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**Department of the Navy**

# **Economic Analysis Guide**

**Analysis informing Department of the Navy resource allocation decisions.**



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## Preface

This Economic Analysis Guide outlines best practices for decision-supporting economic analysis to help inform Navy/Marine Corps resource allocation decisions, and expands on guidance found in DoDI 7041.3, *Economic Analysis for Decisionmaking*, and OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*.

Economic Analysis (EA) is an umbrella term for any type of analysis examining the costs, benefits and uncertainties of alternative ways of achieving a given objective or fulfilling a need, and in this way is the same as Cost-Benefit Analysis (CBA) and Business Case Analysis (BCA). In a fiscally constrained environment characterized by a constant and continuous pressure to reduce costs, maintaining U.S. Navy and U.S. Marine Corps capabilities and force structure requires us to find and pursue those methods and processes that provide equal or greater capability at a reduced cost. EA provides us the tools to do that.

This guide differs from our previously-published Cost Estimating Guide (CEG) in that it focuses not just on the estimating of costs, but on a framework and method of comparing competing alternative ways of achieving a given objective, with an eye towards minimizing costs and maximizing benefits. The guide is intended to be practical and useful. Two companion documents accompany this guide, the Economic Analysis Quick-Start Guide to provide pragmatic, step-by-step instructions on how to begin and perform the analysis, and the DoN Economic Analysis Template to show what a basic EA looks like, in a useful format an analyst can use and build from.

Recognizing that several and varied organizations and commands within the Department of the Navy have already developed some sort of guidance on economic, business case or cost-benefit analysis, the guide also provides a brief survey of practices and published guidance for various specific EA types. As the lead organization for Navy-Marine Corps economic analysis guidance and best practices, the Naval Center for Cost Analysis (NCCA) recognizes how EA practice has evolved for specialized functional areas over time to meet specific needs. NCCA's goal is to assist, augment and facilitate the performance of EA in these and all organizations across the entire Navy/Marine Corps enterprise.

The ultimate goal of this guide is to help ensure warfighter needs are adequately resourced within a fiscally constrained environment. I hope you find this guide useful in advancing that goal.



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For assistance with an EA or for questions on this guidance, please send an email to:  
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# 1. Introduction/Purpose of this Guide

The purpose of this guide is to help analysts perform a type of decision-supporting analysis called Economic Analysis. Economic analysis (EA) is an umbrella term for any type of analysis examining the costs, benefits and uncertainties of alternative ways of achieving a given objective or fulfilling a need. An EA is a systematic approach to choosing the best method of allocating scarce resources to achieve a given objective. This analytical approach does not replace the judgment of the decision maker, but rather aids and informs the decision.

Other terms used for this type of analysis include Cost-Benefit Analysis (CBA) and Business Case Analysis (BCA). BCA, a term used with increasing frequency, is a generic analytical term taken from the private sector and used to describe many different types of analytical exercises. In accordance with Office of Management and Budget (OMB)<sup>1</sup> and Department of Defense (DoD)<sup>2</sup> direction, the analytical framework of a BCA is similar to an EA and is governed by this guide. This guide uses the single term “Economic Analysis” as an umbrella term that includes EA, CBA and BCA.

This guide outlines best practices for economic analysis and describes EA requirements as directed in [DoDI 7041.3](#), *Economic Analysis for Decisionmaking*, [OMB Circular A-94](#), *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, and several Navy publications.

If OMB, OSD, or specific Congressional legislation provides guidance on a particular EA format, then such guidance takes precedence over the guidance in this manual.

Any EA submitted to NCCA for review and approval must adhere to the guidance in this guide. In no case may a preliminary or tailored EA be substituted for a full EA when a full EA is required by OMB, OSD or specific Congressional legislation.

**NOTE:** Review the requirements in the SECDEF Memo *Department of Defense (DoD) Efficiency Initiatives*, 16 Aug 2010. Economic Analyses produced for consumption external to the Department of Defense may require, on the front page of the analysis, an estimate of the cost to produce it. The Office of the Secretary of Defense Cost Assessment and Program Evaluation (OSD CAPE) office has a website containing tools and guidance to help determine if an estimate is required and how to perform these estimates at <https://www.cape.osd.mil/costguidance/>.

**What this guide does and does not cover:** This guide deals with supporting decisions with *analysis*. While the estimating of costs for different alternatives is a significant part of an AoA,

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<sup>1</sup> OMB Circular A-94, 29 Oct 1992, paragraph 4a

<sup>2</sup> DoDI 7041.3, 18 Oct 1972, paragraphs 2.2 and 2.4.3

EA or BCA, the focus here is not on cost *estimating*. It is important to make a distinction between estimating and analysis. Cost estimates support analysis by aiding in the examination of costs, benefits and uncertainty of alternative ways of achieving a given objective.

## 2. Stakeholder Roles and Responsibilities

**The Naval Center for Cost Analysis (NCCA)** is the lead organization for Navy-Marine Corps economic analysis guidance and best practices. This office:

- Provides Navy/Marine Corps-wide guidance on EA policy and procedures,
- Coordinates and supports any EAs to be forwarded to ASN FM&C, or as requested by US Fleet Forces Command, SECNAV or OPNAV staff, ASN (RDA), USD AT&L, OSD CAPE,
- Maintains updated inflation and discount rate information for use in EAs, and
- Is available for support and assistance to offices performing EAs.

**Secretariat and OPNAV offices.** Offices serving as program resource sponsors:

- Decide if an EA is required or advisable before approving any proposal, and
- Issue special guidance, coordinated with NCCA, for EAs in their functional area.

**Other U.S. Navy and U.S. Marine Corps offices.** Follow EA guidance and best practices of their commands, and decide whether to seek support and assistance from NCCA.

When one organization is performing an EA for a client organization seeking such assistance, there are appropriate responsibilities pertaining to each party. Appendix 5 is a Matrix of Responsibilities outlining those respective responsibilities in normal situations.

### 3. Economic Analysis Types and Requirements

**Preliminary and “Tailored” EAs.** A preliminary or tailored economic analysis is a concise tool for making a recommendation to a decision maker without going through the effort of a full EA.

- **Preliminary EAs** are internal planning tools for any level of leadership. The goal is to bring the benefits of economic analysis to decision making early on in the process without being unnecessarily burdened by the more demanding requirements of a full EA. The intent of this paragraph is to allow less rigorous rough-order-of-magnitude (ROM) estimates and analysis for preliminary analyses while maintaining a structured analytical approach. If a Preliminary EA results in a decision to proceed with a specific alternative, the preliminary analysis should be followed up by a full EA.
- **Tailored EAs** are for those occasions when a quick, less burdensome analysis meets the needs of a decision-maker for relatively small decisions without need for a follow-up analysis. The scope and level of effort in performing an EA may be adjusted to meet varying needs of Navy-Marine Corps decision-makers. When deciding on the depth of an EA, preparers should keep in mind the decision-making audience, the timeframe for the decision and the implications of the proposed decision.

Caution: Though preliminary EAs are highly valuable decision tools it is critical that the analysis identify all of the possible impacts of the decision. Though it is not necessary to quantify all of the impacts, the analyst needs to ensure that ALL impacts are identified. Projects most frequently fail because of unintended or unknown secondary consequences that are financially or organizationally unacceptable.

**Full EAs** comply with all instructions in this guide, and include all the normal elements of an EA.

The tables on the following pages show all the requirements for Economic Analysis, the source of the requirement, who prepares the analysis, and who the decision authority is.

## Acquisition-Driven Economic Analyses

Program/System Type	Analysis Type	Statutory Requirement	Regulatory Requirement	When Required	Prepared by	Decision Authority
Major Automated Information System (MAIS) ACAT IAM, IAC	EA	<a href="#">NDAA 2001 PL 106-398 Sec. 811</a> ; <a href="#">Clinger Cohen Act (Title 40 USC)</a>	<a href="#">DoDD 5000.01</a> <a href="#">DoDI 5000.02</a> <a href="#">DoDI 7041.3</a> <a href="#">SECNAVINST 5000.2E</a> <a href="#">OMB Circular A-94 Appendix B</a>	<ul style="list-style-type: none"> <li>MS A (can be combined with the AoA)</li> <li>MS B (or equivalent)</li> <li>MS C (if Program Initiation or if equivalent to Full Deployment DR )</li> <li>Full Deployment DR (or equivalent)</li> <li>Clinger-Cohen Compliance</li> </ul>	Program Office (in consultation with SYSCOM Cost Director)	<b>ACAT IAM:</b> USD(AT&L) or designee <b>ACAT IAC:</b> Head of the DoD Component or, if delegated, the CAE (not further delegable)
Major Defense Acquisition Program (MDAP) also a MAIS	EA	<a href="#">NDAA 2001 PL 106-398 Sec. 811</a> ; <a href="#">Clinger Cohen Act (Title 40 USC)</a>	<a href="#">DoDD 5000.01</a> <a href="#">DoDI 5000.02</a> <a href="#">DoDI 7041.3</a> <a href="#">SECNAVINST 5000.2E</a> <a href="#">OMB Circular A-94 Appendix B</a>	<ul style="list-style-type: none"> <li>MS A (can be combined with the AoA)</li> <li>MS B (or equivalent)</li> <li>MS C (if Program Initiation or if equivalent to Full Deployment DR )</li> <li>Full Deployment DR (or equivalent)</li> <li>Clinger-Cohen Compliance</li> </ul>	Program Office (in consultation with SYSCOM Cost Director)	USD(AT&L) unless delegated to a DoD Component
MDAP ACAT ID and ACAT IC Critical Change	EA	<a href="#">Nunn-McCurdy Act Title 10 USC Sec. 2433</a>	<a href="#">DoDD 5000.01</a> <a href="#">DoDI 5000.02</a> <a href="#">SECNAVINST 5000.2E</a>	Critical breach has occurred : PAUC or PUC has $\geq$ 25% increase over current APB estimate or $\geq$ 50% increase over original APB estimate	PM with support of USD(AT&L) staff	USD(AT&L) via ASN(RD&A)
MAIS Critical Change	EA	<a href="#">Title 10 USC Chapter 144 A Sec. 2445c</a>	<a href="#">DoDD 5000.01</a> <a href="#">DoDI 5000.02</a> <a href="#">SECNAVINST 5000.2E</a>	When a senior official (CAE, USD(AT&L), or ASD(NII)/DoD CIO) has formally determined a critical program change has occurred, but not later than 60 days after a MAIS quarterly report indicating a critical program change.	PM	CAE (after coordination with ASD(NII)/DoD CIO or USD(AT&L) when MAIS is above MDAP threshold)
Defense Business System (DBS) Business Capability Lifecycle (BCL) Applicable to MDAP, MAIS, and Below MAIS Programs; includes modernization	BCA		<a href="#">DTM 11-009: Acquisition Policy for Defense Business Systems (DBS)</a> <a href="#">DoN CIO Memo: Required Use of DoN Enterprise Technology Standard BCA Template (30 June 2011)</a>	MS A Updated for : MS B MS C FDD ATP	Initially, Functional Sponsor (writes the Problem Statement) and later, Program Office	<b>For MAIS and MDAP:</b> USD(AT&L). USD(AT&L) may designate another DoD official such as DCMO, DoD CIO, or CAE as MDA for MAIS or other major technology programs. <b>For DBS programs not meeting MAIS criteria or that are not designated otherwise:</b> CAE designates MDA

### Acquisition-Driven Economic Analyses, continued

Program/System Type	Analysis Type	Statutory Requirement	Regulatory Requirement	When Required	Prepared by	Decision Authority
DoN Enterprise Information Technology (DonCIO)	BCA		<a href="#">DoN CIO Memorandum: Required Use of DoN Enterprise Technology Standard BCA Template (30 June 2011)</a>	<ul style="list-style-type: none"> <li>All DON IT subject to IGB (Information Enterprise Governance Board) consideration (includes all IT investment &gt; \$1 million over FYDP)</li> <li>All IT investments &gt; \$1 million</li> <li>All information-related initiatives requiring DON, Functional Area Manager, or Echelon II enterprise level board consideration</li> </ul>	Functional Sponsor	May include: IRB Chairs, MDAs, IGB Chair, ITEAAs (Information Technology Expenditure Approval Authorities) dependent on nature of program (acquisition vs project), ACAT/non-ACAT, mission area, cost, type/use of funding (modernization vs sustainment), scope, functional areas affected.
Product Support Performance Based Logistics (PBL)	BCA	<a href="#">FY 2010 NDAA ( P.L. 111-84 ) Sec 805 Lifecycle Management and Product Support</a>	<a href="#">DoDD 5000.01</a> <a href="#">DoDI 5000.02</a> <a href="#">DoDI 7041.3</a> <a href="#">ASN(RDA)Memo dtd 27 Jan 2003</a> <a href="#">Performance Based Logistics (PBL) Guidance</a> <a href="#">SECNAVINST 5000.2E</a> <a href="#">OMB Circular A-94</a>	MS B MS C FOC BCA to be updated every 5 years or prior to each change to the strategy	Program Office under oversight of the Program Office Product Support Manager (PSM)	PM SYSCOM
Open System Architecture (OSA)/ Technical Data Rights (National Security Systems NSS)	BCA		Memoranda USECDEF(AT&L) dtd <a href="#">14Sept2010</a> and <a href="#">3Nov2010</a> concerning Directive for and Implementation of Better Buying Power	MS B	Functional Sponsor	
TOC Efficiency Initiatives	BCA and Cost Analysis				Functional Sponsor	ASN(RD&A) OPNAV N4
Discretionary (PM, PEO, etc)	EA		<a href="#">DoDI 7041.3</a>		Func Sponsor	PM

