacts not only within their immediate organization, but horizontally and vertically of the larger organization (Army-wide) as well. **Finally, one of the most important questions that must always be evaluated is: “If a recommendation is adopted, will it create a bill for another organization?”** Again, if a bill is created for another organization, the analysis/recommendation must be coordinated with that organization.

#### *Example of 2nd and 3rd Order Effects*

Due to funding constraints, a post commander reduces the number of shuttle bus routes from 3 per hour to 1 per hour. The second order effect is that more people decide to use Privately Owned Vehicles (POVs) instead of waiting for the bus. The third order effect is that traffic congestion becomes worse, leading to late supply deliveries to critical on-post facilities.

# 2nd and 3<sup>rd</sup> Order Effects



## Perform Sensitivity Analysis and Risk Assessment

### Sensitivity Analysis

Sensitivity analysis is a tool for assessing the extent to which costs and benefits are sensitive to changes to specific assumptions. It repeats a prior analysis using different quantitative values to determine their effects on the results of the basic analysis. If changing an assumed value results in a relatively large change in the outcome of the analysis, it is said to be sensitive to that assumption. When changes are made to one or more inputs, what happens to the outputs? Factors that have a strong impact on results obviously deserve the most attention.

All cost estimates should include sensitivity analyses. It is not sufficient to present the decision maker with a set of alternatives where costs and benefits are based on “most likely” factors and assumptions. The decision maker needs to be informed about how well the alternative’s rankings will hold up under reasonable changes to factors and assumptions. Describe how sensitive the costs and benefits are to changes, or how much risk (for example, 90 percent probability of success) exists in the data supporting the results.

It may be helpful to divide your analysis into two groups:

- Those that are outside your control (i.e. assumptions)and,
- Those that you can influence or control to some degree.

Suggested steps for conducting a sensitivity analysis are:

- Choose several costs that appear to have the greatest impact on the results of the analysis and which are most subject to variance.
- Vary each one over a reasonable set of values while holding the other variables in the analysis constant.
- Determine the impact of these changes on the net present value results and the ranking of alternatives.

Some factors that may warrant sensitivity analyses are:

- The effects of a shorter or longer economic life.
- The effects of variation in the estimated volume, mix, or pattern of workload; for example, the production rate or learning curve.
- The effects of potential changes in requirements resulting from either congressional mandate or changes in functional responsibilities.
- The effects of potential changes in requirements resulting from changes in organizational responsibility at the site, installation, base, or Army command/direct reporting unit/Army service component command level.
- The effects of changes in configuration of hardware, software, data communications, prime support equipment, and other facilities.
- The effects of alternative assumptions on areas such as project operations, inflation rate, residual value of equipment, and length of development.
- The effects of changing the fielding strategy.

## **Risk Assessment**

Risks/barriers are inherent in the implementation of any project/alternative. A risk assessment is the identification and analysis of relevant risks associated with achieving agency objectives. It is the first step toward improving management controls. It is a screening device that facilitates rapid identification of potential problems that may require corrective action. The analyst should use the CBA to demonstrate that the risks have been identified, and how to mitigate them. Based on the risk assessment analysis, the analyst must develop a statement of risks that will likely be encountered by the initiative/proposal, and identify methods for addressing each one. Finally, the CBA must also explain how the recommended approach reduces the risk or at least takes it into account.

The goal of a risk assessment is to answer questions such as:

- What risks may occur?
- What is the source of these risks – internal or external?
- What is the cause of these risks?
- What are the consequences if the risks go uncontrolled?

- What assets, operations, activities, functions, etc. will be affected as a result?
- What is the likelihood that the risk will occur?
- How much risk is tolerable?
- What has management done to anticipate or prevent occurrence or limit consequences?

Risk should always be measured by the potential monetary loss or other adverse event to the organization.

### **Quick Review**

- All efforts to this point have been building to the point where the analyst can compare the costs and benefits of each alternative. Therefore, the comparison step is a fundamental part of the CBA methodology.
- Ideally, the least costly alternative or the one whose benefits exceed the costs is the optimal solution to the problem identified in step 1 of the CBA process.
- A decision matrix is an effective tool for performing a comparison as well as the rank ordering of alternatives.
- Trade-offs/billpayers are the funding sources that have been identified which will cover (partially or entirely) the costs of an alternative.
- Second and third order effects are the results (consequences) stemming from a decision. Second and third order effects identify what a decision maker can do or not do as a result of a decision.
- Sensitivity analysis is a technique for analyzing whether changes in assumptions, quantitative values, or priorities will affect the recommendation.
- The CBA should include a discussion of all risks that can impact the implementation of a recommendation. For each risk identified, the analyst should identify an associated mitigation strategy that will explain how the risk will be minimized or eliminated.

## STEP 8 – Report Results and Recommendations

This section discusses two areas:

- Documenting the CBA
- Briefing the results of the CBA using the template
- Case Study Extract

### Documenting the CBA

It is essential to thoroughly document the CBA. There must be sufficient documentation of all assumptions, costs, methodology, results, and data to enable a person unfamiliar with the project to arrive at the same conclusion as the person who prepares it. If the decision maker is unable to follow the assumptions, data, and computations, the project may be delayed while clarification is obtained. Decision makers at various levels of review may not be as familiar with the CBA as the analyst that prepared it, yet each will critically analyze and pass judgment on the CBA's validity and adequacy.

CBA documentation should describe the functional process performed; define the requirement; identify significant assumptions, constraints, and key variables. The CBA documentation should also identify feasible alternatives, and present total costs and differential savings expected in constant, discounted, and current dollars over the project life. **The CBA must address estimating methods/relationships and data sources; treat sensitivity, risk, and uncertainty of key cost drivers and assumptions; and address all quantifiable benefits as well as any non-quantifiable benefits influencing the recommended course of action.** Furthermore, alternatives must be defined in such a way that the differences between alternatives are clear and there is adequate rationale for their inclusion. In all cases, clearly document all alternatives that were eliminated and include the justification for their deletion.

Documentation supporting the results of the analysis must include the computations and methodologies used to estimate the costs and benefits. For example, if cost factors are used, indicate their source and/or the basic assumptions used in their derivation. All data sources should be specifically identified for all costs and benefits. Support documentation should be sufficient to allow an independent reviewer to recreate the estimate and reach the same conclusions.

All costs must be presented in constant and current dollars, and displayed by fiscal year for the entire project life, beginning with the first fiscal year in which costs will be incurred. Cost estimates must reflect the Army's true requirement for a system or project, not just available funding. If the system or project is not fully funded, the strategy for obtaining needed funding



should be explained to the decision maker. Options for implementation within current funding levels must be addressed.

Specify clearly in the analysis the criteria by which benefits have been evaluated.

Documentation supporting the results of the analysis will include all computations and a detailed description of the methodology used in developing these estimates. In addition, it is important to identify the sources of benefit data, methods used to collect the data, and quality of data.

The comparison of alternatives should show differences in costs and benefits by fiscal year. Comparison of alternatives should be shown in net present value terms. Some examples (discussed in Step 6) are: Benefit/COST Ratio (BCR), Break-even Point (Payback Period), Rate of Return (ROR) and Internal Rate of Return (IRR).

Other factors that may quantitatively or non-quantitatively affect the assessment of costs and benefits for one or more of the alternatives should also be identified. Examples include non-quantifiable benefits such as improved morale, better quality of life, customer satisfaction, etc.

A recommendation as to the preferred alternative, with all appropriate supporting justification, should accompany the comparison of alternatives.

## **Briefing the Results of the CBA Using the Template**

Below is a suggested outline for a briefing template that can be used to brief decision makers on the CBA:

<p><b>Main Briefing:</b></p> <p><b>Cover Page</b></p> <p><b>Executive Summary</b></p> <p><b>Background</b></p> <ul style="list-style-type: none"><li>• Problem Statement</li><li>• Objective</li><li>• Scope</li><li>• Assumptions and Constraints</li></ul> <p><b>Timeline (Optional)</b></p> <p><b>Courses of Action (Alternatives) Definition</b></p> <p><b>COA Analysis</b></p> <p><b>COA Cost Analysis and Budgetary Impact</b></p> <p><b>Costs and Benefits Comparison</b></p> <ul style="list-style-type: none"><li>• Costs and Benefits</li><li>• Trade-Offs and Billpayers</li><li>• Second and Third Order Effects</li><li>• Decision Matrix Summary</li></ul> <p><b>Recommendation (include justification)</b></p> <p><b>Coordination (Optional)</b></p> <p><b>Backup Slides:</b></p> <ul style="list-style-type: none"><li>• Sources and Derivation of Cost Estimates and Other Support Documentation<ul style="list-style-type: none"><li>○ Slide Sensitivity Analysis and Risk Assessment</li></ul></li></ul>
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## Appendix A

### References

#### Office of Management and Budget and Government Accountability Office

- OMB Circular No. A-11, Part 7, Planning, Budgeting, Acquisition, and Management of Capital Assets
- OMB Circular A-94, Guidelines and Discount Rates for Benefit-cost Analysis of Federal Programs
- GAO Cost Estimating and Assessment Guide, March 2009  
(<http://www.gao.gov/products/GAO-09-3SP>)

#### Department of Defense References

- DoDI 5000.02 Operation of the Defense Acquisition System, December 2008
- DoDI 7041.3, Economic Analysis for Decision-making
- DoD Business Case Development Guide, V2, November 2003
- DoD Business Case Model for the DoD Logistics Community, September 2009

#### U.S. Army References

- AR 11-18, The Cost and Economic Analysis Program
- AR 70-1 Army Acquisition Policy, April 2009
- AR 700-127 Integrated Logistics Support
- ASA(ALT) Performance-Based Logistics (PBL) Business Case Analysis
- Department of the Army Pamphlet (DA PAM) 70-3, Army Acquisition Procedures, April 2009

### **Guidance Prepared By DASA (Cost and Economics Directorate)**

- Economic Analysis Manual, February 2001
- Cost Management Handbook, April 2009
- Lean Six Sigma Deployment Guidebook, Section 8 and Appendix B, April 2009
- Budgetary and Cost Template to Support Legislative Proposals, March 2009

### **Miscellaneous Documents and Sources**

- Air Force Manual 65-510, Business Case Analysis Procedures, 22 September 2008
- Enhanced Defense Financial Management Training Course, Module 2, Competency Area 2: Cost and Economic Analysis
- Defense Acquisition Guidebook, Chapter 3, Affordability and Life Cycle Resource Estimates, Defense Acquisition University
- Weapon Systems Acquisition Reform Act of 2009, House of Representatives, 111<sup>th</sup> Congress, May 2009
- CJCSI 3170.01G, 1 March 2009

## Appendix B

### Acronyms

<b>ADM</b>	Acquisition Decision Memorandum
<b>APB</b>	Acquisition Program Baseline
<b>AS</b>	Acquisition Strategy
<b>BCR</b>	Benefit/Cost Ratio
<b>CARD</b>	Cost Analysis Requirements Description
<b>CBA</b>	Cost Benefit Analysis
<b>CDD</b>	Capability Development Document
<b>CER</b>	Cost Estimating Relationship
<b>CES</b>	Cost Element Structure
<b>COA</b>	Course of Action
<b>CPD</b>	Capability Production Document
<b>DAES</b>	Defense Acquisition Executive Summary
<b>DOTMLPF</b>	Doctrine, Organization, Training, Materiel, Leader and Training, Personnel, and Facilities
<b>FOC</b>	Full operational capability
<b>FY</b>	Fiscal Year
<b>GFE</b>	Government Furnished Equipment
<b>GR&amp;A</b>	Ground rules and assumptions
<b>ICD</b>	Initial Capabilities Document
<b>IOC</b>	Initial Operation Capability
<b>IRR</b>	Internal Rate of Return
<b>JCIDS</b>	Joint Capabilities Integration and Development System

<b>LCC</b>	Life cycle cost
<b>MDEP</b>	Management Decision Package
<b>MER</b>	Manpower Estimate Report
<b>MILCON</b>	Military Construction
<b>NPV</b>	Net Present Value
<b>O&amp;M</b>	Operations and Maintenance
<b>O&amp;S</b>	Operations and Support
<b>OASA(FM&amp;C)</b>	Office of the Assistant Secretary of the Army (Financial Management & Comptroller)
<b>ORD</b>	Operational Requirement Document
<b>POE</b>	Program Office Estimate
<b>POM</b>	Program Objective Memorandum
<b>POV</b>	Privately Owned Vehicle
<b>PPBE</b>	Planning, Programming, Budget and Execution
<b>RDT&amp;E</b>	Research, Development, Test and Evaluation
<b>ROR</b>	Rate of Return
<b>SAR</b>	Selected Acquisition Report
<b>SEPM</b>	Systems Engineering and Program Management
<b>STRAP</b>	System Training Plan
<b>TDA</b>	Table of Distribution and Allowances
<b>TEMP</b>	Test and Evaluation Master Plan
<b>TOE</b>	Table of Organization and Equipment
<b>WBS</b>	Work Breakdown Structure

## Appendix C

### Glossary

#### **Acquisition strategy**

Conceptual framework for conducting materiel acquisition, encompassing broad concepts and objectives that direct and control overall development, production, and deployment of system.