## Budget-Driven Economic Analyses

Program/System Type	Analysis Type	Statutory Requirement	Regulatory Requirement	When Required	Prepared by	Decision Authority
Infrastructure Investments	EA	<a href="#">EO 12893 Principles for Federal Infrastructure Investments 24 Jan1994</a>		Budget Decisions for infrastructure	Various organizational levels throughout the DoD	Varied
<b>MILCON</b>						
Long-Term Facilities Contracts	EA & Lease vs Buy Analysis	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6, p 24</a> <a href="#">DoDI 7041.3</a> <a href="#">OMB Circular A-94 (formerly A-104 incorporated into A-94)</a>	EA required for consideration of proposed project for budget. <b>Lease vs Buy</b> to show requirement project at least 5% less expensive than reg military construction appropriation	Various organizational levels throughout the DoD	Varied
New Construction/Renovation	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6, p 30</a> <a href="#">DoDI 7041.3</a>	New Construction > \$2M	Various organizational levels throughout the DoD	Varied
Immediate Subordinate Account: Minor Construction	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6, p 14</a> <a href="#">DoDI 7041.3</a>	Urgently required project not otherwise authorized by law ≤ \$2M; if life, health, safety threatening ≤ \$3M.	Various organizational levels throughout the DoD	Varied
<b>Post-Acquisition Construction</b>						
Improvement Projects	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6 p 31</a>	Projects > \$50,000/unit	Various organizational levels throughout the DoD	Varied
Maintenance and Repair	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6, p 34</a>	M&R > \$20,000/unit	Various organizational levels throughout the DoD	Varied

### Budget-Driven Economic Analyses, continued

GFOQM Maintenance and Repair	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 6, p 34</a>	Total M&R > \$35,000/unit per Budget year; Lease project request per PL 98-115, sec. 801	Various organizational levels throughout the DoD	Varied
<b>Defense Working Capital Funds</b>						
Pre-Investment	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 9, p 12</a>	Justify investment for Capital Budget submissions in 4 Capital Budget Investment Categories for projects ≥ \$1M	Various organizational levels throughout the DoD	Varied
<b>Equipment</b>						
Productivity Equipment	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 9, p 96</a>	For equipment that significantly exceeds the efficiency or capability of existing equipment	Various organizational levels throughout the DoD	Varied
New Mission Equipment	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 9, p 96</a>	For equipment needed to support increased work load or a new mission	Various organizational levels throughout the DoD	Varied
Replacement Equipment	EA	N/A	<a href="#">DoD FMR 7000.14 Volume 2B, Chapter 9, p.96</a>	Find most cost effective alternative meeting replacement requirements	Various organizational levels throughout the DoD	Varied

## 4. Elements of an Economic Analysis

**Executive Summary:** Every EA should be accompanied by an Executive Summary, and should include a completed version of the table at Figure 4.1. Additional financial indicators may be added to this table (see Chapter 9. and Appendix 2). The Cost/Benefit Ratio can also be rendered as a Benefit/Cost Ratio if desired.

	Alternative	New Investment Required	Total Life Cycle Cost (Discounted)	Weighted Benefit Score	Cost/Benefit Ratio	Recommend?
1						
2						
3						

**Figure 4.1. Summary of Analysis Results**

The EA itself includes the following basic parts:

- Problem Statement/Background
- Objective
- Key Facts and Assumptions
- Alternatives/Courses of Action (COAs)
- Cost Analysis
- Benefit Analysis
- Uncertainty Analysis
- Comparison of Alternatives and Recommendation

NCCA recommends performing a Change Management Plan for the recommended alternative when implementation would be a complex and high-profile undertaking, and it is not the Status Quo alternative. A Change Management Plan is more commonly a part of BCAs, and is developed to manage the organizational change associated with implementing a new initiative, and so would not be done if the Status Quo is the recommended alternative.

The Change Management Plan consists of:

- Funding Plan
- Stakeholder Plan
- Communications Plan
- Training Plan
- Implementation plan
- Key Performance Measures and Outcomes

**Documentation.** A key element of credible analysis is sufficient documentation of method and information sources. A reader not familiar with the study but with the same material should be able to reconstruct the same result without having to look elsewhere for any information used

to perform the analysis. The documentation in an EA must meet this standard.<sup>3</sup> If supporting documents are too voluminous for inclusion in the EA, they must be cited in sufficient detail so the exact document(s) may be found by an independent reviewer or reader if they choose to read them. In addition to providing documents substantiating information used in the EA, documentation also includes any calculations or adjustments used to turn raw source data into normalized data used in the analysis. Documentation can be included as a series of appendices.

- Reviewers must be able to trace costs from the most basic inputs and units of measure. Cite sources and dates, show rates, factors, and the source of estimates. Include publications, memos, and letters, and show all calculations. For estimates based on expert opinion, include the individual's office symbol, email address, and phone number.
- Document the analysis sufficiently to withstand close scrutiny by a reviewer or other independent authority not familiar with the project. To facilitate review, number all pages in an EA, including attachments. Number all paragraphs, subparagraphs, tables and figures. Thoroughly cite and cross-reference data and information contained in supporting attachments.
- EAs/BCAs/AoAs are the starting point for budget, production, contracting actions and further analysis. Complete detailed documentation not only supports the initial decision but allows follow-on work to be more productive and comprehensive.

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<sup>3</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.2.7

## 5. Problem Statement, Objective, Assumptions, Alternatives

**Problem Statement/Background.** This section should clearly define the problem, requirement, or opportunity to be analyzed, explain why an analysis is being done, and provide background information to put the problem in context. The Problem Statement should explain the purpose of the analysis and the framework for its recommendation.

**Objective.** The statement of the objective should clearly define and quantify (to the extent possible) what the project or program under study seeks to attain<sup>4</sup>.

- The objective should address the true problem to be solved, rather than a symptom of the problem.
- The objective should be stated broadly enough to be met by multiple alternatives, and not in a way that favors or pre-supposes one particular alternative. This is sometimes called “pre-selection”.
- Depending on the project or program under analysis, it may helpful to identify and document the specific desired outcomes the project or program seeks to attain.

**Key Facts and Assumptions.** **Key facts** are factors known to be true that may affect the current or future conditions under consideration in the analysis. Examples of key facts are laws, defined criteria, ground rules, constraints, regulations, OSD or Navy-Marine Corps guidance. **Assumptions** are what we believe-but do not know- about future states. We make assumptions when we lack reliable knowledge to assign values or probabilities to factors influencing decisions<sup>5</sup>. The reasonableness and validity of assumptions, as well as the need for new assumptions, should be periodically re-assessed throughout the course of the analysis. Only necessary and reasonable assumptions should be included in an EA.

- There are times when assumptions can appropriately narrow the scope of an EA to manageable proportions, but they should not unduly restrict the analysis by eliminating potential significant alternatives.
- All assumptions must be explicitly stated.
- If any assumption excludes or includes one or more major categories of cost or benefit, the assumption needs to be explicitly stated and justified. For instance, if an analyst wishes to include the opportunity costs of some capital asset or other resource, such inclusion must be justified in the Cost Analysis section of the EA, and the alternative uses fully explained and calculations shown. Assumptions should not be made for the convenience of the analyst, or to unfairly favor one alternative over another.

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<sup>4</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, paragraph E3.2.1

<sup>5</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, paragraph E3.2.2

- The analyst should be alert to assumptions that assign fixed values to variables subject to uncertainty, then treating those assumptions as facts (i.e., projecting past workload or reliability rates into the future). Any such assumptions should be explicitly stated in the Assumptions section of the EA.
- If any alternative will include opportunity costs in the Cost Analysis section of the EA, this must be pointed out and explained in the Assumptions section of the EA.
- Assumptions are one way we handle uncertainty in an EA. A Sensitivity Analysis should be performed to test the effect that major assumptions have on the recommendation of the EA.<sup>6</sup>

**Alternatives.** Also known as Courses of Action (COAs), these are the various methods of attaining the stated objective, with a full description of each. Fully explain what each alternative involves, especially those things that drive costs and benefits. Explain how each process or procedure would work, what personnel, equipment, or facilities would be required, and what other changes would be involved. Describe each alternative completely, so that someone completely unfamiliar with the alternative can fully understand it and what would be involved in implementation. At a minimum, the description should include all things resulting in costs to the government.

- Whenever possible, every EA should include a Status Quo alternative<sup>7</sup>. This is the “change nothing” or “as is” alternative that describes how the function or process under study currently meets the objective. A Status Quo alternative provides a baseline alternative for comparison.
- Each alternative should be evaluated for feasibility. If any alternative is deemed infeasible, the reasons should be fully explained in this section, and the alternative should not be considered any further in the EA<sup>8</sup>. It is important to keep infeasible alternatives in the list of possible alternatives, along with the reasons they are infeasible, so later readers and reviewers know all reasonable alternatives were considered and the reasons the infeasible alternatives were considered infeasible.

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<sup>6</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Attachment 1, paragraph E3.A1.1.1.2

<sup>7</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.3.1.1

<sup>8</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.3.2

## 6. Cost Analysis

**General.** This section of the EA consists of an estimate of the life-cycle costs associated with each alternative. An EA normally includes all costs to the US government, not simply those incurred by the function under study, and should include all costs resulting from second-order effects. The estimate will show all interim calculations so that the values in the cost analysis can be tracked from the source data to the total cost for each alternative.

### Types of costs.

**Monetary cost:** A financial, monetary outlay or expenditure. This is typically the only type of cost found in the Cost Analysis section of an EA, except for Opportunity Cost. This is sometimes also called a Hard Cost.

- **Fixed cost:** A cost that does not change with the level of activity. It is an expense that is constant regardless of the level of output. When output drops to zero, the fixed cost will remain unchanged.
- **Variable cost:** A cost that varies directly with the level of activity or volume of output. It is an expense that increases or decreases as activity or output does.
- **Semi-variable cost:** Expenditures which remain fixed within a particular level of activity, but increase once that level of activity is exceeded. An expense that:
  - Remains fixed up to a certain set volume. When the set volume is exceeded it becomes variable (such as a piece of support equipment that is needed for every four aircraft, but would not be procured for only a single additional aircraft),
  - Changes less than proportionately to changes in volume of activity, or
  - Has both a fixed cost element (such as monthly rental for a phone line) and a variable cost element (call charges).
- **Marginal cost:** The total cost of producing one extra unit of a good, service, or activity. The word “marginal” in this sense means “extra”.

**Opportunity cost:** The cost of an existing asset measured in terms of its value in the best alternative use. It is the asset’s value if used in the next-best choice available to someone who has to pick between several mutually exclusive choices.<sup>9</sup>

- If an opportunity cost is included in the Cost Analysis section of an EA, the calculations of the value of that asset in the best alternative use must be clearly shown, and the alternative use must be clearly described. The value of an existing asset may be included

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<sup>9</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.2.1.4

in the Cost Analysis section of an EA only when there is a measurable and documented opportunity cost associated with that asset's use.

- Inherited assets, a form of opportunity cost, are those resources such as installations, equipment, and trained personnel inherited from efforts that are being phased out.

**Non-monetary cost:** Any cost that is neither a monetary (hard) cost nor an opportunity cost. Such non-monetary costs, even when quantified and expressed in dollar terms, should be dealt with in the Benefit Analysis section of the EA. This is sometimes also called a Soft Cost.

**Life-cycle cost:** The total cost to the government for a system over its full life, including the cost of development, procurement, operation, support and disposal.

**Non-recurring cost:** One-time costs, usually taking the form of initial capital or other unique expenditures. Types of non-recurring costs are:

- Research and development costs.
- Investment costs. These are costs associated with the acquisition of equipment, real property, nonrecurring services, nonrecurring operations and maintenance (start- up) costs, and other one-time outlays.
- Costs of acquisition, rehabilitation, or modification of land, buildings, machinery, equipment, and one-time computer software costs.
- Costs of acquisition, rehabilitation, or modification of other assets such as furnishings and fittings required for the project.
- Costs of plant rearrangement and tooling associated with the project.
- Costs of freight and insurance required by the project.
- The value of nonrecurring services received from others, both internal and external to the DoN.
- The costs of leaseholds required for the project.
- Working capital and current assets on hand or on order, including inventories of consumable items and resources required for the project.
- The cost to cancel or terminate any existing arrangement that would result if a different alternative were implemented.

**Recurring cost:** A cost incurred repeatedly, either annually or periodically.

- Annual recurring cost: A cost incurred every year, like personnel or utilities.
- Periodic recurring cost: A cost incurred in a period that is other than one year long, like replacement of heating, ventilation and air conditioning (HVAC) equipment that may be replaced every 10 years.

**Common cost:** Any cost that is “common” to all alternatives in the analysis. For costs to be considered common, they must be identical in terms of both amount and timing. Common costs add no additional information to the decision making process, and may be excluded from the analysis, unless there is a requirement to show the total program costs<sup>10</sup>. Whenever such costs are excluded from an EA, such exclusion must be clearly and explicitly stated in the Assumptions section of the EA. However, if a decision-maker wants to see the total cost of the alternatives in an EA, the analyst should include common costs, to show the full costs of each alternative. While a category of cost may be common, the amount may differ, even differ significantly, among alternatives. Exercise caution before deciding to exclude common costs, and be able to defend doing so.

**Differential cost:** The difference in cost between two or more alternatives. Example: In alternative A, the annual cost for 10 laborers is \$1M. Alternative B, however, requires 12 laborers, at an annual cost of \$1.2M. The recurring differential cost of manpower in alternative B is \$0.2M.

**Sunk cost:** Any cost incurred in the past, to include future costs that have been irrevocably committed in the past. Such costs have no bearing on any decision to be made, and so should NOT be included in the comparative costs of any alternative. They should, however, be shown separately as supplementary information and mentioned in the Key Facts and Assumptions section of the EA.<sup>11</sup>

**Costs incurred in foreign currency:** EAs produced by Navy-Marine Corps activities overseas should always perform the cost analysis portion of the EA in US Dollars. These costs must always be converted at the known or estimated exchange rate of the base year of the analysis, NOT the Foreign Currency Fluctuation Account (FCFA) exchange rate, also known as the “budget rate”. The FCFA budget rate is structured and designed to protect budgets and introduce predictability in budgeting for units overseas. Using the FCFA rate will help you calculate the dollar costs to your individual unit, but NOT costs to the US government. EAs should include all costs incurred by the government for following a given alternative. The FCFA keeps exchange rates constant for military units overseas, from budget planning through budget execution, while absorbing daily gains and losses due to day-to-day fluctuations in actual (market-based) exchange rates as units pay their daily bills in foreign currency. Thus, overseas units appear to have a fixed exchange rate during budget execution year, but in fact the government pays a varying rate every day. This rate is often masked by the FCFA.

- Figure 6.1 demonstrates the difference between the cost, in dollars, to an individual

<sup>10</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.2.1.3

<sup>11</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.2.1.2

overseas unit and the cost to the government when using the FCFA rate. The example uses the Euro and a FCFA budget rate of \$1 = €1.2403. If the unit incurs a cost of € 1,000, it'll cost the unit \$806 (at the FCFA budget rate). When finance pays the vendor, they'll convert the cost at the daily exchange rate on the day they make the payment. This rate will be different from the FCFA budget rate the unit originally used to build their budget.

- In Figure 6.1, the daily rate is more favorable to the government than the FCFA rate originally used to build the unit's budget, so the FCFA experiences a net inflow of money in this transaction. In Figure 6.2, the daily rate is less favorable, so the FCFA experiences a net outflow of money in this transaction.
- The FCFA gains and loses money every day, in many different currencies around the world, and it designs its rate structure (considering all currencies) to ensure it stays solvent. This example demonstrates that the cost to an overseas unit, using the FCFA budget rate, is not the same as the cost to the government for any given cost incurred in foreign currency.

(A) Cost in Foreign Currency	(B) Rate	(C) Cost in Dollars (A x B)	
€1,000	(FCFA) 1.2403	\$806.26	Cost to Overseas Unit
€1,000	(Daily) 1.3043	\$766.69	Cost to Government
		\$39.57	Net inflow to FCFA

**Figure 6.1. Example of daily exchange rate MORE favorable than FCFA budget rate**

(A) Cost in Foreign Currency	(B) Rate	(C) Cost in Dollars (A x B)	
€1,000	(FCFA) 1.2403	\$806.26	Cost to Overseas Unit
€1,000	(Daily) 0.8298	\$1,205.11	Cost to Government
		-\$398.85	Net outflow from FCFA

**Figure 6.2. Example of daily exchange rate LESS favorable than FCFA budget rate**

- Ordinarily do EAs in constant dollars; however, if your cost sources cite nominal costs, you may do EAs in inflated dollars. If Then-Year dollars are needed for budgeting purposes for the recommended alternative, convert from constant dollars and use this result in the Funding Plan. The guidance immediately below addresses, in turn, constant and Then-Year (nominal) dollar analysis. The guidance assumes you have collected some costs expressed in foreign currency.

- **Constant Dollar Analysis.** Obtain a forecast of the exchange rate for the base year of the analysis (i.e., the first year in which there will be differences in expenditures for different alternatives.) Use the exchange rate for that base year of the analysis to convert expenditures in every year. The resulting dollars are constant dollars of that base year, resulting in a constant dollar analysis.
- **Then-Year (Nominal) Dollar Analysis.** Obtain a forecast of the exchange rate for each year of the analysis. Convert each year's foreign currency expenditures into dollars using the forecast exchange rate for each year. The resulting dollars are Then-Year dollars. If the forecast does not cover all the years in the analysis, use the exchange rate for the last year forecast for all remaining years. An alternate approach: use the exchange rate for the first year of the analysis to convert foreign currency into US dollars; then use a US inflation rate forecast to convert these constant dollars into Then-Year dollars.

**Depreciation expense:** Depreciation accounts for the gradual consumption of capital goods and resources over time. A common use is to allow business to "recover" investment in capital goods through tax benefits. Normally, depreciation will not be included as a cost in a economic analysis since it would double-count expenses (i.e., the acquisition cost of assets are entered when the asset is acquired). However, depreciation procedures can be used to estimate terminal or residual values. Also, it may be a consideration in commercial lease versus buy alternatives if it provides extraordinary tax benefits to the lessor that are a cost to the U.S. Treasury (see Appendix 4).

**Fuel/Energy Costs:** The fully burdened cost of delivered energy shall be used in analyses conducted for all DoD tactical systems with end items that create a demand for energy, per [DoDI 5000.02](#), *Operation of the Defense Acquisition System*.

**Direct Cost:** Any cost that can be identified specifically with a particular final cost objective and that is directly associated with a change in the product. It consists of direct material, direct labor and other direct costs.

**Indirect Cost:** Any cost not directly identified with a single, final cost objective, but is identified with two or more cost objectives or an intermediate cost objective. Unlike direct costs, indirect costs cannot be easily identified with one product or service.

### **Economic considerations in the Cost Analysis:**

**Base year:** The first year of the analysis where there is a difference in costs between alternatives. This will normally be the Start Year of the analysis. All costs will normally be in constant dollars of the base year of the analysis.<sup>12</sup>

**Economic life:** The economic life of a project or asset is the time benefits from the project or asset may be expected to accrue to the DoN.<sup>13</sup> The economic life of a project or asset is set by

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<sup>12</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.1.5

<sup>13</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.1.1

the shortest of its physical life, mission life, or technological life. Economic lives of assets can often be found in functional area directives for planning, programming, and budgeting for resources. [Appendix 3](#) of OMB Circular A-76 also has a Useful Life and Disposal Value table.

- Physical life: The number of years a facility or piece of equipment can physically be used before it wears out.
- Mission life: The estimated number of years that the need for the asset is anticipated, before the mission either changes or is no longer required.
- Technological life: The period before improved technology makes an asset obsolete.
- For more information on the value of assets at the end of either their useful lives or the period of analysis, see Chapter 6.

**Period of analysis:** Economic life plus project lead-time determines the period of analysis for an EA.<sup>14</sup> If the alternatives do not have equal lives, there are two methods of selecting a period of analysis:

- **The terminal value method** sets the period of the analysis to the duration of the alternative with the shortest economic life. To calculate the present value of each alternative under this approach, the analyst needs to know the terminal or "salvage" values of the assets for the alternative with the shortest life and the residual values of the asset(s) for the alternative(s) with longer economic life (lives). The terminal/residual values of assets are included as inflows, or negative dollar amounts, in the final period cash flows for each alternative. This adjusts the present value of the net cash flow for the disparity between the lives of the alternatives. The terminal value method is the most commonly used method.
- **The common denominator method** assumes the assets associated with each alternative are replaced in the last year of their lives with identical equipment, and replacement continues until all alternatives have assets reaching the last year of their lives during the same year. Choose that year as the last year of your analysis.
  - To illustrate this approach, suppose an analyst must choose between two machines, A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A has an economic life of three years, while Machine B has an economic life of two years. The first Machine A reaches the end of its life in year three, and the second Machine A reaches the end of its life in year six. The B Machines reach the end of their lives in years two, four and six, with year six being the first ending year common to both machine alternatives.

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<sup>14</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.1.4

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
Machine A Life Cycles	1	1	1	2	2	2
Machine B Life Cycles	1	1	2	2	3	3

**Figure 6.3. Example of the common denominator method**

- It is important to keep in mind the major assumption being made: that “chaining” the assets in this manner represents a realistic investment strategy. This approach is not recommended for use with an asset having a short technological life (e.g., computer hardware and software).

**Inflation.** Inflation is a rise in the general level of prices. The [Navy-published inflation indices](#) originate at the Office of Management and Budget (OMB), and reflect the economic assumptions of the current administration. EAs will ordinarily be in constant dollars of the base year of the analysis. Dollar values are expressed two ways, constant dollars or current dollars (also known as Then-Year dollars). There are also two types of inflation indices, raw and weighted.

- **Constant dollars** reflect the value or purchasing power of a dollar in a single, specific year (as in "constant FY13 dollars"), and as such do not include the effects of inflation. Its value is "constant" throughout the years of the analysis period. Expressed this way, the cost of a certain cost element (assuming no other changes to that element) is the same in the first year of the analysis as it is in the last. Base-Year dollars are constant dollars. These are also called “real” dollars.
- **Current dollars**, also called **Then-Year dollars**, have a value that is different from year to year, and reflect the value of that dollar in the *current year* in which it is spent. A current dollar implicitly **includes** the effects of inflation. Dollar amounts in program budgets are current dollars. These are also called “nominal” dollars.
- **Raw inflation indices** show the estimated change in price level from one base year to another. Use a raw index to convert a dollar amount from constant dollars in one year to constant dollars in another year.
- **Weighted inflation indices** combine raw inflation indices with outlay profiles to account for the additional effects of inflation caused by spending money over a multiyear period. An outlay profile shows the percentage of an obligated amount that is expensed (spent) in each year the applicable appropriation is valid. It takes into account that not all money obligated in a given year will be spent that year, but will be spent over several years over the course of the legal life of the applicable appropriation, and that inflation will have an effect on costs in those years.
- **Adjustment to the Base Year.** Since EAs propose a future course of action, the base

year is usually one or more years in the future. Since cost source data is often in a year other than the base year of the analysis, costs must be adjusted from the source year to the base year of the analysis. Use raw inflation indices to adjust costs to the base year of the analysis. After adjustment to the base year, the costs will not vary from year to year (provided there are no changes in requirements or scope, like if a building requires more maintenance as it ages). No further inflation adjustment is necessary unless the analysis contains resources that are subject to differential price changes.