#### **Alternative**

One of two or more approaches, programs, or projects that are the means of fulfilling a stated objective, mission, or requirement.

#### **Alternative cost**

The total cost associated with developing, producing, fielding (including military construction), and sustaining the system. The alternative cost also includes the phase-out cost of the status quo. It does not include sunk cost.

#### **Appropriation**

A legislative process setting aside a designated amount of public funds for a given purpose. Jointly, the Senate Appropriations Committee and House Appropriations Committee annually establish funding levels through an appropriations bill, which ultimately is enacted into law upon signing by the President.

#### **Army Acquisition Executive**

The Secretary of the Army designated principal advisor and staff assistant for acquisition of Army systems. The Assistant Secretary of the Army for Research, Development, and Acquisition is currently designated as the Army Acquisition Executive responsible for overall management of Army acquisition programs.

#### **Army Cost Position**

The results of the comparative analysis of the Program Office Estimate or Economic Analysis and the Component Cost Analysis or an Independent Cost Estimate. The ACP is documented in the Cost Analysis Brief and approved by the Assistant Secretary of the Army for Financial Management and Comptroller. It is the approved cost position for all subsequent programming, budgeting, and cost analysis activities.

#### **Army Systems Acquisition Review Council**

A panel composed of regular, special members, and participants designated by the chairman whose mission is to review DoD major programs and DAPs at specific milestones and provide Army approval prior to the next phase of system acquisition.

**Assumption**

A statement or hypothesis that is essential to the success of a plan or alternative and is beyond the control of the organization making the analysis. Assumptions should never be confused with facts.

**Benefit**

Results and outputs expected in return for costs and inputs incurred or used. A positive output of an alternative. It includes measures of utility, effectiveness, and performance. Benefits focus on the purpose and the objectives of a project.

**Benefit/cost ratio**

The ratio of the present value of the total benefits (savings and cost avoidances) divided by the present value of the total costs. It does not include sunk cost. A benefit/cost ratio (BCR) of 1.0 indicates that the present value of the benefits is equal to the present value of the total costs. The calculation for BCR begins by applying the discount factor to the constant-dollar benefits and the constant-dollar costs to arrive at the present value of the total benefits and the present value of the total costs.

**Benefit/investment ratio**

The ratio of the present value of the dollar quantifiable benefits (savings and cost avoidances) divided by the present value of the investment (development, production, military construction, and fielding) cost of the alternative. It does not include benefits that are associated with sunk cost. A benefit/investment ratio of 1.0 indicates that the present value of the benefits is equal to the present value of the investment. The calculation begins with constant dollars.

**Break-even point**

The point in time, for example, number of years or fractional years, at which the savings in current dollars equals the investment in current dollars. It does not include sunk cost.

**Component Cost Analysis (this term is not used anywhere else in the guide)**

A complete and fully documented life cycle cost estimate for a system that is developed externally and independently from the acquisition proponent, or an independent estimate of major cost drivers and or cost elements. The Component Cost Analysis or Independent Cost Estimate is used to test the reasonableness of the POE/EA and provide a second opinion of the system's cost.

**Constant dollars**

All prior year, current, and future costs that reflect the level of prices of a base year. Constant dollars have the effects of inflation removed.



**Cost analysis**

The act of developing, analyzing, and documenting cost estimates through various analytical approaches and techniques. It is the process of analyzing and estimating incremental and total resources required to support past, present, and future systems. In its application to future resource requirements, it becomes an integral step in selection of alternatives by the decision maker.

**Cost avoidances**

All cost reductions that are not savings.

**Cost Benefit Analysis**

A structured methodology that determines the costs and benefits of one or more alternatives and compares them in order to identify the best alternative to achieve a stated goal/objective.

**Cost estimate**

- a. A prediction of costs consisting of:
  - (1) A clearly defined requirement.
  - (2) A statement of cost assumptions.
  - (3) A source identification for basic cost data.
  - (4) A documentation of the methodologies used.
- b. The estimated cost of a component or aggregation of components that is developed by using historical cost data and/or mathematical models.

**Cost-estimating relationship**

A mathematical expression relating cost as the dependent variable to one or more independent cost-driving variables. The expression may be represented by several functions, such as linear, power, exponential, and hyperbolic.

**Cost factor**

A cost-estimating relationship where the cost estimate is determined by performing a mathematical operation on some other related cost element. It is a brief arithmetic expression where cost is determined by application of a factor such as a percent, and so on.

**Cost reduction**

A reduction in the number of dollars needed to meet an established requirement. All cost reductions are categorized as savings or cost avoidance.

**Current dollars**

Dollars that reflect the purchasing power of the dollar in the year the cost or savings is to be realized or incurred. That is, current dollars reflect the effects of inflation. Prior-year costs stated in current dollars are the actual costs incurred in those years. Future costs or savings stated in current year dollars are the projected values that will be paid out in the future years.

**Defense Acquisition Board**

A senior DoD corporate body for systems acquisition that provides advice and assistance to the DAE and the Secretary of Defense.

**Defense acquisition program**

A program designated by OSD management or the AAE for DAB or ASARC review.

**Director of Cost Assessment and Program Evaluation**

An OSD committee, which serves as the principal advisory body to the Defense Acquisition Board on matters, related to cost estimates.

**Discounting**

A technique for converting various annual cash flows occurring over time to equivalent amounts at a common point in time, considering the time value of money, to facilitate comparison. (This is an alternative definition of present value.)

**Discount rate**

The interest rate used to discount or calculate future costs and benefits so as to arrive at their present values. This term is also known as the opportunity cost of capital investment. OMB Circular A-94 presently uses a discount rate tied to the Government's cost of capital.

**Economic analysis**

A systematic approach to identify, analyze, and compare costs or benefits of alternative courses of action that will achieve a given set of objectives. This approach is taken to determine the most efficient and effective manner to employ resources. In the broad sense, the systematic approach called economic analysis applies to new programs as well as to the analysis of ongoing actions.

**Economic life**

The period of time over which the benefits to be gained from deployment or use of a resource may be reasonably expected to accrue. The economic life of a project begins in the year it starts producing benefits and ends when the project no longer accomplishes its primary objective.

**Independent assessment/sufficiency review**

An evaluation and validation of the PEO's and PM's cost or economic analysis, short of performing a full CCA, for a program scheduled to be reviewed by the ASARC or Army MAISRC (neither is discussed elsewhere; need to spell out). This review includes a thorough analysis of the problem definition, alternatives, assumptions, cost estimate, benefit analysis, risks, conclusions, and recommendations.

**Independent cost estimates**

A complete and fully documented life cycle cost estimate for a system that is developed external of, and independent from the acquisition proponent. The ICE is used to test the reasonableness of the POE /EA and provide a second opinion of the system's cost.

**Information systems**

Organized assembly of resources and procedures designed to provide information needed to execute or accomplish a specific task or function. It applies to those systems that evolve, are acquired, or are developed that incorporate information technology. It applies to all five Information Mission Area disciplines and encompasses AIS (spell out). Information system equipment consists of components to create, collect, process, store, retrieve, transmit, communicate, present, dispose, and/or display information.

**Inherited assets**

Operational equipment or software that becomes part of a system irrespective of original funding or "ownership."

**In-process review**

Review of a project or program at critical points to evaluate status and make recommendations to the decision authority; accomplish effective coordination; and make cooperative, proper, and timely decisions bearing on the future of the project.

**Investment cost**

Includes the research and development phase and the production and deployment phase (to include military construction) costs of the system.

**Life cycle cost estimate**

A document that:

- a. Includes all costs incurred during the total life (from project initiation through termination) of a system or aggregation of systems.
- b. Includes cost for research and development, production, military construction, deployment, and operating and support.

**Major system**

- a. Systems estimated by the Secretary of Defense to require a total expenditure for RDT&E of more than \$200 million (FY 80 constant dollars) or an eventual total expenditure for procurement of more than \$1 billion (FY 80 constant dollars).
- b. Materiel system acquisition programs recommended by HQDA to be managed as MDAPs or ADAPs. Designation is normally a part of the required operational capability.
- c. Army systems designated by the Secretary of Defense for DAB review are automatically identified as Army major systems.

**Management Decision Package**

A structured life cycle process that represents the most current approved funding position developed through the PPBES. A separate MDEP will normally be created for each major system. Each MDEP covers a 9-year period.

**Markovian process**

A simple stochastic process in which the distribution of future states depends only on the present state and not on how it arrived in the present state.

**Materiel system**

A combination of hardware components that function together as an entity to accomplish a given objective. A materiel system includes the basic items of equipment, support facilities, and services required for operation and sustainment.

**Milestone decision review**

An event (meeting) composed of top military and civilian managers, including the program manager. Its purpose is to address and resolve major program issues before approval is granted to proceed to the next life cycle management phase.

**Net present value**

The difference between the present value of the benefits and the present value of the costs.

**Non-quantifiable benefits**

A benefit that does not lend itself to numeric valuation, such as better quality of services. Non-quantifiable benefits are to be addressed in narrative form in the documentation.

**Operating tempo**

The annual operating miles or hours for systems in a particular unit required to execute the commander's training strategy.

**Payback period**

The number of years required for the cumulative savings to equal the cumulative investment costs (development, procurement, military construction, and fielding) in current dollars. The payback period is normally stated in non-discounted terms; however, a discounted payback period may also be shown ( See Break-even point).

**Phase-out cost**

That cost required for the parallel operations of the status quo while the new system is being developed, fielded, and accepted. This cost occurs from the time the development of the new system begins to when fielding is completed.

**Present-value dollars**

Dollars that have had their annual cash flow occurring over time converted to equivalent amounts at a common point in time in order to account for the time value of money. The normal discount rate is 7% (this percentage amount is not addressed elsewhere), as prescribed by OMB. The computation begins with constant dollars.

**Productivity improvements**

Cost avoidances that are in the form of personnel time savings and are dollar quantified, and that do not represent an opportunity to reduce a force structure or MDEP.

**Program baseline**

A description of a specific program containing the following key elements:

- a. Requirements. A concise statement of prioritized functional needs.
- b. Program content. A concise description of the program capabilities and products to be provided, including required technical and operational characteristics, within the approved funding.

**Program cost**

Consists of research and development, procurement, and deployment (includes military construction) costs (including sunk) that are in direct support of the system or project. Included within this definition are operations and maintenance funds for expenditure directly related to concept development, design, and deployment. Program cost and program acquisition cost are synonymous terms.

**Program/project/product manager**

An individual assigned the responsibility and delegated the authority for the centralized management of a specific system acquisition program/project/product.

**Program Office Estimate**

A complete, detailed, and fully documented materiel system life cycle cost estimate updated throughout the acquisition cycle and the Planning, Programming, Budgeting, and Execution System. The Program Office Estimate, as accepted or modified by the Army Cost Position, provides the basis for subsequent tracking and auditing.

**Quantifiable benefit**

A benefit that can be assigned a numeric value, such as dollars, physical count of items, or percentage change.

**Rate of return**

The discount rate at which the present value of the investment cost equals the present value of the savings. The calculation begins from constant dollars. The ROR does not include sunk cost.

**Savings**

Any cost reduction that enables a manager to remove programmed or budgeted funds and apply them to other uses.

**Savings/investment ratio**

The ratio of the present value of the savings to the present value of the investment required to produce the savings. It does not include sunk costs. An SIR of 1.0 indicates that the present value of the savings is equal to the present value of the investment. The calculation begins with constant dollars.

**Sunk costs**

Sunk (past or unavoidable) costs are past expenditures or irrevocably committed costs that are not avoidable and, therefore, should not be considered in the decision process.

**System**

A combination of all components and tangible items that function together as an entity to accomplish a given objective.

**System-specific cost**

Hardware, software, and related costs that can be directly attributable to a particular system.

**Uniform annual cost**

A measure of the relative cost of a project that represents the average yearly cost, and is derived from the total discounted cost figure. The average yearly cost (UAC) is the total project cost discounted, divided by the sum of the discount factors for the years in which the system provides benefits (economic life).

**Validation**

A review of all elements in a cost estimate to confirm that they are sound, developed using acceptable cost estimating methods, adequately documented, and capable of being justified, supported, and defended. The validation will be performed by an organization external and independent from that of the functional proponent and preparer of the estimate.

## Appendix D

### **Cost Estimating Models and Tools**

The following cost estimation tools, databases and financial models are currently licensed by the U.S. Army. The analyst is not required to use these tools, databases or models to complete a CBA.