- **Differential Price Changes.** Even in a constant dollar analysis, you may need to adjust the costs of some elements if economists project price changes significantly above or below general inflation. The "core" rate of inflation, for example, excludes food and energy costs. Food and energy costs are two of the most volatile sectors of the economy. For many years, the cost of computer systems has been decreasing relative to increasing processing capability. If an EA contains food, energy, or computer system costs, adjustments to costs in the out years may be advisable. Apply sector-specific inflation indices to costs in the EA from volatile sectors of the economy, where appropriate. Analysts may consult NCCA for information on such indices. Any use of an inflation index other than one issued by NCCA and OSD must be fully explained and justified in the analysis.
- **Then-Year/Current Dollar Analysis.** While EAs will ordinarily be in constant dollars of the base year of the analysis, there are certain situations where a Then-Year dollar analysis is appropriate. A Then-Year (current) dollar contains implicit adjustment for variation in the purchasing power of a dollar over time. Then-Year dollars represent amounts that will be paid for resources in the years in payments will be made (therefore sometimes referred to as budget dollars):
  - Perform EAs in Then-Year dollars when cost information is obtained in inflated dollars.
  - In Then-Year dollar analyses all outlays are escalated for inflation using the most appropriate indices. In principle the weighted inflation indices are used to establish Then-Year dollar amounts. Weighted inflation indices are derived by applying raw inflation indices to each appropriation's outlay pattern. The outlay pattern is based on historical average expenditure profiles. However, if more specific information is known about when amounts will be spent for a particular project, then the amounts should be placed in the appropriate year and inflated with raw inflation rates. Also, no weighted indices exist for pay and fuel categories because the assumption in the Navy inflation indices is that these categories are expended within one fiscal year. If specific data is known about prices of a given acquisition or contract provision, these specific price increases should be used rather than the inflation indices.
- Do not mix constant and Then-Year/current dollars in the same analysis.
- The [Joint Inflation Calculator](#) is a tool available on the NCCA web page. This model helps an analyst to quickly accomplish conversions into different types of dollars or into different base years. Program offices can use alternative inflation rates that are specific to

their program or system.

**Discounting and Present Value.** Discounting is a method of calculating the value today (present value) of a future cost or stream of future costs. We discount because we recognize that the timing of expenditures makes a difference, that because of interest and other business opportunities, time has value. One dollar invested today will earn interest and be worth more one year from now. For example, if you had a debt of \$1000 due one year in the future, and you could get an interest rate of ten percent (very high compared to most historical periods, but used for simplicity of the example), then you would need only \$909.09 today to meet that obligation. This is because \$909.09 can be loaned for one year to produce principal plus interest of \$1000. Discounting favors alternatives that push costs further into the future, where they are discounted more heavily, resulting in a lower value in the present. It also has the effect, intended or not, of minimizing estimating errors in the future, because the further into the future you go, the more discounting reduces the present value (and any estimating error) of a given cost element.

**NOTE:** Do not confuse discounting with inflation. Discounting involves the concept of the time value of money in view of the interest that can be earned on financial instruments such as treasury securities or commercial time deposits. Inflation involves changes in prices. While expectations of inflation may influence interest rates, the concepts of inflation and the time value of money are separate ideas.

- **Net Present Value (NPV).** The sum of all discounted costs for all years of the analysis period. All costs in DoNEAs will be discounted to present value, and alternatives will be ranked according to NPV.<sup>15</sup>
- **Discount Rate.** EAs are performed using discount rates that represent the government's cost of borrowing, as provided annually in the President's Budget and [Appendix C](#) to OMB Circular A-94.<sup>16</sup> Rates used for analysis are interest rates on Treasury notes and bonds with maturities of 3, 5, 7, 10 and 30 years (normally). The rate to be used should correspond to the period of analysis. Interest rates on Treasury securities are cited on both a real and nominal basis. Ordinarily EAs use a real rate, consistent with a constant dollar analysis. When inflated (Then-Year) dollars are used in an EA, the nominal rate is used. NCCA has a [discount rate calculator](#) on their website, updated annually, for use by any analyst.
- **Discount Factors.** Discount factors for use in EAs are derived from the discount rate used, using the formulas found in Appendix 2. There are two kinds of discount factors we normally see in EAs.
  - **End-of-Year Factors:** These factors implicitly assume that costs and benefits occur as lump sums at the beginning of the year, so that interest is accrued or paid for the entire year (the interest period we normally use).

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<sup>15</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraphs E3.1.2 and E3.2.5

<sup>16</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.4

- **Midyear Factors:** When costs and benefits occur in a steady stream, applying midyear discount factors is more appropriate.<sup>17</sup> Midyear factors approximate actual disbursement patterns--i.e., funds are typically disbursed throughout a given fiscal year rather than at its beginning or end. When the precise timing of outlays is critical to program evaluation, monthly (or quarterly) rather than annual flows of funds may be considered for early program years. Midyear factors are generally more appropriate in DoN EAs unless you know and can document that all costs in your EA will occur as lump sums at the beginning of each year, and if this is the case, it should be explained in the analysis.
- Figures 6.4 and 6.5 show the difference between an interest rate and a discount rate. Figure 6.4 shows how an interest rate is applied to a present dollar amount to arrive at a desired future amount. Figure 6.5 turns this example around to show how the same interest rate, converted into a discount rate, can be applied to the desired future amount to arrive at the present amount that would be needed to invest to reach that future desired amount. Note that investment amounts are rounded.

(A) Year	(B) Invested Today	(C) Annual Interest Rate	(D) Value in Future Year (B x C)
1	\$ 909	1.10 (10%)	\$ 1,000
2	\$ 826	1.10 x 1.10 (10%)	\$ 1,000

**Figure 6.4. Interest rate example**

(A) Year	(B) Needed in Future Year	(C) Discount Rate	(D) Amount to Invest Today (B x C)	(E) Type of Discount Factor Used
1	\$1,000	0.909 (10%)	\$909	End-of-Year
2	\$1,000	0.826 (10%)	\$826	End-of-Year
1	\$1,000	0.953 (10%)	\$953	Mid-Year
2	\$1,000	0.867 (10%)	\$867	Mid-Year

**Figure 6.5. Discount rate example**

<sup>17</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Attachment 3, Paragraph E3.A3.3.2

- Figure 6.6 shows how the discount rate is applied and how the NPV is calculated.

(A) Year	(B) Cost	(C) Factor	(D) Present Value (B x C)
1	\$1,000	.953	\$953
2	\$1,000	.867	\$867
3	\$1,000	.788	\$788
4	\$1,000	.716	\$716
5	\$1,000	.651	\$651
6	\$1,000	.592	\$592
7	\$1,000	.538	\$538
8	\$1,000	.489	\$489
9	\$1,000	.445	\$445
10	\$1,000	.404	\$404
<b>Net Present Value:</b>			<b>\$6,443</b>

**Figure 6.6. Application of the discount rate and calculation of net present value (using a 10% discount rate and midyear discount factors)**

**Remaining value at the end of an asset's useful life** should be calculated for assets that will still have value at the end of the analysis period.<sup>18</sup> There are three terms used to describe the value of an existing asset that remains at the end of its useful life: terminal value, residual value and salvage value.

- Salvage value is the value of an asset at the end of its physical life (scrap value). Salvage value should be offset by the cost to dispose of the asset.
- Residual value is the value of an asset at any point in time before the end of its economic life.
- Terminal value is the value of an asset remaining at the end of its economic life. If its economic life is deemed to be the same as its physical life, then terminal value will equal salvage value. If, however, an asset's physical life is longer than its mission or technological life, there may be some value left in the asset beyond salvage value.
- The remaining values of assets are included as inflows, or negative dollar amounts, in the final period of the cost analysis for each alternative. This step adjusts the present value of the net cash flow for the differences between the lives of the alternatives. A straight-line depreciation method is acceptable for estimating terminal, residual or salvage value. This

<sup>18</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.2.1.8

is done only to estimate the remaining value of existing assets, and for no other purpose. DoN EAs do not include depreciation expense as an element of cost, since doing so would be double-counting the investment cost of the asset. The only time Navy-Marine Corps EAs will take depreciation expense into account is when there are special tax advantages to lessors taking accelerated depreciation (see **Appendix 4**).

## 7. Benefit Analysis

This section of the EA consists of an estimate of the life-cycle benefits associated with each alternative. An EA normally includes all benefits to the US government, not simply those incurred by the function under study. While costs can be thought of as “inputs” to a project or program, benefits can be thought of as the “output” or what the government gets for its resource inputs. In developing the list of costs and benefits, care must be taken to avoid double-counting. Costs and benefits must be mutually exclusive and may not overlap. For instance, a cost saved or avoided by one alternative is reflected in that alternative’s reduced cost in the cost analysis, and to claim “Cost Savings” as a benefit in the benefit analysis would be to double-count this item.<sup>19</sup>

- The selection of any particular alternative should be based on a full economic evaluation, where both costs and benefits have equal weight. An alternative with the lowest cost may not be the most economical; other alternatives may, after incorporation of non-dollar costs and benefits into the analysis, provide more benefits for the resources expended.
- Any and all categories of benefits analyzed should be fully explained so someone unfamiliar with the benefits can fully understand the benefit and its measurement.
- Appendix 7 is a sample Benefit Analysis of non-quantifiable benefits.

**Types of benefits.** The sources and derivation of quantifiable benefits must be documented in the same level of detail as costs, and should include all interim calculations as appropriate. There are three types of benefits.

- **Monetary benefits.** These quantifiable benefits include financial, monetary income to the government, including cash receipts, proceeds from the sale of assets, lease fees, and other revenue. Monetary benefits are incorporated into the analysis as offsets to expenditures. Revenues, government earnings, and the like are subtracted from cost totals to yield net costs or net dollar outflows for each alternative. This is done in the cost analysis section of the EA, but should be discussed in the benefit analysis section.
- **Non-monetary quantifiable benefits.** Any non-monetary benefit that can be measured quantifiably, like a reduction in military overtime manhours.
  - Characteristics such as product or service performance (miles/hour, orders/hour) or work environment (average noise level, mishaps/week) can sometimes be quantified in nonmonetary terms. In such cases, nonmonetary costs and benefits should be quantified to the greatest extent possible, and direct comparisons among these measures across alternatives should be made. If quantifying such benefits in dollar terms, make sure it is clear dollars are only being used as a unit of measurement for comparison purposes. Make sure the decision-maker is not misled into thinking such quantifications represent actual dollar cash flows.

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<sup>19</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.4.2.1

- Normalization. To compare benefits with different units of measure, score or poll them on a consistent scale (e.g., 0 through 100%). Describe the scoring criteria for each benefit to identify how the benefit will be measured and how that measure will translate into a score.
- **Non-quantifiable benefits.** Also known as **qualitative benefits**, these cannot be readily stated in dollar terms, or otherwise quantifiably measured, like mission effectiveness, security and organizational morale. These are usually subjective in nature and generally don't lend themselves to quantifiable analysis. We can still, however, attempt to determine the comparative desirability of each alternative relative to each benefit. We can also attempt to measure the magnitude of the differences in desirability between alternatives. Thus, while not measuring these benefits in an objective way, we can still establish a basis of comparison. One such way is by assigning subjective weights and values to various benefits. Appendix 7 is a sample completed Benefit Analysis of non-quantifiable benefits.
  - The EA objective, requirements, and desired outcomes should drive the selection of benefits to be evaluated. Individual benefits to be analyzed are best selected, weighted and scored by knowledgeable subject matter experts (SMEs).
  - Non-quantifiable benefits will require numerical transformation of a qualitative variable, for example, morale, maintainability, supportability, or customer satisfaction. The methods and rationalization for numerical transformation of subjective factors must be fully described, and the criteria for evaluating them should be independent, relevant, and clearly defined for the reader of the EA.
  - The weight of each benefit should show how important each benefit is relative to the others, while the score should measure how well the alternative provides the benefit. The weight times the score equals the weighted score. These are then summed to show the various alternatives' overall weighted benefit score. Figure 7.1 shows a sample benefit matrix identifying the benefits analyzed, their assigned weights and scores.
    - When establishing weights for each benefit, it is important to consider such questions as “Is the benefit of morale improvement equal to safety improvement?” or “Is safety improvement equal to targeting accuracy?” Just as in determining a rating scale, deliberately define the weighting scale. For example, a 10 weight means the benefit is “critical importance”, a 7 weight indicates “above average importance”, 5 shows “average importance”, 2 shows “below average importance”.
    - Always define the scores used. Always define and document the scoring system used and how the resultant the scores were applied in an evaluation. For example, morale could be rated as a 0 for “does not improve morale”, 25% for “maintains

current morale”, or 75% for “improves current morale”. The larger the span of ratings, the greater the difficulty in explaining what improvements an alternative would need to move up a point in the ratings scale. Any number of potential scoring methodologies can be devised.

- Following is a sample list of benefits to consider:
  - Availability
  - Reliability
  - Safety
  - Mission readiness
  - Supportability
  - Sustainability
  - Versatility

		<b>Alt #1: Status Quo</b>		<b>Alt #2: Improved Process</b>		<b>Alt #3: Upgraded Equipment</b>	
<b>Benefit</b>	<b>Weight</b>	<b>Score</b>	<b>Wtd Score</b>	<b>Score</b>	<b>Wtd Score</b>	<b>Score</b>	<b>Wtd Score</b>
Mission Readiness	10	50%	5.0	90%	9.0	100%	10.0
Safety/Security	9	30%	2.7	80%	7.2	100%	9.0
Meeting Standards	5	50%	2.5	50%	2.5	100%	5.0
Morale	4	25%	1.0	75%	3.0	100%	4.0
<b>Total Benefits Score</b>			11.2		21.7		28.0

**Figure 7.1. Sample Benefit Matrix**

## 8. Uncertainty Analysis

**General.** Estimates of costs and benefits contain uncertainties because of imprecision in both underlying data and assumptions. Since estimating errors can be introduced into the analysis in these ways, we must analyze the effect these potential errors have on our analysis and its recommendation.<sup>20</sup> Information useful in an analysis of uncertainty should include the key sources of uncertainty and the sensitivity of analysis results to the primary sources of uncertainty.

- Uncertainty is having less than 100% assurance of knowing something is true (like assumptions, cost variables or benefit estimates). Uncertainty can often be quantified in terms of a range of values over which uncertain outcomes are expected to occur.
- Sensitivity is the magnitude of impact particular inputs have on an analysis and its results. Sensitivity analysis is an evaluation of the effect of uncertainty on the outcome of the analysis. Every EA should have a sensitivity analysis.
- Risk involves the probability and severity of threats to, and vulnerabilities of, each alternative.

**Sensitivity Analysis** identifies key assumptions and variables within an EA and determines how changes in them affect the ranking of alternatives. Its value lies in the additional information and understanding it brings to bear on the decision. For decision makers facing an investment decision, sensitivity analysis is a tool for determining how changes in costs or benefits (e.g., due to estimating errors stemming from uncertainty) affect the EA's recommendation.

- A decision is insensitive to uncertainties regarding a variable if you can change the variable over a wide range without affecting the ranking of alternatives. A sensitivity analysis demonstrates the stability (or instability) of the recommendation.
- A major limitation of sensitivity analysis is that it only analyzes the assumptions, alternatives, or variables you have considered. Critical thinking and dialog with experts is crucial to preparing a quality EA.
- A primary reason for undertaking a sensitivity analysis on cost estimates is to deal with the uncertainty related to their derivation. The definition of uncertainty used here includes both risky and problematic situations. In a risky situation, the analyst knows the probability distribution relating alternative outcomes (i.e., all possible outcomes along with the probability of occurrence of each outcome are known). In an uncertain situation, the probability distribution cannot be determined. When anyone tries to estimate costs or predict future occurrences over a long time, variations are bound to occur between the estimated and the actual occurrences. Some variations in estimates can be described statistically, others cannot. For instance, consider the case of a life-cycle cost analysis of operating a vehicle fleet. Regardless of the estimating technique employed, any forecast

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<sup>20</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.2.6 and Attachment 1, Paragraph E3.A1.1

of fuel costs will be subject to estimating error for fuel usage rates and uncertainty as to fuel prices.

**Considerations:** Consider conducting a sensitivity analysis:

- On assumptions containing uncertainty impacting the estimates of costs or benefits.
- On major cost drivers. Determine major cost drivers by calculating the percentage of total cost accounted for by each cost element, using discounted costs. After determining the percentage that each cost element (for example, research and development, investment, and recurring cost categories) is of the total cost for each alternative, examine those cost elements which constitute the largest percentage of life cycle cost.
- On the discount rate, if there are significant differences in the outlay patterns of the alternatives. If the sensitivity analysis results in a change in the cost ranking of the alternatives, report the rate where the change occurs.
- On any inflation or other rate that appears to have a high degree of uncertainty.
- When the results of the analysis do not clearly favor any one alternative.

**Performing a Sensitivity Analysis:** To perform a sensitivity analysis, vary any uncertain costs and benefits within what you consider to be a reasonable and relevant range (e.g., plus or minus 10% of initial investment costs, plus or minus \$3.50 per operating hour, or whatever is appropriate), recalculate the costs and benefits of all affected alternatives, and compare them again. If the ranking of alternatives changes as a result of these variations, then the recommendation of the analysis is sensitive to uncertainties in a certain assumption, over a given relevant range of variation. You can do several iterations, varying costs and benefits at whatever interval (e.g., every 2%) you believe is appropriate. Make sure you document all your reasoning and assumptions, and show all your calculations and intermediate steps.

**Risk Analysis.** Not required in all EAs, risk analysis deals with the likelihood and severity of possible threats and vulnerabilities of each alternative. There are many methods one can use to assess risk, but they are ultimately subjective and judgmental in nature, no matter how they are developed and applied. The intent of this section is to provide a method for estimating risk using a qualitative, non-statistical, approach that can provide decision-makers a summary of the risks involved with each alternative. The more explicitly the risk is defined, the greater the possibility for the decision maker to safely utilize the analysis. This technique involves the steps listed below, followed by an example.

Step 1: Develop List of Threats/Vulnerabilities

Step 2: Identify probability of threat occurrence

Step 3: Identify severity of threat occurrence

Step 4: Determine risk rating

Step 5: Develop and describe risk mitigation strategies

**Step 1: Develop List of Threats/Vulnerabilities**

Three sample threats:

**Increased Component Failure:** The risk of experiencing higher than expected failure rates for the proposed new components.

**Increased Maintenance Costs:** In the event aircraft originally used for training are made available for operational use, it is possible those aircraft will operate more frequently in desert/austere environments. This may result in increased maintenance requirements.

**Implementation/Schedule Risk:** The risk the program will not be completed on time due to schedule delays.

**Step 2: Identify likelihood of threat occurrence:** Use the definitions in Figure 8.1, Probability Definitions, to assign a likelihood of each threat occurrence to each alternative/COA.

Probability Definitions	
Frequent	Occurs often, continuously experienced
Likely	Occurs several times
Occasional	Occurs sporadically
Seldom	Unlikely, but could occur at some time
Unlikely	Can assume it will not occur

**Figure 8.1: Probability Definitions**

**Step 3: Identify severity of threat occurrence:** Use the definitions in Figure 8.2, Severity Definitions, to assign the severity of each threat occurrence to each alternative/COA.

Severity Definitions	
Catastrophic	Death or total permanent disability, system loss, significant property damage, mission failure
Critical	Permanent partial disability, temporary total disability in excess of 3 months, major system damage, major property damage, significant mission degradation
Major	Some mission degradation, temporary disability (between 1 day and 3 months)
Minor	Minor injury, lost workday accident, minor system damage, minor property damage, some mission degradation
Negligible	Negligible medical injury, minor system impairment, little/no mission impact

**Figure 8.2: Severity Definitions**

**Step 4:** Determine risk rating using Figure 8.3, Risk Assessment Matrix, to determine the risk level of each threat by alternative/COA, then enter the information from Steps 1 through 3 into the Risk Analysis Summary Table at Figures 8.5a and 8.5b.

Risk Assessment Matrix					
	Probability				
Severity	Unlikely	Seldom	Occasional	Likely	Frequent
Catastrophic	M	M	H	H	H
Critical	L	M	M	H	H
Major	L	L	M	M	H
Minor	L	L	L	M	M
Negligible	L	L	L	L	M

**Figure 8.3: Risk Assessment Matrix**

Risk Definitions	
<b>H:</b> High	Likely mission failure
<b>M:</b> Moderate	Degrades mission capability in terms of required mission standards
<b>L:</b> Low	Little or no impact upon mission accomplishment

**Figure 8.4: Risk Definitions (from Figure 8.3)**

Threat	COA #1: Status Quo		COA #2: Deploy System X		COA #3: Deploy System Y	
	Probability	Severity	Probability	Severity	Probability	Severity
<b>Increased Component Failure</b>	Frequent	Major	Seldom	Critical	Unlikely	Catastrophic
	High		Moderate		Moderate	
<b>Increased Maintenance Costs</b>	Likely	Minor	Occasional	Negligible	Seldom	Minor
	Moderate		Low		Low	
<b>Implementation/Schedule Risk</b>	Unlikely	Negligible	Unlikely	Minor	Seldom	Critical
	Low		Low		Moderate	

**Figure 8.5a: Risk Analysis Summary Table**

Threat	COA #1: Status Quo	COA #2: Deploy System X	COA #3: Deploy System Y
<b>Increased Component Failure</b>	High	Moderate	Moderate
<b>Increased Maintenance Costs</b>	Moderate	Low	Low
<b>Implementation/Schedule Risk</b>	Low	Low	Moderate

**Figure 8.5b: Risk Analysis Summary Table, Alternate Version**

**Step 5:** Develop and describe risk mitigation strategies. Develop a plan to address ways to reduce and manage the risks involved with the recommended alternative

## 9. Comparison of Alternatives and Recommendation

Once all the costs and benefits are estimated for each alternative, the results must be analyzed, and the alternatives compared and ranked to arrive at a recommendation. This section of the EA must include an analysis of the data, a comparison and ranking of alternatives, discussion of any uncertainty analysis, and a recommendation.<sup>21</sup>

Briefly summarize each alternative. Provide a brief narrative explanation of the summarized cost and benefit data, as well as any measurements and indicators. Compare the relative strengths and weaknesses of each alternative and identify the most effective alternative accomplishing the mission objective. Make sure you also discuss the results of any risk and sensitivity analysis you performed.

- Every EA must recommend one of the alternatives considered.<sup>22</sup>
- Summarize the results of the analysis in a table like the one below (from Figure 1.1, this one containing sample data and additional elements), comparing, **at a minimum**, the four metrics listed below. Additional metrics/financial measures may be added to this table. The formulas can be found in Appendix 2.
  - New Investment Required
  - Total Life Cycle Cost, Discounted (NPV)
  - Weighted Benefit Score
  - Cost/Benefit Ratio (or Benefit/Cost Ratio)

	Alternative	New Investment Required	Total Life Cycle Cost (Discounted)	Weighted Benefit Score	Cost/Benefit Ratio	Overall Risk	Recommend?
1	Status Quo	-	\$ 150.2M	11.8	\$ 12.8	High	No
2	System X	\$ 12.5M	\$ 115.0M	27.8	\$ 4.1	Low	Yes
3	System Y	\$ 14.2M	\$ 121.3M	28.8	\$ 4.2	Moderate	No

Below are some metrics/financial indicators you can use to compare alternatives; some apply to costs, some to benefits and some to a combination of the two (formulas can be found in Appendix 2):

- Net Present Value (NPV): NPV reflects the value today of a future amount or stream of future amounts, expressed as a single sum of dollars. It is calculated by multiplying the net amount for each year by the corresponding discount factor, and summing the results.

<sup>21</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.2.7

<sup>22</sup> DoDI 7041.3, 18 Oct 1972, Enclosure 3, Paragraph E3.2.7

- **Uniform Annual Cost (UAC):** A method to compare alternatives with unequal lives, UAC is calculated by dividing the present value of the costs of an alternative by the sum of the discount factors for the periods covering the life of each alternative.
- **Savings/Investment Ratio (SIR):** The ratio of savings generated from an investment to the original investment.
- **Internal Rate of Return (IRR):** The annual return on an investment, expressed as a percentage of the amount invested. It can also be defined as the *annualized effective compounded return rate* that can be earned on invested capital.
- **Return On Investment (ROI):** The total return generated by an investment.
- **Weighted Benefit Score:** The result of the subjective scoring of intangible benefits of a given alternative, weighted by the relative importance of each individual benefit.
- **Cost/Benefit Ratio (CBR):** The ratio of the life cycle cost of an alternative to its weighted benefit score. This can also be rendered as a Benefit-Cost Ratio, where the weighted benefit score would be the numerator and the life cycle cost the denominator.
- **Payback Period:** The length of time it takes for the revenue or savings generated by a project to equal its investment costs.