#### **Automated Cost Data Base (ACDB)**

ACDB is part of the suite of Automated Cost Estimating Integrated Tools (ACEIT). ACDB is a source of commodity based cost, technical and performance data. Commodities include communications/electronics, rotary wing aircraft, missiles and munitions, wheeled and track vehicles. ACDB provides the unique capability to enter, search, and retrieve standardized cost, schedule, technical, and programmatic data with easy interface with the ACEIT Cost Analysis Statistic Package (COSTAT) or Excel. The ACDB system includes two components, the Database Developer Kit (DDK) and the Report Wizard. The Report Wizard allows analysts to access existing ACDB databases, review raw data reports, and extract data for analysis. The DDK is designed to allow an analyst with little or no database development training to build a cost/schedule/technical/programmatic database to support cost research. Additional ACDB information is available from the Office of the Deputy Assistant Secretary of the Army (Cost and Economics) website at <http://www.asafm.-army.mil/ODASA-CE.htm> and in the Reference section of this Handbook.

#### **Automated Cost Estimating Integrated Tools (ACEIT)**

ACEIT is a PC-based model which provides standard framework for cost estimating and risk analysis tasks. ACEIT automates the storage, retrieval, and analysis; facilitates building cost models, risk analysis, budget time phasing and narrative documentation of the cost estimates. ACEIT is an integrated suite of tools (ACDB, COSTAT, ACE, POST, POSTDOC and LIBRARIAN). ACE automates all of the steps of the estimating process, including building a Cost Element Structure (CES), specifying estimating methods, performing learning, time phasing, inflation, and documentation. ACE also provides access to on-line databases and knowledge bases of cost estimating relationships (CERs), models, and source references. Some of ACEITs' new features include Plug-Ins for ACE, Excel, MS Project, PRICE S, H/HL, SEER H, SEER-SEM and NAFCOM.

ACEIT is widely used by Army organizations from the headquarters to small cost shops. Additionally the Air Force, Navy, OSD, other government agencies and support contractors use it. For more information see the Office of the Deputy Assistant Secretary of the Army (Cost and Economics) website at <http://www.asafm.army.mil/ceac.htm>, <http://www.aceit-.com/> or telephone ACEIT Sales at (281) 333-0240.

## **Army Military-Civilian Cost System (AMCOS)**

AMCOS is an automated tool that helps users estimate the costs associated with personnel and personnel requirements for different components, grades and skills. AMCOS Lite performs quick estimates of military, civilian and the private labor market. AMCOS is located on the OSMIS website <http://www.osmisweb.com/>.

## **The Cost and Performance Portal (CPP)**

The Cost and Performance Portal (CPP) program is run by ODASA-CE and helps Army organizations with cost estimating, modeling, metric development, performance tracking and process automation. Our mission is to support effective cost and performance management in the Army, to promote visibility and transparency into Army spending and operations, and to promote an organizational culture that maximizes cost effectiveness. The CPP consolidates data from disparate data sources, configures reporting and analytical tools, creates data models and automates processes for users throughout the Army. The CPP is Common Access Card (CAC) enabled and is accessible anywhere in the world via the Internet.

The CPP program is run by Army civilians with contractor support. Although we work extensively with and have expertise in cost and accounting information, we are not limited to any specific functional area. We integrate data from legacy systems, emerging systems and individual analytical products.

Most of the CPP's products are available to everyone in the Army with an AKO email account. The CPP serves a wide variety of Army users throughout HQDA and beyond ranging from Army senior leaders to functional analysts. Organizations that are directly supported by the CPP include: DASA-CE, ABO, ACSIM, IMCOM, G-1, G-3, ASA (M&RA) and others+. Many senior leaders use the specialized reports and tools found on the portal to inform decision making and track the management of cost and performance outcomes.

Some of the products available on the CPP are: Appropriation execution scorecards - Tracks overall execution levels in comparison to spending plans and available funds. OACSIM Dashboard - Tracks execution data against planned execution for the entire II PEG. Specialized focus area displays are available for deep dives into contracts, Future phases will link execution to performance outcomes.

MPA Overview - Shows high level MPA execution metrics with the ability to drill-down. Also shows costs by activity, entitlement, and grade as well as end strength.

MPA Analysis - Modeling products that get into specific data and assumptions used to project cost rates for the MPA appropriation. Also contains the Army's reports for MPA overseas contingency operations spending. OPTEMPO - Reports showing total OPTEMPO obligations by



[MACOM is no longer a valid term]and total spending for each major ground and air system.

Additional metrics include

\$/aircraft, \$/flying hour, \$/tank, \$/mile.

Generating Force Census - A semi-annual census of the Generating Force of the Army that displays required, authorized, and on hand military, civilians and contractors by command and UIC. Also identifies the functional activity that is associated with each position.

Capabilities Knowledge Base (CKB) - A capability-based costing and analytical tool that contains program data for ACAT 1 systems across all military components. The CKB supports the development of service component cost estimates at Milestone-A as required by the December 2008 DoDI 5000.02. Future phases will incorporate ACAT II & III systems.

### **Base Operations Requirements Model (BRM)**

ACSIM uses BRM to develop baseline requirements for Base Operations Support for POM input. ISR - Services and ISR – Services Cost data are used in the Standard Service Costing (SSC) model to calculate Cost Estimating Relationships (CERs) that are used in the Base Operations Support Requirements Model.

### **Facilities Operation Model (FOM)**

The FOM is an OSD mathematical Budget Planning Tool to identify, advocate and defend funding for Facilities Operations (FO) Functions over the Future Years Defense Plan (FYDP). Costs based on commercial cost factors researched by Whitestone Research and other sources. Provides annual cost for each of ~ 400 facility analysis categories (FACs) within the facilities operation program (utilities, custodial, grounds maintenance, etc.) It includes: Fire & Emergency Services Utilities (Energy + Water & Waste Water), Pavement Clearance, Refuse Collection & Disposal, Real Property Leases, Grounds Maintenance & Landscaping, Pest Control Custodial, Real Property Management & Engineering Services and Readiness Engineering. Formerly called Real Properties Services (RPS)

### **Facilities Sustainment Model (FSM)**

The FMS is an OSD mathematical model used to calculate maintenance and repair activities necessary to keep a typical inventory of DoD facilities in good working order throughout their allocated service life. Includes regularly scheduled adjustments and inspections, preventive maintenance, emergency response and service calls for minor repairs and major repairs/-replacement of facility components expected to occur periodically throughout the facility life cycle. i.e. regular roof replacement, refinish wall surfaces, repair/replace electrical, heating, and cooling systems, replacing tile/carpets, etc. Excludes repair/replace non-attached equipment-furniture, or building components that typically last more than 50 years (such as foundations and structural members).

## **Facility Modernization Model (FMM)**

The FMM is an OSD mathematical model used to predict the average annual funding required to modernize\* DoD facilities inventory on a continual, ongoing basis. Recapitalized replaces or renovates to a “like new” condition such that its useful life may be extended. Modernization updates-renews a facility to current standards without changing the fundamental size or function. Does not include: expansion or enlargement; restoration/repair to facilities prematurely deteriorated due to lack of sustainment; and restoration /repair due to unforeseen events such as fire or hurricane.

## **Facility Planning System (FPS)**

The FPS module provides planners and other users with an automated tool to assist in determining and analyzing facility allowances and requirements for Army organizations. The FPS also provides valuable reference material about Army organizations, facility space planning criteria, Army school course data and other information. Access to FPS is generally available to RPLANS users. FPS allows the user to obtain personnel and equipment (P&E) lists for DA approved OTOE, as well as the mission statement for OTOE. A list of SRC (OTOE) is available to select from, or selection can be made by branch of the OTOE or by searching for key words in the title of the unit. P&E lists are also available for TDA organizations by entering the UIC of the TDA, or searching for key words in the organization’s title. In both cases, FPS shows the category code(s) that are assigned to each paragraph of the OTOE and TDA. This is a major help in understanding why an organization is getting a certain allowance for certain category codes. A search feature also allows a user to look for specific information, such as a Line Item Number (LIN), or Military Occupational Specialty (MOS), in the OTOE and TDA documents. Information on courses run by the TRADOC schools and other commands is also available on FPS. Each year, the FPS data on OTOE, TDA and courses is updated from DA sources to provide the user with current reference material.

FPS calculates the allowances for OTOE and TDA for over 50 category codes. These category codes are primarily those used at the unit level, such as general purpose admin, unit headquarters, maintenance facilities, instructional buildings, and organizational parking. This calculation is done by algorithms that use DA approved criteria and the various data elements from the OTOE or TDA document, such as strength figures, equipment counts, and position or job codes. By selecting the category code and organization, FPS will not only show the allowance, but the details of how that allowance was calculated. In most category codes, this allowance is fed into, and reflected by RPLANS.

FPS provides valuable help to a user in determining what the requirement should be for a specific organization when it is determined, by careful analysis, that the allowance calculated is not correct for a specific unit or situation. This feature allows the user to modify a number of data elements, such as strength figures, equipment counts, or maintenance availability, to

reflect the specific situation that applies to the organization. By changing these data elements, the user can immediately determine for a category code, the impact of the change. This new figure may be used, with justification, as input to a requirement edit in RPLANS.

### **Force & Organization Cost Estimating System (FORCES)**

FORCES' is a suite of tools available on the OSMIS website <http://www.osmisweb.com/>. The tools that are available are the FORCE Cost Model (FCM), End-Strength Cost Model (ESCM), Cost and Factors Handbook (CFH) and the Army Contingency Cost Model (ACM). FORCES data includes financial and non-financial data such as OPTEMPO/cost factors, equipment costs, force structure, personnel costs, base operations, movement costs and indirect training costs.

### **Headquarters Real Property Planning and Analysis System (HQRPLANS)**

HQRPLANS module provides planners at HQDA, Army Commands and IMCOM Regions with an automated tool to assist in determining and analyzing facility allowances and stationing initiatives for all Army installations. The Headquarters module calculates facility allowances at all Army locations worldwide by FCG. The system tracks installation assets via the Headquarter Executive Information System (HQEIS), to include the Army National Guard (ARNG) real property inventory, and calculates facility allowances based on existing and projected force structures as defined in the Army Stationing and Installation Plan (ASIP). Unit driven allowances are provided to the module by the Facility Planning System (FPS) module which bases calculations on unit personnel and equipment. Allowances are also calculated for the on-going Reserve Component training missions at each installation.

### **Installation Real Property Planning and Analysis System (INSTRPLANS)**

INSTRPLANS module is an integrated, automated planning tool that provides installation planners with the capability to readily and efficiently calculate peacetime facility space allowances and compare them to available real property assets for a wide range of facility types. The Installation module provides automated support for master planning activities, to include site planning, satisfying the requirement for an installation Tabulation of Existing and Required Facilities (TAB) outlined in AR 210-20, construction program development, stationing analysis, unit/organization facility allowances analysis, functional area assessments and space utilization. The module tracks installation assets and calculates facility allowances based on existing and projected force structures for seven years. Allowances are also calculated for the on-going Reserve Component training missions at each installation. An edit utility provides the capability to edit requirements in cases where calculated allowances do not fully account for mission, equipment or personnel impacts on infrastructure.

### **Joint Integrated Analysis Tool (JIAT)**

The Joint Integrated Analysis Tool (JIAT) concept is an architecture that allows models in the functional areas of cost estimating, engineering design, requirements, capability, and

performance analysis to be linked together. JIAT provides real-time cost estimating capability to the cost, acquisition, requirements and modeling and simulation (M&S) and communities. JIAT provides seamless linkages to cost estimating software packages such as ACEIT, SEER, PRICE and OSMIS, AMCOS, FORCES and Capability-based costing databases.

JIAT provides the capabilities for cost and requirements analysts to develop cost estimates and perform cost-performance trades at the system level with the limited amounts of data available early in a program's life cycle. The architecture also allows analysts to perform Cost as an Independent Variable (CAIV) analysis and capabilities costing. JIAT incorporates various Army analysis models to perform trade-off analysis with optimization techniques.

Information regarding JIAT's capabilities can be accessed at: <http://asafm.army.mil/offices/CE/Jiat.aspx>

### **Operating and Support Management Information System (OSMIS)**

OSMIS is the Army's portion of the Department of Defense (DoD) Visibility and Management of Operating and Support Costs (VAMOSOC) Program. OSMIS is managed by the Office of the Deputy Assistant Secretary of the Army (Cost and Economics). It is the U.S. Army's source of standardized historical operating and support (O&S) cost information for more than 500 systems deployed in tactical units – Active, Guard, and Reserve. It is easily accessible and widely used by Department of Defense analysts in developing O&S cost analyses, preparing O&S estimates and cost reduction initiatives. The types of analyses and comparisons include: Component Cost Analyses (CCAs), Program Office Estimates (POEs), Cost Estimating Relationships (CERs), Alternative of Analyses (AOAs), Economic Analyses (EAs), and weapon/materiel system O&S cost comparisons between legacy and new systems. It is available on the OSMIS website <http://www.osmisweb.com/>.

### **PRICE TruePlanning Suite**

The PRICE *TruePlanning Suite* is the umbrella for all of the PRICE systems' toolsets. *True H and PRICE H* (Hardware Acquisition and Development) estimates costs, resources and schedules for hardware projects. *True S* (Software Acquisition and Development) predicts costs, resources, and schedules for all types and sizes of software projects. *True IT* (Information Technology Project Modeling and Management) provides a framework for devising and executing and enterprise IT strategy that can include one or many projects. The PRICE suite of cost estimating models also includes *True COCOMO*, an implementation of USC's COCOMO II, for estimating software engineering requirements analysis, design, construction, and verification at the software configuration item level. More information regarding the PRICE *TruePlanning Suite* can be obtained at <http://www.pricerestimates.com/> or telephone (703) 740-0080.

## **Real Property Planning and Analysis System (RPLANS)**

The Real Property Planning and Analysis System (RPLANS) is an integrated planning tool that allows installation and higher level planners to efficiently calculate peacetime facility space allowances and compare them to available real property assets for a wide range of facility types. RPLANS provides automated support for master planning activities, to include site planning, satisfying the requirement for an installation Tabulation of Existing and Required Facilities (TAB) outlined in AR 210-20, construction program development, stationing analysis, unit/organization facility allowances analysis, functional area assessments and space utilization. An editing utility allows the installations to modify the calculated facility allowances to reflect special mission, equipment or personnel impacts on their infrastructure.

RPLANS uses installation infrastructure assets via the Headquarter Executive Information System (HQEIS), to include the Army National Guard (ARNG) real property inventory, and calculates facility allowances based on existing and projected force structures as defined in the Army Stationing and Installation Plan (ASIP) using approved business rules.

RPLANS supports a number of other Army systems including the Installation Status Report and the Facilities Degradation

RPLANS is comprised of four modules designed to meet the needs of users at installation, Installation Management Command (IMCOM) Region, Army Commands and Headquarters, Department of the Army (HQDA) level. Users at each level share a common need to correlate data about real property assets, installation force structure and populations, and facility allowances and requirements. The four modules are levels or views in the RPLANS Suite that provide different degrees of detail. The Installation module (INSTRPLANS) provides unit and facility level of detail; the Region module (RGNRPLANS) provides unit level of detail; the Headquarters module (HQRPLANS) provides Facility Category Group (FCG) summary level of detail; and, the FPS module provides unit level detail, to include personnel duty position and Line Item Number (LIN) detail for Army organizations. Data from the RPLANS Suite support a number of other Army automated systems including ISR Infrastructure and FDM.

## **Region Real Property Planning and Analysis System (RGNRPLANS)**

RGNRPLANS module is an integrated, automated planning tool that provides IMCOM Regions with a UIC level detail view of Installation RPLANS sites within their Region. The Region module is used for reviewing and approving installation requirement edits, analyzing proposed construction projects and similar management tasks. Approved requirements in the Region module support ISR facility quantity ratings. The Region module provides each IMCOM Region with maximum flexibility to manage the requirement approval process for their assigned Installation RPLANS sites, to include a variety of options for managing users, requirements and Major Subordinate Commands (MSCs) within the module.

### **Software Estimation, Planning and Project Control (SEER-SEM)**

SEER-SEM estimates the software development and maintenance effort, cost, schedule, staffing, reliability, and risk. There are several basic drivers behind SEER-SEM's estimating engine. These driver values are established by your choice of knowledge bases and parameter settings. Parameter categories include those for size and other, more qualitative factors. Qualitative inputs rate programmer and analyst capabilities and experience, the use of automated tools, anticipated volatility, etc. Other SEER cost estimation tools include SEER-SSM (Software Size Estimation), SEER-H (Hardware Estimation, Planning, and Project Control), SEER-IC (Integrated Circuit Cost and Yield Analysis) and SEER-DFM, Cost Design for Parts, Process and Assembly. More information regarding SEER can be obtained at <http://www.galorath.com> or telephone (310) 414-3222.

### **Software Life cycle Management (SLIM)**

SLIM-Estimate is a software project estimation, presentation and analysis tool that generates estimates of cost, schedule, effort and quality. SLIM-Estimate is one of a family of tools offered by Quantitative Software Management ([www.qsm.com](http://www.qsm.com)). The other tools in the family support planning roll-ups (MasterPlan), project oversight (SLIM-Control) and historical data collection (DataManager) and analysis (SLIM-Metrics).

## Appendix E

### **Cost Benefit Analysis Case Study** **Cost Benefit Analysis Example Narrative**

Determining the Best Course of Action (COA) to provide the *Next Brigade Combat Team (NBCT) with Supply and Maintenance Logistics Support*

#### **STEP 1– Develop the Problem Statement and Define the Objective and Scope.**

1a. Problem Statement: The optimal mix of supply and maintenance logistics support personnel for NBCTs has not been established potentially leading to higher costs and/or reduced performance.

1b. Objective: Before committing to organic logistics support, the Army will provide a cost effectiveness analysis of logistic support options and the Army's recommendation for a logistic support concept at the least cost and greatest benefit to the US Army.

1c. Scope: These alternatives address contractor and organic logistics support for 20-year life cycle maintenance at the field level for NBCT-unique Class IX parts; national and field level contractor and organic logistics support for generally used Class IX parts for the following NBCT variants:

Infantry Carrier Vehicle- ICV	Fire Support Vehicle- FSV
Reconnaissance Scout Vehicle- RV	Engineer Squad Vehicle- ESV
Mortar Carrier- MC	Medical Evacuation Vehicle- MEV
Command & Control Vehicle- CV	Recovery Maintenance Vehicle- RMV
Mounted Combat Vehicle- MCV	CBRNE Scout Vehicle- CSV

#### **STEP 2 – Formulate Assumptions and Identify Constraints.**

2a. Assumptions: The most significant assumption for this CBA is that there is a one to one ratio of contractors versus soldiers required to maintain the NBCT weapon systems. The results of this analysis will change if fewer contractors are required to perform the field level supply and maintenance support than soldiers. The contractor to soldier ratio will be addressed in section 7d (Sensitivity Analysis and Risk Assessment). The other significant assumptions are as follows. This CBA will consider only the cost of NBCT-unique parts. A Directorate of Logistics (DOL) will be available at each of the fifteen brigade locations. Repair expertise is not site specific. Both national and field level costs will be considered for the supply requisition process. All NBCT consumable and reparable parts will be considered. Target operational availability is 90%. Organic maintenance options will not change the current process used for weapon system fleets. Use of organic maintenance will require no new field level maintenance facilities to be built. The organic field level supply requisition process will require purchase and stocking of NBCT unique repair parts and unique repair equipment. Contractor support will be performed on all national level maintenance to include vehicle overhaul at contractor facilities or at Anniston Army Depot. If the contractor option is selected, in-house repair capabilities will need to be developed. All NBCT consumable and reparable parts will be considered. Target operational availability is 90%.

2b. Constraints: Estimates will be for a 20-year life cycle. FY10 constant dollars will be used throughout the analysis. The NBCT is an Army Core System. The analysis supports 10 NBCT variants. The analysis supports the fielding of 15 Brigades. Five COAs will be included in the analysis. The maintenance depot for the NBCT is located in Anniston, Alabama. A Two-Level maintenance concept will exist throughout the NBCT Life Cycle. The COA chosen will not impact the field level requisition process. Only funds detailed in the Program Evaluation Groups (PEGs) requirements in the Program Objective Memorandum (POM) for the 2012-2017 time frame extrapolated out to 2030 will be considered in the analysis.

**STEP 3 – Document the Current State (the Status Quo).**

Current State. The current Army configuration of 45 Active Component (AC) BCTs and 28 Army National Guard Reserve Component (RC) BCTs consisting of 15 AC and 7 RC Heavy Brigade Combat Teams (HBCTs), 20 AC and 20 RC Infantry Brigade Combat Teams (IBCTs), 10 AC and 1 RC Stryker Brigade Combat Teams (SBCTs) have the following maintenance concepts: HBCTs and IBCTs have organic field level supply and maintenance requisition support and Contractor Logistics Support (CLS) national level supply and maintenance requisition support. SBCTs are currently transitioning from a hybrid CLS and organic field level supply and maintenance requisition support to a completely organic field level logistics support along with CLS national level and supply requisition support. NBCTs will replace 15 AC HBCTs. The NBCT is lighter by as much as 30%, requiring less field level maintenance due to increased use of Line Replaceable Units (LRUs). The cost of the current field level support for the HBCTs that the NBCTs will replace has a twenty-year net present value for maintenance of \$212.4B for a 20-year life cycle.



Discount Factors	Base Case (HVY BCT)
20 year Current Cost FY 10 (\$M)	<b>\$34,297</b>
Alternative Expenditure	\$829
1	\$34,297
0.973	\$12,093
0.946	\$11,758
0.919	\$11,422
0.892	\$11,087
0.865	\$10,751
0.838	\$10,415
0.811	\$10,080
0.784	\$9,744
0.757	\$9,409
0.73	\$9,073
0.703	\$8,737
0.676	\$8,402
0.649	\$8,066
0.622	\$7,731
0.595	\$7,395
0.568	\$7,060
0.541	\$6,724
0.514	\$6,388
0.487	\$6,053
0.460	\$5,717
<b>Total Net Present Value</b>	<b>\$212,402</b>

**STEP 4 – Define Alternatives with Cost Estimates.**

4a. The five supply and maintenance support options are illustrated below. Note that maintenance support at the field level requires 85% of all organic or contractor support; the remaining 15% of organic or contractor personnel support at the field level will be dedicated to supply support operations required to maintain the NBCT Variants.

## ***Logistics Alternatives***

<b><u>Alternatives</u></b>	<b><u>Maintenance</u></b>	<b><u>Supply</u></b>
Base Case	Organic	Organic
Organic	Organic	Organic
Contractor	Contractor	Contractor
Blend 1	Contractor(30%)/ Organic (55%)	Organic (15%)
Blend 2	Contractor – NBCT unique parts (42%) Organic- Common parts (43%)	Contractor – NBCT unique parts (8%) Organic- Common parts (7%)
Blend 3	Contractor (55%)/Organic (30%)	Contractor (15%)

4b. Strategic and mission goals for selecting the best COA are to minimize cost while maximizing the benefit to the Army. The COA chosen must not jeopardize or put at risk the 90% system operational availability objective for the NBCT variants over the near, far, and lifecycle timeframes from an Army enterprise perspective.

4c. The cost elements considered for evaluation of the maintenance supportability include: 1) The salary and benefits associated with the maintenance and supply support personnel; 2) Training of maintainers at the Depot, DOL Contractor and Field Support locations; 3) The cost of Component Repair; 4) The cost to build maintenance facilities and the cost to furnish the facilities with requisite repair equipment; 5) The cost to develop National Maintenance Work Requirement (NMWR) to accomplish technical manual component overhaul; 6) The cost to develop Test Package Sets to perform diagnostics on damaged equipment; 7) The transportation cost of reparable parts. The 10th year overhaul cost of NBCT variants will be evaluated for all five COAs. Also labor, materials and overhead and administrative costs will be considered in maintenance costs.

The Supply and Repair Parts Analysis includes: 1) The salary and benefits associated with the maintenance supply support personnel; 2) The cost of End Item Class VII and Class IX repair management for all major and secondary parts; 3) The cost to stock initial spare parts; 4) The cost to stock sustainment parts; 5) The cost to transport material to and from repair field facilities located at the Depot and Contractor-operated repair locations; 6) The cost of running supply operations 7) The cost to build/maintain storage locations. The cost of paying logistics supply personnel for running Receipt/Issue facilities along with Forward

Distribution Points (FDPs) collocated at each NBCT location is also considered in this analysis.

The tools used to conduct the analysis on the Supply and Maintenance Cost Elements discussed in the previous two paragraphs include five models, Regression Analysis and the use of analogy. Selected Essential-item Stock for Availability Method (SESAME), which is a multi-echelon, multi-indentured inventory model that determines the optimal range and depth of spares and repair parts to meet an optimal performance target, will be used to estimate the initial provisioning spare parts. The SESAME Life Cycle Cost (SESLCC) Model uses the SESAME initial issue stock lists, projections of depot repair pipeline requirements, unit and end item deployment schedules, and input part reliability and maintenance data to determine both discounted and non-discounted expected life cycle spares and repair part costs for an end item. This tool will be used to estimate yearly consumption (sustainment) of Class IX parts over the 20 year life cycle. Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS), which optimizes maintenance policy based on cost and availability, will be used to estimate the cost of repair and the number of maintainers required for training. Automated Cost Estimating Integrated Tools (ACEIT), which is an integrated suite of tools used for estimating lifecycle cost, will be used to combine all cost elements and to compute a 20-year life-cycle cost with inflation adjustments. Forces and Organization Cost Estimating System (FORCES), which is a suite of approved Army standard cost models used to conduct analyses ranging from Force activation, annual operating costs and movement of TO&E units, contingency deployment costing, as well as a myriad of end strength reduction and streamlining actions, will be used to determine personnel costs and net present value of the Supply and Maintenance Operation at the field level.