### **Making the Recommendation Decision**

- Once the final cost, benefit and uncertainty information is put into a summary table like the one in Figure 5.1, the best alternative to recommend will sometimes be obvious, like if one alternative has the lowest costs, the lowest risk, the highest benefits and the most advantageous financial indicators. When the solution is not obvious, the process of selecting the preferred alternative becomes less quantitative and more subjective. There is a simple process that may be helpful in this type of situation:
  - **Summarize the results of the analysis into a table.** It helps to have all relevant results summarized and easily available at a glance.
  - **Round 1: Eliminate some alternatives.** Are one or more alternatives clearly weak or inferior to the others? If so, eliminate them from further consideration and proceed to Round 2.
  - **Round 2: Take a hard look at the strengths and weaknesses of the remaining alternatives.** Some questions to consider in this round:
    - Is one alternative inherently simpler and easier to implement than the others? Other things being equal, simplicity trumps complexity in execution.

- Is one alternative less risky or sensitive to critical assumptions than the others?
- If two or more alternatives are close in cost, which provides the most benefit?
- If two or more alternatives provide the same level of benefits, which has the lowest cost?
- Which alternative will optimize the use of financial and other resources?
- **Make a selection.** It is time to make a decision. If you need to do another round or two to further narrow down your options to one clear choice, do it.
- **Do a sanity check.** Ask yourself if your recommendation really makes sense given the fiscal environment and competing priorities. Would it seem to make sense to someone unfamiliar with the project or program?

# 10. Change Management

**General:** Change Management is performed only on the recommended alternative, and only when it is not the Status Quo alternative. Stakeholders and leadership teams develop Change Management Plans (CMPs) to manage the organizational friction associated with implementing a new initiative. A well drafted change management plan should discuss any cultural changes required, shared visions between stakeholders, what necessitates the change, expected stakeholder resistances, leadership buy-in, communication strategies, possible infrastructure changes, Change Management is based on effective marketing of the project and the building of a partnership between the project management team and the user community. The plan should contain the following major elements:

**Funding Plan:** Identify the amount of funding required for each phase of the recommended alternative (pilot, implement, and sustainment), identify the source(s) of these funds, and current funding status. Be sure you know, and account for, any restrictions associated with these funding sources. Any amounts used in the Funding Plan will be in Then-Year or nominal dollars. Explain briefly the initiative's funding strategy. Include:

- Whether the amount of funding from existing or previously submitted budgets for existing operations is available to be used for the new proposed operation.
- The amount of new funding, if any, needed to be requested, by appropriation or major budget account.
- The rationale for requesting funds from these sources.
- Whether there are any limitations on these funding sources.
- Whether the proposed funding will require other existing or planned efforts or programs to go unfunded or have budgeted amounts reduced.
- The effect of funding impacts on other organizations.
- The risk of availability of funding source(s).

**Stakeholder Action Plan:** Most proposed actions involve stakeholders, those who have an interest in a requirement or the means of achieving it. If the investment decision impacts stakeholders, address how the stakeholders will be informed, involved, convinced or otherwise engaged in the new process to gain their support. It is important to remember, depending on the process being changed, there may also be reserve components involved. If reserve component personnel rely on a process or automated system operated by active duty forces, they may very well be a stakeholder and the impact to their organization must be considered. In addition, changing business processes affecting civilian personnel administration may require added analysis considering organized labor union involvement, as applicable. The critical point to keep

in mind is to not overlook potential stakeholders in the process being changed. For each stakeholder, address the following questions:

- What are their interests in the action plan?
- Why should they be involved or to what extent?
- Do they concur on the recommended alternative for the new way of business operation?
- What are any concerns they may have about the proposed alternative?
- Were they represented in the development of the business case? If yes, how? If no, why not?
- What might this stakeholder contribute to the implementation or planning process?

**Communications plan:** Communication is a major component of any successful project. Without effective communication, key stakeholders in a project may miss out on vital information and may not understand why change is needed. Customers might not be aware of the plans for a new way of doing business, and may raise concerns about how the proposed alternative would meet their needs. The other military services, DFAS, or the Joint Staff may need to be informed of the new way of doing business. Also, oversight groups such as OSD, OMB, or Congressional staff may need to be informed of the new way of doing business, through the budget formulation process if not by other means. In some cases OSD or Joint Staff coordination or approval may be needed before adopting the new way of business, or Congressional Committees or Subcommittees may need to approve it. The best way to approach communication is to develop a clearly planned approach or strategy. Address the means, methods and messages, including who will issue messages, along with a schedule for delivery, to explain the initiative to stakeholders and other parties impacted by the proposed new way of doing business.

- **Target Audience/Stakeholder Group:** Identify the Target Audience by considering the following:
  - Who will benefit from the project?
  - Who are the key stakeholders?
  - Who are the stakeholder groups and the target audience within them?
- **Objective:**
  - What do you intend to communicate to the stakeholder groups?
  - What are the key points stakeholder groups need to understand and act upon?
- **Communication Tools:** What communication methods/tools are most appropriate for the stakeholder groups? (e.g., electronic, written)

- **Responsible Party:** Who will be responsible for implementing each action?
- **When:** When must the action be completed?
- **Costs:** What are the costs associated with each action?

**Training Plan.** The Training Plan describes the strategies, activities and tasks necessary to provide the individuals or organizations implementing the new process the skills necessary to perform the new initiative successfully. The training plan helps to ensure project outcomes are successfully achieved. The key to effective training and successful project implementation is to start the planning process early. If training needs are not considered until late in the implementation process, there may not be enough time to effectively prepare staff to implement the new process, or to budget or contract for needed training. Appendix 8 contains a list of recommended elements to include in a comprehensive training plan.

**Implementation plan:** With a well thought-out, high level implementation plan, the project manager will be able to communicate and coordinate the tasks necessary for a successful transition throughout pilot, implementation and sustainment phases. Implementation plans should have specific events tied to specific, achievable milestones factoring in technical, cost, and schedule risk. Identify the type of approach to implementing the preferred alternative, for example one large project, a number of smaller projects or a combination of both. The breakdown of the projects within this strategy can also be included where the 'manageable chunks' or phases for each project have been identified. Deployment of complex projects or systems in modular units may reduce the risk of the failure of the new way of doing business. OMB has directed this approach for large information technology systems. Holding a walkthrough of the implementation plan with all stakeholders is a good way to verify all necessary tasks are accounted for, are in their proper sequence, and are assigned to appropriate organizations or individuals. EA preparers must make sure the implementation plan is consistent with scheduled costs and budgets elsewhere in the EA. When developing the implementation plan, consider the following:

- Have dates been assigned to all tasks?
- Are the sequencing and timing of all tasks correct?
- Is there an assigned person or organization responsible for completing each task?
- Have dependencies between tasks been identified and communicated to the resources affected by the dependency?
- Has the plan been reviewed with all impacted stakeholders and resources assigned to the implementation or action tasks?
- Has the initiative schedule been reviewed and updated based on the tasks and timeframes

identified in the implementation plan?

- Is the implementation plan consistent with the funding plan?
- Have other ongoing projects or processes been reviewed for possible changes based on the contents of this implementation plan?

**Key Performance Measures and Outcomes:** A key aspect of any initiative is the ability to track results of the initiative over time. Determining performance measures and outcomes (metrics) at the beginning of an initiative helps assure the initiative stays true to the initial purpose and priorities. Defining the desired outcomes or acceptance criteria at the beginning of the initiative also clarifies the initiative's scope. Using performance measures establishes whether the initiative did indeed succeed, and provides a starting point for developing future lessons learned. If the business process will change dramatically due to the initiative, then it is especially important to choose a stable basis of comparison. Some common measures to consider are: program cost savings (requires baseline), business process time savings (requires baseline), amount of usage of project outputs (number of website hits, etc), change in number of customer complaints (requires baseline), and nature of customer feedback (may require a survey, both before and after implementation). Each proposed metric should address the following:

- Do the performance measures directly target an initiative's objective?
- If the objective of a business operation has several parts, do the performance measures cover all parts of the objective?
- Does the measure use readily available data?
- If the measure uses data not readily available, what must be done to develop or collect the data, and is preparing a data base to receive and utilize the data feasible and manageable?
- How long will it take changes to come about or to be able to capture meaningful data?
- Has baseline data been captured (necessary if changes are to be measured)?
- Is the basis for comparison consistent? (Apples to apples?)
- Have timeframes been considered?
- Are possible seasonal variations in data accounted for in the timeframe or reporting periods?

# 11. Practices for Specific EA Types

## Analysis of Alternatives (AoA).

- An analysis of alternatives (AOA) is part of the acquisition process and is prepared at appropriate Milestone Decision Reviews. It is an analytical comparison of the operational effectiveness, cost, and risks of proposed materiel solutions to gaps and shortfalls in operational capability, and so may be considered a type of EA. AoAs are required for analysis of weapons systems according to DoD Instruction 5000.2, Operation of the Defense Acquisition System. The Air Force has an extensive [AoA Handbook](#) with in-depth instructions on performing this type of analysis.
- An AoA has an important role in determining whether or not a system should be procured and if so, what would be the nature of the technologies and capabilities available for acquisition. AoAs must not only make a case for having identified the most cost-effective alternative, they must also make a compelling statement about the capabilities and military worth acquiring those alternatives will provide.
- An AoA goes beyond the normal examination of costs, benefits and risks. AoAs focus a great deal on military utility and the selection of a manageable yet comprehensive set of alternatives considering the threats and operational environment.

**EAs for Naval Facilities.** The Naval Facilities Engineering Command (NAVFAC) has an [Economic Analysis Handbook](#) currently dated October 1993. The NAVFAC Handbook is built around the concepts of engineering economics, and contains extensive guidance on performing EAs for naval facilities.

- Within the NAVFAC facilities acquisition process, there are two distinct classes of EA: Fundamental Planning Analysis (FPA) and Design Analysis (DA).<sup>23</sup> EA principles apply equally to both classes of EA.
  - **Fundamental Planning Analysis** looks at all feasible methods of fulfilling a facilities-related need, and may include both MILCON and non-MILCON alternatives.
  - **Design Analysis** comes into play only after a decision has been made to procure a facility with MILCON funding, and examines only design alternatives (like wood vs concrete, or one-level vs multi-level).
- In addition to the two classes of EAs, NAVFAC also recognizes two basic types of EA: Type I and Type II.<sup>24</sup>

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<sup>23</sup> Economic Analysis Handbook, Naval Facilities Engineering Command, October 1993, Paragraph 2.2

<sup>24</sup> Economic Analysis Handbook, Naval Facilities Engineering Command, October 1993, Paragraph 2.2

- A **Type I** EA (also called a primary EA) examines a situation where there is currently a Status Quo method currently filling the need, but consideration is being given to alternative methods of meeting this need at a reduced cost. Example: Replacement of existing high-cost facilities or equipment with lower-cost ones.
  - A **Type II** EA (also called a secondary EA) examines a situation where the need is not currently being met, or the current situation is unacceptable. In Type II EAs there is no Status Quo alternative. Examples: Correction of deficient facilities, or pollution-abatement projects.
- EAs are important for the approval of most DoN facility-related projects. Projects with missing or incomplete EAs do not compete well with well developed and documented EAs. These alternatives may not be approved without one.
  - NAVFAC recommends performing a preliminary EA, at the earliest possible stage of project development, for inclusion with the Project Data Sheet submission.<sup>25</sup> A more detailed EA should later be prepared as part of the DD form 1391/Facility Study submission.
  - The EA should be reviewed and updated each time the project cost is revised, to ensure the alternative selected is the one with the lowest life cycle costs.<sup>26</sup>
  - NAVFAC recommends the use of end-of-year discounting factors when discounting costs to present value.<sup>27</sup>

### **EAs for MAIS/Information Technology (IT) Systems.**

- In a memo dated [30 Jun 2011](#), the DON Chief Information Officer (CIO) directed the use of a standard template for use in IT BCAs. While different from the structure in this guide, the CIO BCA template contains all the same essential elements, but focuses on areas of particular interest to the IT community. The DON CIO guidance also focuses more on budgeting and programming actions than most EAs do.
- The memo requires use of the template for all IT investments subject to Information Enterprise Governance Board, DON, Functional Area Manager, or Echelon II enterprise-level board consideration. Use of the template by other DON decision authorities is strongly recommended for all IT investments and is required for IT investments over \$1M. The memo allows tailoring of the template to fit particular decisional needs based on the scope and nature of the projects.<sup>28</sup>

<sup>25</sup> Economic Analysis Handbook, Naval Facilities Engineering Command, October 1993, Paragraph 2.4.2.b

<sup>26</sup> Economic Analysis Handbook, Naval Facilities Engineering Command, October 1993, Paragraph 2.4.2.d

<sup>27</sup> Economic Analysis Handbook, Naval Facilities Engineering Command, October 1993, Paragraph 3.4.4, page 3-8

<sup>28</sup> DON CIO Standard BCA Template User Guidance, 15 Jul 2011, Paragraph 3

- The template and related guidance depends heavily on the DoD Economic Viability (EV) Tool to calculate costs. An EV analysis is required to be prepared for each alternative. The EV Tool also generates a number of financial indicators, however there is an ongoing debate about the return on investment (ROI) formula in the tool, so while the ROI generated may be used in a BCA, it should not be used in any go/no-go decisions for the system in question.<sup>29</sup>
- Even in cases where the Status Quo or “as-is” alternative is unacceptable, its cost will be used to establish the “cost baseline”. All other alternatives and their financial measures and metrics (like NPV, break-even point, benefit-cost ratio) will be compared to this baseline.<sup>30</sup>

### **EAs for Lease-Purchase Decisions.**

- [OMB Circular A-94](#), *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, distinguishes two types of decisions regarding lease-purchase:<sup>31</sup>
  - **The decision to acquire an asset.** This involves cost-benefit analysis to show acquiring the asset is the best economic alternative.
  - **The decision to lease or purchase the asset.** In this lease-purchase type of analysis, benefits are often essentially the same. In many Navy-Marine Corps analyses, mission need has already determined the requirement. In this situation, only a lease-purchase analysis would be required (i.e., an EA with two alternatives, lease and purchase).
- When estimating for major facilities, the DoN normally does not have authority to solicit bids both for a lease or service contract alternative and for a purchase alternative.
- All EAs involving lease-purchase analysis follow special guidance outlined below. Consult Appendixes 3 and 4 for more detailed guidance on lease-purchase analysis.
  - Leases are often "level term." Their cost is set per month or year over a number of months or years. The lease terms are in effect stated in nominal (i.e., inflated) dollars. For this reason, EAs involving lease-purchase analysis are often accomplished in nominal dollars. Discount these nominal dollars using the nominal Treasury borrowing rate on marketable securities of comparable maturity to the term of the lease. The [rates](#) are updated annually when the President presents his Budget, and are found on the NCCA homepage.
  - If lease costs are stated in constant dollars, use constant dollars in the EA and discount at the real (constant dollar) rate.

<sup>29</sup> DON Enterprise IT Business Case Analysis Template-v. 1.1, 15 Jul 2011, Page 3, Footnote 2

<sup>30</sup> DON CIO Standard BCA Template User Guidance, 15 Jul 2011, Paragraph 5, under “Chapter 4”

<sup>31</sup> OMB Circular A-94, 29 Oct 1992, Paragraph 13

- When the term of a lease or service contract differs from the economic life of the asset under the purchase option, estimate asset terminal value and include the value in the purchase alternative as a benefit (negative cost) in the final period of the analysis.
- Add to the cost of the lease the cost to the Treasury of any special tax benefits associated with a lease.<sup>32</sup> Examples: highly accelerated depreciation allowances or tax-free financing. Consider current tax laws applicable to a lessor to determine whether or not an adjustment is appropriate in a particular EA. Because tax laws change, consult with legal and contracting staff. If a particular leased asset enables a lessor to take advantage of accelerated depreciation tax benefits, increase the contract bid to offset these losses to the Treasury. In most accelerated depreciation schedules, the amount of the special tax advantage is only the portion of the total allowance for depreciation in excess of "normal" economic depreciation. In such cases, the calculation of normal economic depreciation is an annual amount equaling acquisition price divided by economic life.

### **EAs for Major Weapon System Warranties**

- Follow this guidance when performing a cost-benefit analysis (CBA) to determine whether using a warranty is beneficial to the government.
- The principal criterion for determining life cycle cost (LCC) advantage is the present value (i.e., discounted dollars) of expected program costs and benefits, estimated both with warranty coverage and without warranty coverage, and (if appropriate) with partial warranty coverage.
- Plan sufficient lead time to complete the detailed work required in a warranty CBA. Start early if the CBA will support contract negotiations. Intermediate CBA findings are very valuable in establishing government negotiating positions; the CBA identifies expected major cost drivers and potential failure nodes.
  - You may do the CBA as early as the demonstration and validation phase and then update the CBA during full-scale development and source selection or negotiations for the production contract. It is best to accomplish the CBA before release of the Request for Proposal for the production contract and update after receipt of proposals with the contractor's proposed warranty price.
  - The office of primary responsibility (OPR) for life-cycle cost analysis of the program is OPR for the warranty CBA, unless the program manager assigns responsibility elsewhere. The program manager should ensure the CBA is initiated as soon as system technical design is well enough established to allow LCC estimation.

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<sup>32</sup> OMB Circular A-94, 29 Oct 1992, Paragraph 13.c(4)

- Offices of Collateral Responsibility (OCRs) are significant stakeholders and any other organizations with information necessary to develop the life-cycle cost model. OCRs usually include engineering and logistics staffs.
- Estimate LCC for the system or component without warranty coverage. Then estimate LCC under full or partial warranty coverage.
  - Break down the system or item under consideration into its constituent parts, based on the expected major operating and support (O&S) cost drivers and associated failure nodes. Items considered for warranty coverage may be a combination of new components and of components similar to those in historically procured items. Therefore, analysts may face a combination of historical data and engineering forecasts to identify cost drivers and failure nodes.
  - Estimate the expected costs over time for each failure node, based on expected failures and anticipated cost per failure.
    - Use statistical methods or mathematical models to relate failures at each node to variables measuring system deployment and operation (e.g., shelf life, operation cycles, hours of operation, or presence or absence of special operating conditions).
    - Estimate the mean time between failures and variables related to failure, mean operating cycles between failures, etc.
    - Build estimates of the cost of a failure at each node from historical data or projections, as applicable.
    - Sum up monetary LCCs as the total of the costs of each failure node.
- Estimate LCCs for the alternative including warranty coverage. The basic procedure is the same as above: break down the system or item into its major cost components. This is particularly useful for addressing whether proposed warranty provisions should be accepted.
  - Estimate the costs and benefits of each warranty clause or provision.
    - Consider benefits to the government of warranty implementation plans and procedures.
    - Consider administrative costs of the warranty and potential claims the warranty is likely to cover. When possible, identify administrative costs with specific warranty provisions, to increase the precision of the warranty assessment.

- Consider warranty effects on system or item cost components or performance characteristics outside warranty coverage. For example, consider such factors as the effects of warranty provisions on system field performance or the implicit cost differences due to different turnaround times between contractor and in-house repair.

### **EAs for Product Support/Sustainment/Performance-Based Logistics Decisions.**

- [DoDI 7041.3](#), *Economic Analysis for Decisionmaking*, requires any analytic studies for weapons and weapon system support that deal with cost and effectiveness considerations must comply with the policy and procedures in the instruction.<sup>33</sup> This includes any analysis for weapon system sustainment and product support. There two publications that provide more detailed guidance for performing these types of analyses, and while they propose a structure different from the structure in this guide, they contain the essential elements.
  - The Office of the Secretary of Defense for Acquisition, Technology and Logistics (OSD AT&L) has published a DoD Product Support BCA Guidebook.
  - ASN (RD&A) has published a Performance Based Logistics (PBL) Business Case Analysis (BCA) guide. PBL focuses on results-oriented approaches to logistics support, incentivizing and empowering the provider (government, commercial, or some combination) to meet customer performance requirements without directing specific processes or methods.
- For large and extensive analyses, governance becomes very important. Proper governance provides enterprise-wide context for the effort and ensures adequate oversight to steer the analysis through the process.

### **EAs for Open System Architecture (OSA)/Data Rights (DR) Investments**

- Open Systems Architectures yield modular, interoperable systems allowing components to be added, modified, replaced, removed, and/or supported by different vendors throughout the life cycle in order to drive opportunities for enhanced competition and innovation. This leads to increased opportunities for innovation and competition, enable reuse of components and software, facilitate rapid technology insertion, and reduce development schedules and maintenance costs of systems acquired by the DoN.
- A key component of OSA is taking delivery of design information (e.g., CDRLs), exercising rights granted to the Government for technical data and computer software, and acquiring additional data rights when necessary to support a system over its life cycle. In the course of performing an OSA BCA for a program, an additional evaluation

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<sup>33</sup> DoDI 7041.3, 18 Oct 1972, paragraphs 2.2 and 2.4.3

must be made regarding the acquisition of data rights. The importance of acquiring the proper levels of data rights cannot be stressed enough. It is important to note while data rights are a key requirement for the pursuit of Open System Architectures, they are also vitally important to consider for any system acquired by the Government. Therefore, the guidance provided below on data rights should be recognized as being applicable for any National Security System across the enterprise. As a result, programs should consider performing data rights business case analyses regardless of whether their particular system is being designed as an open architecture.

- Alternatives considered in OSA BCAs must include special consideration of the following six core principles of the OSA approach:
  1. Modular designs with loose coupling and high cohesion that allow for independent acquisition of system components, i.e., composability.
  2. Continuous design disclosure and appropriate use of data rights allowing greater visibility into an unfolding design and flexibility in acquisition alternatives.
  3. Enterprise investment strategies that maximize reuse of system designs and reduce total ownership costs (TOC).
  4. Enhanced transparency of system design through Government, academia, and industry peer reviews.
  5. Competition and collaboration through development of alternative solutions and sources.
  6. Analysis to identify components providing the best return on investment (ROI) to OSA, i.e., which components will change most often due to technology upgrades or parts obsolescence and have the highest associated cost over the life cycle.
  
- The following cost components should be considered, at a minimum, in the BCA when evaluating the implementation of an Open Systems Architecture on a system's life cycle.
  - Costs associated with major components – Grouped by Hardware, Software, Middleware, and Operating Systems.
  - Costs associated with varying utilization levels of COTS based Technical Interfaces, Hardware, Software, Middleware, and Operating Systems.
  - Costs of varying utilization levels of Open Source Software (and/or reused).
  - Costs associated with varying levels of insulation of the application from the O/S using Middleware.

- Costs of varying degrees of standardization for communications between layers.
- Costs associated with varying degrees of open, and published ICDs/APIs.
- Costs of modularizing applications.
- Costs of exposing data in standardized format to network/enterprise.
- Costs associated with adherence to a common architecture across multiple programs/domains/platforms.
- Costs for the use of services (program unique services vs. cross-enterprise common services).
- Costs associated with use of commercial standards/best practices.
- Costs associated with pursuing evolutionary acquisition to facilitate rapid technology insertion as described in the Acquisition Strategy.

## Appendix 1

### REFERENCES

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## Appendix 2

### FORMULAS FOR FINANCIAL METRICS, INDICATORS, AND FACTORS

**Mid-year discount factor:**  $F=1/((1+R)^{(Y-.5)})$ , where F is the discount factor, R is the discount rate written as a decimal, and Y is the sequence number of the year in question, beginning at program inception. The formula produces a unique factor for each year in an analysis. NCCA provides annual updates to the discount rates to be used for economic analysis. The rates can be found on the NCCA web page.

**Mid-monthly discount factor:** For analyses of short periods, monthly factors may be more appropriate:  $F = 1/(RM^{(M-.5)})$ , where F is the discount factor, M is the sequence number of the month in question, and RM is the discount rate on a monthly basis, i.e., the 12th root of (1+R), or  $RM = (1+R)^{(1/12)}$ .

**End-of-year discount factor:**  $F=1/((1+R)^{(Y)})$ , where F is the discount factor, R is the discount rate written as a decimal, and Y is the sequence number of the year in question, beginning at program inception.

**Uniform Annual Cost (UAC):** The UAC equals the total discounted life cycle cost of an alternative divided by the sum of the discount factors of the years in which costs were incurred.

**Savings/Investment Ratio (SIR):** The SIR equals the total savings generated from an investment divided by the original investment amount.

**Internal Rate of Return (IRR):** Calculation of IRR can be a difficult task for an analyst. IRR is an indicator of the efficiency, or yield of an investment, as opposed to NPV. NPV is an indicator of the value of an investment. The IRR is the rate at which the difference between the investment and the present value of cash inflows (or savings) is zero. An investment whose IRR exceeds its cost of capital adds value to the investor. This value cannot be directly calculated, and must be derived through an iterative series of guesses bringing the analyst closer to finding the rate at which the difference between the investment and the present value of returns/savings is zero.