Regression is a statistical modeling technique used to show relationships between one or more variables denoted as the dependent variable (Total Cost of each option in this CBA) to the independent variables (The Cost Elements of each option in this CBA). Linear Regression is used to find parametric relationships that can save data collection effort, time and resources in conducting the CBA. As shown in this CBA, the fully burdened cost of Soldiers and Contractors are predictor variables of the total cost for each COA. Analogy is used to examine the costs of like-systems to estimate NBCT costs (specifically, the HBCT family of systems is considered analogous to NBCT). Analogy is used to estimate costs when system data is not available. The cost elements included in the cost analyses are shown below.

Results: All Alternatives

20-Year Costs in Millions FY10 Constant Dollars

Cost Elements (\$M)	Base Case (HVY BCT)	Organic	Contractor	Blend #1	Blend #2	Blend #3
<b>Maintenance</b>				<b>70/30</b>	<b>50/50</b>	<b>30/70</b>
Field Level Personnel	\$9,166	\$9,166	\$11,919	\$9,992	\$10,543	\$11,093
Training of Maintainers	\$12.4	\$11.8	\$0.0	\$8.3	\$5.9	\$3.5
Component Repair	\$73.0	\$65.7	\$221.3	\$74.5	\$221.3	\$74.5
Facilitization	\$52.4	\$47.2	\$11.4	\$11.4	\$11.4	\$11.4
Develop NMWR/TPS	\$72.5	\$66.8	\$57.5	\$57.5	\$57.5	\$57.5
Transportation of Rep.	PART OF SURCHARGE					
Overhaul End Item	\$782.3	\$421.7	\$536.2	\$421.7	\$536.2	\$536.2
<b>Total Maintenance</b>	<b>\$10,158.8</b>	<b>\$9,779.4</b>	<b>\$12,745.5</b>	<b>\$10,565.4</b>	<b>\$11,375.0</b>	<b>\$11,776.4</b>
<b>Supply</b>				<b>70/30</b>	<b>50/50</b>	<b>30/70</b>
Field Level Personnel	\$1,614	\$1,614	\$2,098	\$1,759	\$1,856	\$1,953
Item Management	PART OF SURCHARGE					
Initial Provisioning Spares*	\$172.8	\$139.5	\$116.2	\$120.2	\$120.2	\$139.5
Sustainment Parts*	\$22,352.0	\$14,481.7	\$14,881.3	\$14,892.7	\$14,892.7	\$14,481.7
Transportation of Mat'l.	PART OF SURCHARGE					
Supply Operations	PART OF SURCHARGE					
Facilitization	\$0.0	\$0.0	\$21.0	\$21.0	\$21.0	\$0.0
Forward Distribution Point	\$0.0	\$0.0	\$8.0	\$2.4	\$4.0	\$5.6
<b>Total Supply</b>	<b>\$24,138.4</b>	<b>\$16,234.8</b>	<b>\$17,124.7</b>	<b>\$16,795.3</b>	<b>\$16,893.8</b>	<b>\$16,579.6</b>

## Statistical Analysis

This CBA considered Simple Linear Regression (SLR), Multiple Linear Regression (MLR), Log-linear and Exponential Cost Models for best fit in this statistical analysis. The SLR Model proved to have the highest R<sup>2</sup> (.969) with the Field-Level Personnel Cost Element as the single independent variable. The results are included below. The Personnel Cost Element Parameter will be used in section 7 to compare the COAs.

PERSONNEL COST DRIVER ANALYSIS					$y=mX+b$
Alternatives*	Maintenance Personnel Costs	Supply Personnel Costs	Total Personnel Costs	Total Alternative Costs	Predictive Total Alternative Costs
Organic	\$9,166.22	\$1,613.61	\$10,779.83	\$26,014.23	\$26,140.33
Contractor	\$11,919.12	\$2,098.23	\$14,017.35	\$29,870.25	\$29,807.69
Blend #1	\$9,992.09	\$1,759.00	\$11,751.08	\$27,260.74	\$27,240.54
Blend #2	\$10,542.67	\$1,855.92	\$12,398.59	\$28,268.79	\$27,974.01
Blend #3	\$11,093.25	\$1,952.85	\$13,046.09	\$28,356.03	\$28,707.48

\* Base case is excluded from analysis

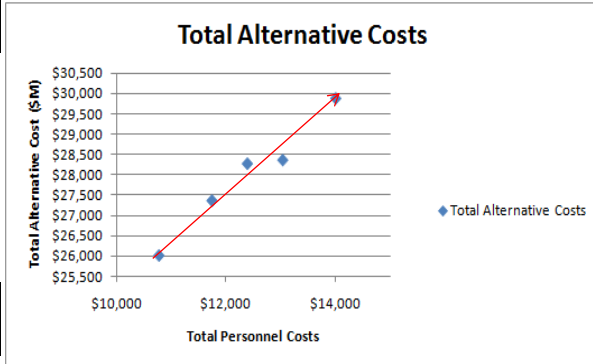
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.984676635
R Square	0.969588075
Adjusted R Square	0.959450767
Standard Error	285.5847055
Observations	5

ANOVA

	df	SS	MS	F	Significance F
Regression	1	7800716.6	7800716.6	95.6455153	0.00227177
Residual	4	244675.87	61168.9175		
Total	5	8045392.5			

	Coefficients	SE	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	13090.76836	1441.7551	9.0813414	0.002354275	9340.980137	18517.59650	9340.980137	18517.59650



**STEP 5 – Identify Quantifiable and Non-Quantifiable Benefits.**

The CBA defines quantifiable benefits as benefits that can be assigned numeric value and non-quantifiable benefits as benefits that do not lend themselves to quantitative measures. Below is a table detailing the quantifiable benefits. The quantifiable benefits for this analysis are defined as the cost savings a COA has over the most expensive COA for a particular cost element. For example, the cost element for Training of Maintainers is the most expensive for the organic option. Therefore, the other four options give you a benefit for the Training of Maintainers cost element equal to the difference in cost. By adding all of the benefit costs you derive a cumulative benefit value. Organic Supply and Maintenance Support has a non-quantifiable benefit of having resident deployable expert maintainers and supply requisition personnel on the NBCT family of systems over a pure contract option and, to a lesser degree, so does the other blended option. The Blended COAs have a non-quantifiable benefit of freeing up personnel that can be used by the Army to fill other Soldier requirements. The non-quantifiable benefits are of less significance than the quantifiable cost elements addressed in this analysis and are vetted as second and third order effects in section 7c of this analysis.

Results: All Alternatives

20-Year Benefits in Millions FY10 Constant Dollars

Benefit (\$M)	Base Case (HVY BCT)	Organic	Contractor	Blend #1	Blend #2	Blend #3
Maintenance				70/30	50/50	30/70
Field Level Personnel	\$2,753	\$2,753	\$0	\$1,927	\$1,376	\$826
Training of Maintainers	\$0.0	\$0.6	\$12.4	\$4.1	\$6.5	\$8.9
Component Repair	\$1.5	\$155.6	\$0.0	\$146.8	\$0.0	\$146.8
Facilitization	\$0.0	\$5.2	\$41.0	\$41.0	\$41.0	\$41.0
Develop NMWR/TPS	\$0.0	\$5.7	\$15.0	\$15.0	\$15.0	\$15.0
Transportation of Rep.	PART OF SURCHARGE					
Overhaul End Item	\$0.0	\$360.6	\$246.1	\$360.6	\$246.1	\$246.1
Total Maintenance	\$2,754	\$3,281	\$315	\$2,495	\$1,685	\$1,284
Supply				70/30	50/50	30/70
Field Level Personnel	\$485	\$485	\$0	\$339	\$242	\$145
Item Management	PART OF SURCHARGE					
Initial Provisioning Spares*	\$0.0	\$33.3	\$56.6	\$52.6	\$52.6	\$33.3
Sustainment Parts*	\$0.0	\$411.0	\$11.4	\$0.0	\$0.0	\$411.0
Transportation of Mat'l.	PART OF SURCHARGE					
Supply Operations	PART OF SURCHARGE					
Facilitization	\$21.0	\$21.0	\$0.0	\$0.0	\$0.0	\$21.0
Forward Distribution Point	\$8.0	\$8.0	\$0.0	\$5.6	\$4.0	\$2.4
Total Supply	\$29.0	\$473.3	\$68.0	\$58.2	\$56.6	\$467.7

### STEP 6 – Define Alternative Selection Criteria.

The quantifiable benefit to cost ratio is the selection criteria for this CBA. The COA with the highest quantifiable benefit to cost ratio will be the recommended COA. Non-quantifiable cost and benefits will be weighed in mitigation and extenuation. Only if those non-quantifiable costs and benefits prove to pose a high risk to meeting the objective of this study, will they weigh into the selection criteria for the CBA.

Net Present Value (NPV). The NPV of the Base Case and the five alternatives are shown below. The savings for each alternative derived from calculating the difference in the most expensive COA (The Base Case for this CBA) and the alternatives for each year,

Net Present Value (NPV)	Discount Factors	Base Case (HVY BCT)	Organic	Contractor	Blend #1	Blend #2	Blend #3
Yearly NBCT Build Factor	20 year Current Cost FY 10 (\$M)	\$34,297	\$26,014	\$29,862	\$27,358	\$28,265	\$28,236
0	Alternative Expenditure	\$829	\$621	\$808	\$677	\$715	\$752
1		\$34,297	\$26,014	\$29,862	\$27,358	\$28,265	\$28,236
2	0.973	\$12,093	\$1,209	\$1,573	\$1,318	\$1,391	\$1,464
4	0.946	\$11,758	\$2,352	\$3,058	\$2,563	\$2,705	\$2,846
6	0.919	\$11,422	\$3,427	\$4,456	\$3,735	\$3,941	\$4,147
8	0.892	\$11,087	\$4,435	\$5,766	\$4,834	\$5,101	\$5,367
10	0.865	\$10,751	\$5,375	\$6,990	\$5,860	\$6,183	\$6,506
12	0.838	\$10,415	\$6,249	\$8,126	\$6,812	\$7,188	\$7,563
14	0.811	\$10,080	\$7,056	\$9,175	\$7,692	\$8,115	\$8,539
15	0.784	\$9,744	\$7,308	\$9,503	\$7,967	\$8,406	\$8,845
15	0.757	\$9,409	\$7,056	\$9,176	\$7,692	\$8,116	\$8,540
15	0.73	\$9,073	\$6,805	\$8,848	\$7,418	\$7,827	\$8,235
15	0.703	\$8,737	\$6,553	\$8,521	\$7,144	\$7,537	\$7,931
15	0.676	\$8,402	\$6,301	\$8,194	\$6,869	\$7,248	\$7,626
15	0.649	\$8,066	\$6,050	\$7,867	\$6,595	\$6,958	\$7,322
15	0.622	\$7,731	\$5,798	\$7,539	\$6,320	\$6,669	\$7,017
15	0.595	\$7,395	\$5,546	\$7,212	\$6,046	\$6,379	\$6,712
15	0.568	\$7,060	\$5,295	\$6,885	\$5,772	\$6,090	\$6,408
15	0.541	\$6,724	\$5,043	\$6,558	\$5,497	\$5,800	\$6,103
15	0.514	\$6,388	\$4,791	\$6,230	\$5,223	\$5,511	\$5,799
15	0.487	\$6,053	\$4,540	\$5,903	\$4,949	\$5,221	\$5,494
15	0.460	\$5,717	\$4,288	\$5,576	\$4,674	\$4,932	\$5,189
<b>Total Net Present Value</b>		<b>\$212,402</b>	<b>\$131,492</b>	<b>\$167,018</b>	<b>\$142,339</b>	<b>\$149,581</b>	<b>\$155,888</b>

NPV:

Used when all alternatives meet the mission requirement over the same period of analysis

Value of future earnings in “today’s money”

Calculated by applying a discount rate % to future costs

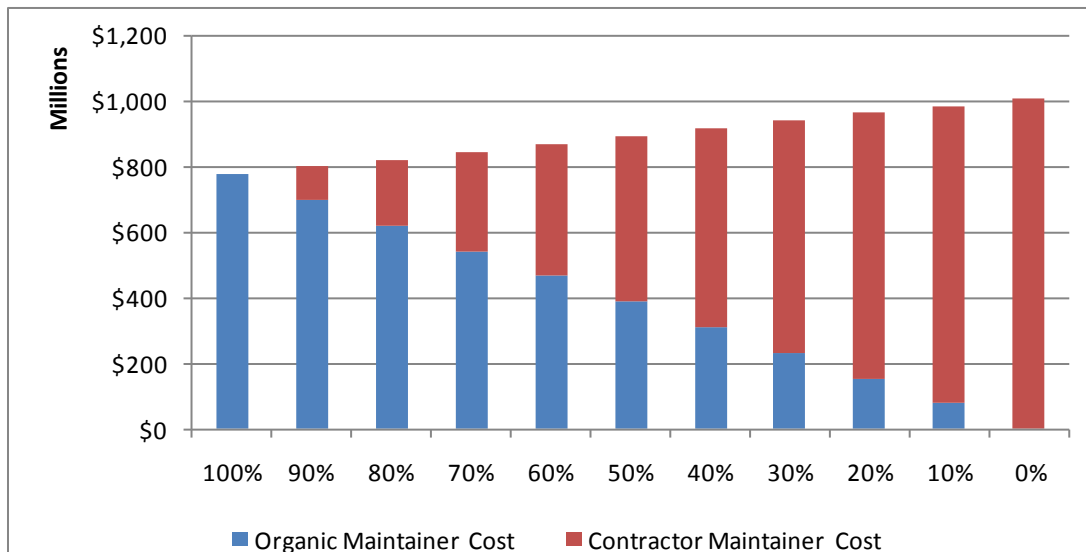
**STEP 7 – Compare Alternatives.**

7a. Benefits to Cost Comparison. The Base Case COA is to keep the current composition of Active Component Heavy Brigade Teams; its benefit to cost ratio is 8% (\$2.8B/\$34.3B). The pure organic supply and maintenance support benefit to cost ratio is 14% (\$3.8B/\$26B). The pure contractor supply and maintenance support benefit to cost ratio is 1% (\$383M/\$29.9B. The 70% organic to 30% contractor supply and maintenance support COA benefit to cost ratio is 9% (\$2.6B/\$27.4B). The 50% organic to 50% contractor supply and maintenance support COA benefit to cost ratio is 6% (\$1.8B/\$28.3B). The 30% organic to 70% contractor supply and maintenance support COA benefit to cost ratio is 7% (\$1.8B/\$28.4B). Summary of the benefit to cost ratio is listed below. [

COAs	Base Case	Organic	Contractor	Blend #1	Blend #2	Blend #3
Benefit to Cost Ratio	8%	14%	1%	9%	6%	6%

7b. Trade-offs/Billpayers. The analogous HBCT has 481 supply and maintenance support Soldiers out of a total of 3917 Soldiers constituting ~13% of the BCT. The assumption that 481 of the NBCT Soldiers or 481 like contractors will be required is the key assumptions to this CBA. The fully burden cost of an average Soldier conducting field level maintenance or supply support is ~\$107K. The research for this analysis indicates that the average fully burden cost of a contractor conducting Field level supply and maintenance support operations is ~\$140K with a cost ratio of a Soldier being 77% of the cost of a contractor. The focal [Is “focal” the right word?] trade-off for this CBA is the trade of increased Contractor Cost for less military manpower. Even taking into account Retirement and Health Benefits amortized over a 20-year military service, the cost for a Soldier is ~77% the cost of a maintenance contractor. The average work year of a military member is 1818 hours or approximately 228 days, as compared to 2200 hours or 275 days per year for the average contractor. When productivity is considered, the average hourly cost of a maintenance contractor is slightly higher at ~\$64 an hour as compared to ~\$59 for a uniformed maintenance Soldier. The ratio of military to civilian costs per year is illustrated below. The bill payer for the additional cost of the contractors, if that option is chosen, would be fewer HBCTs. The contract option and the blend options are clearly more expensive than the organic Soldier support option. If any of the contractor or blend options are selected, a bill payer in terms of fewer contractors or reduced contractor costs must be considered. The other option may be to consider buying fewer NBCTs.

Average Yearly Soldier Maintainer to Contractor Maintainer Cost (\$Ms) for 15 NBCTs

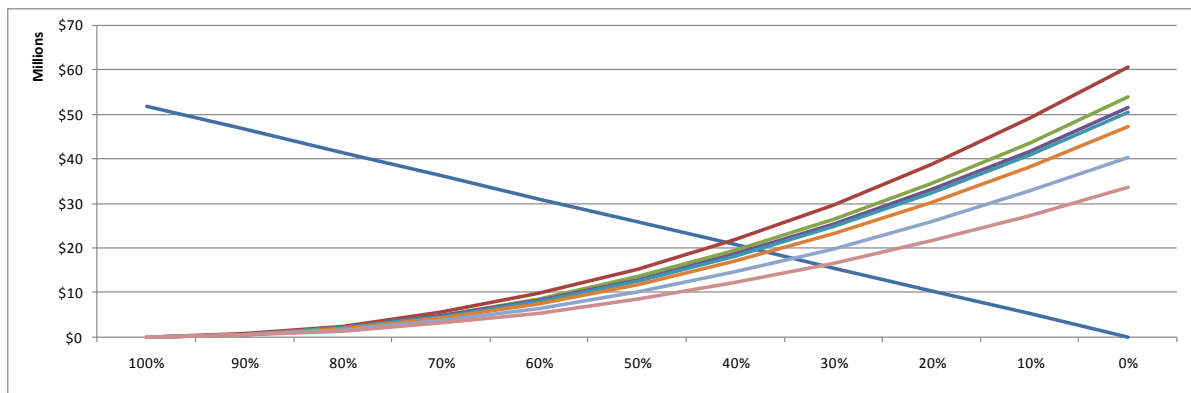


7c. Second and Third Order Effects. The Pure Contractor or Blend Option have second order effects of freeing up manpower. The savings of 7215 Soldier positions could be used to increase Combat Arms or Combat Support units, or reduce the stress on Soldiers used to fill positions in deploying units. The negative impact of filling the Field Level Support positions with contractor personnel is the consideration of deploying additional contractors to war zones as primary supply and maintenance support for the NBCT equipment. In the long run, reliance on contractor support could have a third order effect of reducing the responsibility of NBCT Soldiers for equipment maintenance. This may lead to reduced equipment readiness.

7d. Sensitivity Analysis and Risk Assessment. This CBA is highly sensitive to the difference in the cost of a Soldier compared to the cost of a contractor. The table and chart below illustrate the cost relationship for increased reliance on contractors, along with showing how much more the Army can expect to pay for contractor support each year given the percentages of contractor labor support option chosen. In blue is the breakeven point for the cost of contractor to Soldier support selected.

	Organic Maintainer Cost	% Numbers of Contract Maintainers & Their Cost								
		90%	80%	77%	75%	70%	60%	50%	0%	
100%	\$51,786,803	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	0%
90%	\$46,608,123	\$606,060	\$538,720	\$515,151	\$505,050	\$471,380	\$404,040	\$336,700	\$0	10%
80%	\$41,429,443	\$2,424,240	\$2,154,880	\$2,060,604	\$2,020,200	\$1,885,520	\$1,616,160	\$1,346,800	\$0	20%
70%	\$36,250,762	\$5,454,540	\$4,848,480	\$4,636,359	\$4,545,450	\$4,242,420	\$3,636,360	\$3,030,300	\$0	30%
60%	\$31,072,082	\$9,696,960	\$8,619,520	\$8,242,416	\$8,080,800	\$7,542,080	\$6,464,640	\$5,387,200	\$0	40%
50%	\$25,893,402	\$15,151,500	\$13,468,000	\$12,878,775	\$12,626,250	\$11,784,500	\$10,101,000	\$8,417,500	\$0	50%
40%	\$20,714,721	\$21,818,160	\$19,393,920	\$18,545,436	\$18,181,800	\$16,969,680	\$14,545,440	\$12,121,200	\$0	60%
30%	\$15,536,041	\$29,696,940	\$26,397,280	\$25,242,399	\$24,747,450	\$23,097,620	\$19,797,960	\$16,498,300	\$0	70%
20%	\$10,357,361	\$38,787,840	\$34,478,080	\$32,969,664	\$32,323,200	\$30,168,320	\$25,858,560	\$21,548,800	\$0	80%
10%	\$5,178,680	\$49,090,860	\$43,636,320	\$41,727,231	\$40,909,050	\$38,181,780	\$32,727,240	\$27,272,700	\$0	90%
0%	\$0	\$60,606,000	\$53,872,000	\$51,515,100	\$50,505,000	\$47,138,000	\$40,404,000	\$33,670,000	\$0	100%
# of Maintainers	481	433	385	368	361	337	289	241		
Total # of Maintainers for 15 BCTs	7,215	6,494	5,772	5,519	5,411	5,051	4,329	3,608		
Total Cost of Maintainers for 15 BCTs	\$776,802,047.85	\$909,090,000	\$808,080,000	\$772,726,500	\$757,575,000	\$707,070,000	\$606,060,000	\$505,050,000		





### STEP 8 – Report Results and Recommendations

Based on the benefit to cost ratio, it is recommended that the pure Soldier support option (Organic Support Option) be chosen. The results do illustrate that if contractor support could be reduced by 23% then the cost of a contractor would be equal to the cost of a Soldier. However, if any of the five COAs analyzed in this CBA (or a variation of them) are adopted, the effects discussed in section 7c and 7d of this CBA must be carefully considered.



## User Example

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## Providing the Next Brigade Combat Team (NBCT) with Supply and Maintenance Logistics Support

Prepared by:  
DASA-CE

AS OF: 1/13/2010 2:59 PM

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## Executive Summary

- **Problem:** Determine the optimal mix of supply and maintenance logistics support personnel for NBCTs.
- Cost Benefit Analysis objective is to provide a recommendation with the least cost and greatest benefit to the Army using an option which generates a target operational availability of 90%.
- Proposed alternatives include organic maintenance, fully contracted maintenance and three blends of organic and contracted maintenance.
- Costs include: salary and benefits of personnel, repair of all major and secondary parts, stocking of initial spare parts, transportation to and from field facilities, buildings and maintaining storage locations and payment of logistics supply personnel at each NBCT location.
- Benefits to consider include cost-effectiveness of hiring organic labor, freed manpower with contractor support, and effects on equipment readiness.
- Success is defined as the most cost effective alternative that does not negate its own cost benefits with non-quantifiable disadvantages.
- The **recommended COA** is a completely organic maintenance support option with no contractor support.

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## Background

<p><b>Problem Statement:</b></p> <ul style="list-style-type: none"> <li>• Determine the optimal mix of supply and maintenance logistics support personnel for NBCTs.</li> </ul>	<p><b>Objective:</b></p> <ul style="list-style-type: none"> <li>• Determine the least cost, greatest benefit alternative for the Army before committing to fully organic support</li> </ul>										
<p><b>Scope:</b></p> <ul style="list-style-type: none"> <li>• 20 year life cycle</li> <li>• Include full contractor support</li> <li>• NBCT-unique class IX at field level</li> <li>• National &amp; Field level for class IX parts of following NBCT variants:</li> </ul> <table border="0"> <tr> <td>Infantry Carrier Vehicle</td> <td>Command &amp; Control Vehicle</td> </tr> <tr> <td>Fire Support Vehicle</td> <td>Recovery Maintenance Vehicle</td> </tr> <tr> <td>Reconnaissance Scout Vehicle</td> <td>Mounted Combat Vehicle</td> </tr> <tr> <td>Engineer Squad Vehicle</td> <td>CBRNE Scout Vehicle</td> </tr> <tr> <td>Mortar Carrier</td> <td>Medical Evacuation Vehicle</td> </tr> </table>	Infantry Carrier Vehicle	Command & Control Vehicle	Fire Support Vehicle	Recovery Maintenance Vehicle	Reconnaissance Scout Vehicle	Mounted Combat Vehicle	Engineer Squad Vehicle	CBRNE Scout Vehicle	Mortar Carrier	Medical Evacuation Vehicle	<p><b>Assumptions and Constraints:</b></p> <ul style="list-style-type: none"> <li>• 1:1 ratio of required contractors versus soldiers</li> <li>• Only cost NBCT-unique parts</li> <li>• Dir. of Material at each location</li> <li>• Organic maintenance options will not change current process used</li> <li>• Organic requires no new facilities</li> <li>• Organic will require purchase and stocking of spares</li> <li>• Contractor support includes vehicle overhaul and will require in-house repair capability development</li> </ul>
Infantry Carrier Vehicle	Command & Control Vehicle										
Fire Support Vehicle	Recovery Maintenance Vehicle										
Reconnaissance Scout Vehicle	Mounted Combat Vehicle										
Engineer Squad Vehicle	CBRNE Scout Vehicle										
Mortar Carrier	Medical Evacuation Vehicle										

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## Courses of Action

### COA 1: 100% Organic

- All Maintenance and Supply support is organic.

### COA 2: 100% Contractor

- All Maintenance and Supply support is contractor.

### COA 3: 70% Organic/30% Contractor (Blend 1)

- In this option maintenance is 55% Organic and 30% contractor, and all supply (15%) is organic.

### COA 4: 50% Organic/50% Contractor (Blend 2)

- In this option, maintenance is 43% organic (common parts) and 42% contractor (unique parts) and supply is similarly divided as 7% organic and 8% contractor.

### COA 5: 30% Organic/70% Contractor (Blend 3)

- In the option, maintenance is 30% organic and 55% contractor and supply is all contractor (15%).

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## COA 1: 100% Organic

<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Most cost effective</li> <li>• Benefit to cost ratio is 14% (status quo is 8%)</li> <li>• Soldier costs 77% of cost of contractor</li> </ul>	<p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Less military manpower available</li> <li>• Highly sensitive to cost of soldier vs. contractor</li> <li>• Increased stress on other Army units</li> </ul>
<p><b>Costs:</b></p> <ul style="list-style-type: none"> <li>• \$9,779 in Maintenance</li> <li>• \$16,235 in Supply</li> </ul>	<p><b>Benefits:</b></p> <ul style="list-style-type: none"> <li>• \$3,281 in maintenance (20 yr)</li> <li>• \$473 in supply (20 yr)</li> <li>• Cost/benefit ratio of 14%</li> </ul>

(\$FY10 Millions)

Criteria:

Be sure to let your readers know what \$ increments you are working with

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# COA 1: Cost Analysis and Budgetary Impact

(\$TY Millions)

Cost Analysis	FY10	FY11	FY12-FY17	FY18-FY29
Field Level Personnel	\$104	\$204	\$2,992	\$7,377
Component Repair	\$2	\$2	\$14	\$35
Sustainment Parts	\$518	\$526	\$14	\$35
<b>Total</b>	<b>\$624</b>	<b>\$732</b>	<b>\$3,021</b>	<b>\$7,446</b>

Notes:

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## COA 2: 100% Contractor

<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Maximum manpower availability for army troops</li> </ul>	<p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Most expensive alternative</li> <li>• Deployment of contractors may cause stress to troops</li> </ul>
<p><b>Costs:</b></p> <ul style="list-style-type: none"> <li>• \$12,746 for maintenance</li> <li>• \$17,125 for supply</li> <li>• \$21 facilitization cost</li> <li>• \$8 Forward Distribution Point</li> </ul>	<p><b>Benefits:</b></p> <ul style="list-style-type: none"> <li>• \$315 in maintenance (20 yr)</li> <li>• \$68 in supply (20 yr)</li> <li>• Cost/benefit ratio of 1%</li> </ul>

(\$FY10 Millions)

**Criteria:**

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## COA 2: Cost Analysis and Budgetary Impact

(\$TY Millions)

Cost Analysis	FY10	FY11	FY12-FY17	FY18-FY29
Field Level Personnel	\$135	\$266	\$3,891	\$9,592
Component Repair	\$7	\$7	\$48	\$118
Sustainment Parts	\$533	\$540	\$3,574	\$6,876
<b>Total</b>	<b>\$674</b>	<b>\$813</b>	<b>\$7,512</b>	<b>\$16,585</b>

Notes:

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## COA 3: Blend 1 (70% Org/30% Contract)

<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Most cost effective blending option</li> <li>• Frees some military manpower</li> </ul>	<p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• May require increased deployment of contractors</li> </ul>
<p><b>Costs:</b></p> <ul style="list-style-type: none"> <li>• \$10,565 in Maintenance</li> <li>• \$16,795 in Supply</li> <li>• \$21 facilitization cost</li> <li>• \$2.4 Forward Distribution Point</li> </ul>	<p><b>Benefits:</b></p> <ul style="list-style-type: none"> <li>• \$361 in maintenance (20 yr)</li> <li>• \$58 in supply (20 yr)</li> <li>• Cost/benefit ratio of 9%</li> </ul>

(\$FY10 Millions)

Criteria:

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## COA 3: Cost Analysis and Budgetary Impact

(\$TY Millions)

Cost Analysis	FY10	FY11	FY12-FY17	FY18-FY29
Field Level Personnel	\$113	\$223	\$3,262	\$8,041
Component Repair	\$2	\$2	\$16	\$40
Sustainment Parts	\$533	\$541	\$3,576	\$6,881
<b>Total</b>	<b>\$648</b>	<b>\$766</b>	<b>\$6,854</b>	<b>\$14,962</b>

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## COA 4: Blend 2 (50/50)

<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Straightforward delegation of organic and contractor duties</li> <li>• Frees fair amount of military manpower</li> </ul>	<p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Requires more deployment of contractors than Blend 1</li> </ul>
<p><b>Costs:</b></p> <ul style="list-style-type: none"> <li>• \$11,375 in Maintenance</li> <li>• \$16,894 in Supply</li> <li>• \$21 Facilitization cost</li> <li>• \$4 Forward Distribution Point</li> </ul>	<p><b>Benefits:</b></p> <ul style="list-style-type: none"> <li>• \$1,685 in maintenance (20 yr)</li> <li>• \$57 in supply (20 yr)</li> <li>• Cost/benefit ratio of 6%</li> </ul>

(\$FY10 Millions)

**Criteria:**

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## COA 4: Cost Analysis and Budgetary Impact

(\$TY Millions)

Cost Analysis	FY10	FY11	FY12-FY17	FY18-FY29
Field Level Personnel	\$119	\$235	\$3,442	\$8,484
Component Repair	\$7	\$7	\$48	\$118
Sustainment Parts	\$533	\$541	\$3,576	\$6,881
<b>Total</b>	<b>\$659</b>	<b>\$783</b>	<b>\$7,066</b>	<b>\$15,483</b>

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## COA 5: Blend 3 (30% Org/70% Contract)

<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Frees up most military manpower without moving to 100% contractor</li> <li>• Gets most use of \$21 facilitization cost of all blends</li> </ul>	<p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Most expensive blend</li> <li>• Requires more deployment of contractors than other blends</li> </ul>
<p><b>Costs:</b></p> <ul style="list-style-type: none"> <li>• \$11,776 in Maintenance</li> <li>• \$16,580 in Supply</li> <li>• \$21 facilitization cost</li> <li>• \$5.6 Forward Distribution Point</li> </ul>	<p><b>Benefits:</b></p> <ul style="list-style-type: none"> <li>• \$1,284 in maintenance (20 yr)</li> <li>• \$468 in supply (20 yr)</li> <li>• Cost/benefit ratio of 7%</li> </ul>

(\$FY10 Millions)

**Criteria:**

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## COA 5: Cost Analysis and Budgetary Impact

(\$TY Millions)

Cost Analysis	FY10	FY11	FY12-FY17	FY18-FY29
Field Level Personnel	\$125	\$247	\$3,621	\$8,927
Component Repair	\$2	\$2	\$16	\$40
Sustainment Parts	\$518	\$526	\$3,478	\$6,691
<b>Total</b>	<b>\$646</b>	<b>\$775</b>	<b>\$7,115</b>	<b>\$15,658</b>

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## Cost & Benefits

(\$FY10 Millions)

	100% Organic	100% Contractor	Blend 1	Blend 2	Blend 3
<b>Net Costs</b>	\$16,235	\$17,125	\$16,795	\$16,894	\$16,580
<b>Benefits (quantifiable and non-quantifiable)</b>	\$3,754	\$383	\$2,553	\$1,742	\$1,751
<b>Trade-off and Billpayers</b>		Fewer HBCTs to compensate for increased cost of contractor versus soldier Or Fewer NBCTs	Fewer HBCTs to compensate for increased cost of contractor versus soldier Or Fewer NBCTs	Fewer HBCTs to compensate for increased cost of contractor versus soldier Or Fewer NBCTs	Fewer HBCTs to compensate for increased cost of contractor versus soldier Or Fewer NBCTs
<b>Second and Third Order Effects</b>	Military manpower is diverted to maintenance, which may increase stress on deploying units	Negative impact when filling positions with contractors and deploying contractors  Reliance on contractors may reduce NBCT soldier responsibility for equipment maintenance	Negative impact when filling positions with contractors and deploying contractors  Reliance on contractors may reduce NBCT soldier responsibility for equipment maintenance	Negative impact when filling positions with contractors and deploying contractors  Reliance on contractors may reduce NBCT soldier responsibility for equipment maintenance	Negative impact when filling positions with contractors and deploying contractors  Reliance on contractors may reduce NBCT soldier responsibility for equipment maintenance

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To weight each criteria (if using), choose your weights for each category and then multiply each ranking using the following formula:

$$\text{Score} = \text{rank} * \frac{\text{Category Weight}}{\text{Weight Totals}}$$

Thus in the first scoring cell under Total LC Cost, the equation is "5\*(3/1)"

# Detailed Decision Matrix

(\$FY10 Millions)

Criteria	Weight	COA 1-100% Organic			COA 2-100% Contractor			COA3-Blend 1			COA 4-Blend 2			COA 5-Blend 3		
		Data	Rank	Score	Data	Rank	Score	Data	Rank	Score	Data	Rank	Score	Data	Rank	Score
Total LC Cost	0.3	\$26,014	5	1.5	\$29,870	1	0.3	\$27,361	4	1.2	\$28,269	3	0.9	\$28,356	2	0.6
Net Present Value	0.2	\$131,492	5	1	\$167,018	1	0.2	\$142,339	4	0.8	\$149,581	3	0.6	\$155,888	2	0.4
Training Requirements	0.1	Poor	1	0.1	Excellent	5	0.5	Very Good	4	0.4	Good	3	0.3	Average	2	0.2
Freed Military Manpower	0.1	Poor	1	0.1	Excellent	5	0.5	Average	2	0.2	Good	3	0.3	Good	3	0.3
Benefits to Cost Ratio	0.3	14%	5	1.5	1%	1	0.3	9%	2	0.6	6%	4	1.2	7%	3	0.9
	1.00			4.2			1.8			3.2			3.3			2.4

Highlight the highest score, which should be the recommended option

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To weight each criteria (if using), choose your weights for each category and then multiply each ranking using the following formula:

$$\text{Score} = \text{rank} * \frac{\text{Category Weight}}{\text{Weight Totals}}$$

Thus in the first scoring cell under Total LC Cost, the equation is "5\*(3/1)"

# Summary Decision Matrix

(\$FY10 Millions)

The Summary DECMAT slide does not include the data columns and is designed for a senior decision maker.

Criteria	Weight	COA 1-100% Organic		COA 2-100% Contractor		COA3-Blend 1		COA 4-Blend 2		COA 5-Blend 3	
		Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
Total LC Cost	0.3	5	1.5	1	0.3	4	1.2	3	0.9	2	0.6
Net Present Value	0.2	5	1	1	0.2	4	0.8	3	0.6	2	0.4
Training Requirements	0.1	1	0.1	5	0.5	4	0.4	3	0.3	2	0.2
Freed Military Manpower	0.1	1	0.1	5	0.5	2	0.2	3	0.3	3	0.3
Benefits to Cost Ratio	0.3	5	1.5	1	0.3	2	0.6	4	1.2	3	0.9
	1.00		4.2		1.8		3.2		3.3		2.4

Highlight the highest score, which should be the recommended option

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## Recommendation

•**Recommendation:** Based on the cost-savings and benefits acquired, recommend that the NBCT move to an all organic supply and maintenance logistics support system.

•**Justification:**

- Over a 20 year life cycle, this alternative is expected to cost at least \$3M less than any other option.
- An all organic system would eliminate any potential issues with deploying contractors and hiring contractors to fill potentially military positions
- Moving to an all organic system prevents reliance on contractor support and thus encourages the soldier's personal responsibility to maintain equipment
- No new facilities will need to be built nor do in-house repair capabilities need to be developed

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## Backup

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# Sensitivity Analysis and Risk Assessment

Sensitivity Analysis and Risk Assessment	COA 1	COA 2	COA 3
Sensitivity			
Risk			

*Example*

## Appendix F

### Template User Instructions.

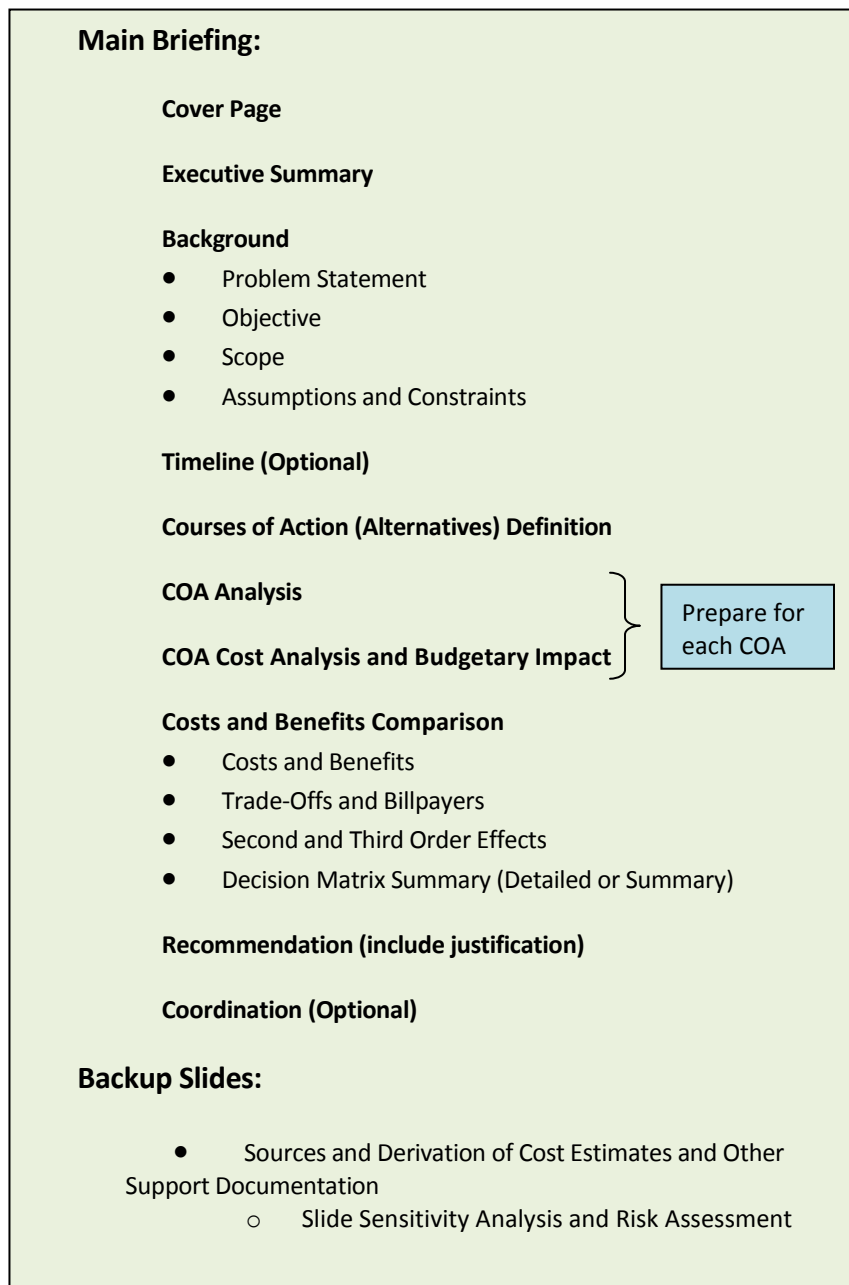
This template is designed for use with the Army Cost Benefit Analysis (CBA) Guide. It is intended to be used as a tool for documenting cost benefit analyses, as well as to present the results and recommendations to senior leadership. The template is in the form of a decision briefing that will lead the decision maker through a logical sequence of how a course of action was identified. It is comprised of both a “main” section, which would be used as the basic briefing, and a “backup” section which would contain additional supporting information. This is the standard briefing presentation structure used within the Army . The briefing is in essence a marketing tool that can be used to “sell” a decision maker on a particular alternative. It will address four essential questions:

- What does the organization want to do?
- How much will it cost?
- What does the organization expect to gain from their investment (Benefits)?
- How will the organization pay for their investment (Billpayers)?

It is understood that the content of CBAs will vary because the proposals or initiatives they support are not the same. The content and layout of a CBA briefing will be influenced by the data and methodology used in building the CBA. Moreover, the user’s leadership may direct the type and format of specific data to be presented, which may differ from the template. Therefore, users are encouraged to customize the template to fit the unique requirements of their CBA and/or the decision maker. This is an acceptable practice.

One of the major goals of the template is to design a presentation that ideally would be no longer than 12 to 16 slides (not including backup and optional slides). Users should give careful consideration to what material will be included in the main part of the briefing and what material is placed in the backup section. There is a general practice by action officers and analysts of reducing the information that is presented to such an extent that a significant amount of valuable analysis is never seen by the decision maker. When this occurs, briefings usually contain noticeable gaps in logic and flow. That is, the recommended course of action, as it appears in the main part of the briefing, lacks the analysis necessary to support it. This template is designed to remedy this shortcoming by ensuring that critical, “must-have”, analysis essential to arriving at a recommended course of action is presented to the decision maker.

The main briefing should present the various alternatives considered, a summary of the supporting analysis for each alternative, the costs and benefits of each alternative, and the recommended course of action. Information which should be placed in the backup slides may include more information about the methodology used (e.g. sensitivity analysis and risk analysis) and supporting analytical data. A general briefing structure (as reflected in Step 8, “Report Results and Recommendations”, of the CBA Guide) has been provided on the following page.





Users may adopt the template exactly as it appears or may build their own briefing based upon the template. Formatting of elements used within the slides (e.g. fonts, graphics, and clip art) is up to the user, and may be dictated by the data being presented. Further, users are encouraged to include explanatory footnotes that help readers understand the information displayed. The only requirement is that the briefing should be organized similar to the template structure shown above. For example, don't place the decision matrix slide before the Course of Action slide. Don't leave out major sections, such as eliminating the Problem Statement or Assumptions and going right into a discussion of the COAs immediately after the cover page. Again, the CBA should present the results of the analysis in an organized and logical manner.

Please note: For CBAs that will be presented to Army senior leadership (e.g. HQDA level forums like the 3-Star Budget Requirements Process (BRP)) and 3-Star GOSCs, and Army Synchronization Meetings), the following core slides must be presented while all others may go in Backup:

- Cover Page
- Executive Summary
- Background
- Courses of Action
- Cost and Benefits Comparison
- Summary Decision Matrix

If there is a need to expand beyond one slide, then do so. Users are not restricted as to how many slides they may use per each step of the CBA process. For example, Slide 3, the Background slide, includes four distinct quadrants (Problem Statement, Objective, Scope, Assumptions and Constraints) on one quad slide. If there are more assumptions than can fit in the Assumptions quadrant, then place them on a new slide. The analyst should consider the overall length of the main part of the briefing and control the slide growth where possible. The backup section of the briefing can be as long / comprehensive as necessary.

### **Cover Page:**

### **Executive Summary:**

Assume that this may be the only slide seen by the decision maker. The following information should be included:

- Explain the problem, including (briefly):
  - Purpose
  - Relevance/importance to the mission of the agency

- Goals
- Proposed actions
- Cost/benefits
- Success criteria
- Explain the recommended course of action (COA)

**Background:**

This slide will take the form of a quad slide. If more space is required, this slide can be broken up into multiple slides. The following quadrants should be filled accordingly:

- Quad 1 - Problem Statement: Describe the problem which the CBA addresses
- Quad 2 - Scope: Time, locations, technology and organizational dimensions in the CBA
- Quad 3 - Objective: What is the purpose of the CBA? What is the final end state?
- Quad 4 - Assumptions and Constraints: What major assumptions are being made? Are there any limitations on the decision maker?

**Courses of Action (Alternatives) Definition**

List all courses of action (alternatives) and provide a narrative for each which reflects the problem and objectives of the COA, , in order to verify that the COA is consistent with the problem statement.

**The following two slides should be prepared for each COA.**

**COA # Analysis**

This quad + 2 slide should consist of the following quadrants:

- Quad 1 – Advantages (usually non-quantifiable)
- Quad 2 – Disadvantages
- Quad 3 – Costs (include a timeframe and summary cost data)
- Quad 4 – Benefits (usually quantifiable)

Two other boxes are provided for any specific criteria used to support the COA (which will be included in the Decision Matrix slide like NPV values) as well as a box for notes/additional information concerning the COA.



## **COA # Cost Analysis and Budgetary Impact**

The purpose of this slide is to convert/translate costs into a format that a resource manager/budget analyst will understand. This slide connects/links the cost benefit analysis to resourcing/budgeting requirements. **Successfully completing this slide may require the assistance of a resource manager/budget analyst.** Include a cost estimate by all relevant cost elements (US Army Cost Benefit Analysis Guide, pg. 8). over the entire life cycle. Create a slide which displays costs for the *major/significant* cost elements in the CBA, creating one slide for each COA. Include any relevant notes, if needed. This is best done in an Excel workbook (copy and paste final table into the slide). Finally, this slide should include information related to evaluation/alternative selection criteria such as NPV or breakeven points. See Step 6 of the CBA Guide for more information. Finally, don't forget to update the columns headings with the correct years applicable to the CBA.

## **Costs and Benefits Comparison**

This slide provides a summary comparison of the costs, benefits, UFRs, Billpayers, and 2<sup>nd</sup> and 3<sup>rd</sup> order effects (identified on preceding slides) of all COAs together in a single slide. Please consider including the time period (usually years) that the data used in this slide is associated with. Unfunded requirements (UFRs) are of immediate concern to resource managers for current year (CY) of execution and the budget year (BY) events (e.g. 2010 is the CY and 2011 is the BY). Refer to Step 7 of the CBA Guide for further guidance. The recommended format is to use a table to compare COAs. What we incorporate in the template is a suggested format. Users have the option to design one that better meets the needs of their CBA.

## **Decision Matrix**

The decision matrix slide is the most important slide in the template. It compares each COA using the evaluation criteria as discussed in Step 6 of the CBA Guide beginning on page 32. The purpose is to concisely make the argument for one alternative over all the others under consideration. A simple example is displayed on page XX of the guide. Users are encouraged to build decision matrices that are tailored to the requirements of the CBA. That is, users may want to design more sophisticated matrices (for example, the matrix may include weights for the criteria). The decision matrix may include such criteria as total cost, NPV, and break-even information. It is important that the criteria used should be customized/tailored to the CBA. For example, if an organization wishes to buy a new passenger vehicle for their fleet, some of the criteria that would go into the evaluation of the alternatives could include size, mpg, number of seats and etc. There are two versions of the decision matrix to choose from—a detailed one and a summary one. The detailed decision matrix is recommended for briefings below the general officer level while the summary is geared toward senior decision makers. When in doubt always use the detailed version.

## **Recommendation**

Provide a summary of the recommended COA and include a ranking of the non-recommended COA alternatives. Then, provide any justifications used when choosing the recommendation.

## **Optional Slides**

Users may include two optional slides if they perceive a need: **Timeline** and **Coordination**.

- The **Timeline** slide should follow the Background slide, and should communicate any time sensitive actions, events, schedules that may have a bearing on the CBA and its outcome. It provides more context and background information to provide readers with a deeper understanding on the importance of the CBA. The Timeline slide is a user defined and structured slide.
- The purpose of the **Coordination** slide is to update readers as to who has reviewed the CBA prior to it going before a decision maker. Often, the CBA will be reviewed (staffed) by other entities or organizations prior to being presented to a decision maker for approval. This slide may be placed at the end of the main brief to be available for a decision maker as needed.


## **Backup Slides**

Users should prepare the backup section of the briefing with as much care as is used for the main part of the briefing. Like the main section, the backup section needs to be well organized. The content of the main part of the briefing is in large measure derived from the supporting information that should be placed in the backup section.

- **Slide Sensitivity Analysis and Risk Assessment**

This is a backup slide unless a decision maker requests it be in the main part of the briefing. The format of this slide is user defined.

## The Briefing Template

 <p>Briefing Format V1.ppt</p>	<p>To open the template, double click. You may also right click on the icon. Move the arrow pointer over “Presentation Object”. A drop down menu will appear. Click on “Edit”. The file will open in PowerPoint ready to be modified. The briefing template may also be found here:</p> <p><a href="http://asafm.army.mil/offices/LinksDocsOffice.aspx?OfficeCode=1400">http://asafm.army.mil/offices/LinksDocsOffice.aspx?OfficeCode=1400</a></p>
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## Quick Review

- Layout the CAB in an organized and logical structure using the suggested slides.
- Include/insert additional slides if they are necessary to support the CBA.
- Using notes to better explain the contents of a slide(s) is acceptable.
- While the briefing template has been designed to be as flexible as possible – able to be used for a wide variety of CBA topics, it should be tailored to the particular needs of the CBA for which it is being adapted for. However, it should follow the 8-Step CBA methodology (and the briefing outline described in this Appendix). Leaving out steps may weaken the case for the recommended alternative/COA.
- The Detail DECMAT is the recommended slide for most briefings below senior level decision makers. While the Summary DECMAT was designed for briefings for general officer and above.
- **Analysts responsible for preparing a CBA and the briefing template are strongly urged to seek assistance from their resource manager/budget analyst especially for those slides that require budgetary data.**