We can represent the IRR calculation as shown below, where  $n$  is the period and  $C_n$  is the return/savings cash flow.  $n$  is a positive integer,  $N$  is the total number of periods, NPV is the net present value of the investment. The IRR is given by  $r$ .

$$NPV = \sum_{n=0}^N \frac{C_n}{(1+r)^n} = 0$$

There are many methods one can use to estimate the IRR. The following equation is one method:

$$r_{n+1} = r_n - NPV_n \left( \frac{(r_n - r_{n-1})}{NPV_n - NPV_{n-1}} \right), \text{ where } r_n \text{ is considered the } n^{\text{th}} \text{ approximation of the IRR.}$$

This method requires the analyst to know the initial NPV of the investment, and to make an initial estimate of the IRR ( $r_0$ ). This produces an iterative sequence of IRR and NPV comparisons eventually converging to the point where the difference between NPV and the present value of returns/savings is zero.

Many automated tools exist to calculate IRR. The one most easily accessible to the Navy-Marine Corps analyst is the one found in the IRR function in government-provided spreadsheet software, and we recommend using this tool.

**Return On Investment (ROI):** The total return generated by an investment divided by the initial investment amount.

**Cost/Benefit Ratio (CBR):** The NPV of an alternative divided by the weighted benefit score of the alternative. The result will be a dollar amount, the cost per unit of benefit. The CBR can also be rendered as a Benefit/Cost Ratio (BCR), where the weighted benefit score is the numerator and the NPV is the denominator.

**Payback Period:** If you have one investment amount, and your return/savings is a constant amount every year, this formula applies: Investment Cost divided by the Return/Savings Amount per Period. If the Return/Savings amount you entered is an annual amount, this will give you the year the investment will be paid back. If the Return/Savings amount you entered is a monthly amount, the result will be the number of months required of pay back the investment.

If your investment will span more than one period and/or if your return/savings will be different in different periods, simply add up the expected returns/savings for each period, until the total equals or exceeds the investment total, and will be the period you achieved payback. In the example below, investments are reflected as negative numbers.

	Yearly Totals	Cumulative Totals	
Year 1	-100,000	-100,000	Initial Investment
Year 2	-50,000	-150,000	Additional Investment
Year 3	28,000	-122,000	Savings/Return
Year 4	32,000	-90,000	Savings/Return
Year 5	40,000	-50,000	Savings/Return
Year 6	53,000	3,000	Year of Payback; First year cum total is positive

**Figure A2-1 Payback Period Example**

## Appendix 3

### LEASE-PURCHASE PROCEDURES

**Intent.** Federal agencies should acquire the use of a capital assets in the most economical way possible considering all government costs not only the cost to that agency. Lease-purchase analysis conducted under Circular A-94 will determine whether it would be more economical to lease or to buy a given asset. It is not intended to determine what kind of asset should be acquired, the quantity, or acquisition schedule. When a decision involves both aspects (e.g., a choice between leasing an asset this year and purchasing an asset the next year), the economic analysis should first determine when, in what quantity, or on what acquisition schedule to acquire the asset, and then analyze the lease-purchase aspect of the overall decision using the principles outlined in this Appendix.

**Applicability.** OMB Circular A-94 lease-purchase analysis procedures are required when both of the following conditions are met:

- The analysis involves a capital asset or a group of related assets whose total fair market value exceeds \$2 million.
- The analysis involves a capital asset (including durable goods, equipment, buildings, facilities, installations or land) which:
  - Is leased to the government for a term of 3 or more years.
  - Is new, with an economic life of less than 3 years and is leased to the government for a term of 75 percent or more of the economic life of the asset.
  - Is built for the express purpose of being leased to the Federal government.
  - Is leased to the Federal government and clearly has no alternative commercial use (e.g., a special-purpose government installation).

**NOTE:** Application of these procedures for analysis of asset leases valued at less than \$2 million is optional. Circular A-94 procedures are not required for service contracts involving the use of capital assets by the contractor incidental to the provision of services to the government. However, OMB may require any particular lease or service contract be subject to Circular A-94 provisions.

**Methods of Justification.** All leases of capital assets must be justified as preferable to direct government purchase and ownership. In general, this can be done in one of three ways:

- **Separate Analysis** . This involves conducting a separate lease-purchase analysis on each lease of one or more capital assets by a government agency. This is the only acceptable method for major acquisitions. A lease of one or more capital assets is a major acquisition if:
  - The acquisition represents a separate line-item in the federal agency's annual budget,
  - The agency or OMB determines the significance of the acquisition merits designating

it as major, or

- The total value of the acquisition, as measured by the purchase price of the assets leased, exceeds \$500 million.
- **Generic Class Analysis** . In the case of recurrent decisions to lease similar assets for the same general purpose, periodically conduct a lease-purchase analysis for the entire class of assets in question, using the same analytic methods used to evaluate individual leases. OMB approval should be sought in determining the scope of any such generic analysis.
- **Policy Approval from OMB** . Federal agencies may request approval from OMB of a formal policy that generally results in the same lease-purchase decisions as a requirement for lease- purchase analysis. Agencies must demonstrate:
  - The leases in question would generally result in substantial savings to the government that could not be realized in a purchase,
  - The leases are so small or so short-term as to make separate lease-purchase analysis impractical, and
  - Leases of different types are scored consistently with the instructions in Appendices B and C of OMB Circular A-11. Any such proposed policy must be approved by OASN (FM&C) and forwarded by the Secretariat through OSD to OMB for approval.

**Definitions and Analytic Methods.** The definitions and methods below characterize the principles to be used in lease-purchase analysis.

- **Life Cycle Cost.** Lease-purchase analysis should include a net present value comparison of the life cycle cost of leasing to the full cost of buying or constructing an identical asset. The full cost of buying includes the asset's purchase price plus any relevant ancillary services connected with the purchase. Terms of leases vary. The basic principle is that any services included in the terms of a prospective lease are also included, for purposes of analysis, in the purchase alternative, and vice versa.
- **Ancillary Services** are any services included either in the terms of the lease or the terms of the purchase. If, for example, services will be provided by the lessor but are not included in the purchase price, then the cost of obtaining these services separately should be added to the purchase price. Such costs may be excluded if they are estimated to be the same for both lease and purchase alternatives or too small to affect the comparison. If costs are excluded for these reasons, they must be addressed in the assumptions section of the analysis. Examples of ancillary services include:
  - All costs associated with acquiring the property and preparing it for use, including construction, installation, site, design, and management costs.
  - Repair and improvement costs.
  - Operation and maintenance costs.
  - Imputed property taxes (excluding foreign taxes on overseas acquisitions except where actually paid); imputed taxes approximate the costs of providing municipal services such as water, sewage and police and fire protection.

- Imputed insurance premiums. Imputed costs do not involve a direct monetary payment but are included in an analysis to provide a consistent basis of comparison.
- **Economic Life.** For purposes of lease-purchase analysis, the economic life of an asset is its remaining physical or productive lifetime. An asset's economic life begins when the asset is acquired and ends when the asset is retired from service. The economic life is frequently not the same as the useful life for tax purposes.
- **Purchase Price.** The purchase price of the asset for purposes of lease-purchase analysis is its fair market value, defined as the price a willing buyer could reasonably expect to pay a willing seller in a competitive market to acquire the asset. Estimates of fair market value may be obtained from catalogs, e.g., GSA catalogs, from vendor quotations or from data on recent purchases. **NOTE:** Seeking vendor quotes is done in consultation with acquisition or contracting personnel so it is clear the government is conducting an analysis and not making a commitment.
  - In the case of property already owned by the Federal government or donated or acquired by condemnation, an imputed purchase price should be estimated.
  - If public land is used for the site of the asset, the imputed market value of the land should be added to the purchase price.
  - The asset's estimated residual value, as of the end of the period of analysis, should be subtracted from its purchase price. A property's residual value is an estimate of the price the property could be sold for at the end of the period of the lease-purchase analysis. The recommended way to estimate residual value is to determine what similar, comparably aged property is currently selling for in commercial markets. Alternatively, book estimates of the resale value of used property may be available from industry or government sources. Assessed values of similar, comparably aged properties determined for property tax purposes may also be used.
- **Property Taxes.** Imputed property taxes may be estimated in two ways:
  - Determine the local property tax rate and assessed (taxable) value for comparable property; if there is no basis to estimate future changes in tax rates or assessed value, the first-year rate and assessed value (inflation-adjusted for each subsequent year) can be applied to all years; multiply the assessed value by the tax rate to determine the annual imputation for property taxes.
  - Obtain an estimate of the current local effective property tax rate from the Building Owners and Managers Association's Regional Exchange Reports. Multiply the fair market value of the government-owned property (inflation-adjusted for each year) by the effective tax rate.
- **Insurance Premiums.** Imputed insurance premiums may be estimated by determining local estimates of standard commercial coverage for similar property from the Building Owners and Managers Association's Regional Exchange Reports.

## Appendix 4

### SPECIAL TAX ADVANTAGES IN LEASE-PURCHASE ANALYSIS

OMB Circular A-94 specifies that in lease-purchase analysis the cost of leasing should include "...the cost to the Treasury of any special tax benefits associated with leasing such as the investment tax credit or the tax deferral provided by accelerated depreciation allowances." The Tax Reform Act of 1986 subsequently repealed the investment tax credit. The Deficit Reduction Act of 1984 together with the Tax Reform Act of 1986 effectively eliminate accelerated cost recovery system (ACRS) depreciation for assets leased by the US government, under most circumstances. Analysts should seek legal and contracting opinion to ascertain whether or not a given lease provides a favorable tax advantage to lessors or service providers (hereafter referred to simply as lessors). This may require obtaining an opinion from the legal office servicing their organization. If the law changes in the future to allow ACRS or a modified ACRS (MACRS), there will be tax losses to the US Treasury. The procedures below show how to estimate those tax losses so they can be included in a lease-purchase EA if appropriate. Neither normal taxes on income and profit nor ordinary depreciation of assets should be included as a cost or benefit to the government. If it is known that the lessor will take advantage of favorable tax provisions contained in ACRS or MACRS, then it will be assumed in the analysis that the lessor's marginal tax rate is the maximum corporate rate.

ACRS and MACRS depreciation allowances are amounts subtracted from the lessor's taxable income. Therefore, only the portion of the total allowance in excess of normal "economic depreciation" contributes to special tax advantage. Accelerated depreciation schedules allow deductions greater than economic depreciation in the first few years of asset ownership. Since no more than 100 percent of asset value may be deducted during its life (by any one owner), this means accelerated depreciation schedules provide smaller deductions in later years of ownership, compared to economic depreciation, and therefore tax disadvantages for these years. Altogether, ACRS or MACRS provides a tax advantage through deferral and the time value of money. The amount of taxes deferred in any year  $t$  is equal to  $T(A_t - D_t)$  where  $A_t$  is the amount the lessor is able to deduct under ACRS or MACRS.  $D_t$  is the amount deductible under economic depreciation, and  $T$  is the marginal tax rate.

An economic analysis compares the outlays associated with different alternatives; therefore, the tax deferral due to ACRS or MACRS, a revenue loss, must be made equivalent to an outlay by the Treasury. The cost to the Treasury of ACRS or MACRS, equivalent to a normal outlay, is

$$T(A_t - D_t) / (1 - T)$$

For the later years of asset life, this sum is negative (i.e., for those years when economic depreciation exceeds ACRS or MACRS allowable deductions). The outlay-equivalent measure of tax losses should be added (effectively, subtracted for later years) to annual costs for the lease alternative in the economic analysis.

Schedules of annual deductions allowed under ACRS or MACRS are available from IRS Publication 534. Computation of the annual amounts will differ under ACRS and MACRS. The

simplest way to estimate economic depreciation of an asset is by straight-line depreciation over its economic life. Therefore, annual economic depreciation of an asset is approximately equal to its acquisition price divided by its economic life, for each year of its economic life.

## Appendix 5

### MATRIX OF RESPONSIBILITIES FOR ECONOMIC ANALYSIS (EA)

<u>TASK</u>	<u>ECONOMIC ANALYST</u>	<u>FUNCTIONAL OPR</u>
Identify Need		OPR
Determine if EA Required	OCR	OPR
Initiate EA		OPR
Develop Alternatives	OCR	OPR
Identify Data Requirements	OPR*	OPR**
Data Gathering	OCR	OPR
Data Analysis	OPR	
Recommend/Select Alternative	OCR	OPR
Identify Changes in Scope		OPR
Documentation	OPR*	OPR**

\* For cost data

\*\*For functional data

OPR – Office of Primary Responsibility

OCR – Office of Collateral Responsibility

## Appendix 6

### COST SUMMARY FORMATS

The following table is an example of a spreadsheet to capture and summarize non-recurring and recurring costs. Add additional rows and columns as needed. Use one spreadsheet for each alternative.

Cost Summary								
Title of Alternative		Alternative 1: Status Quo						
Project Life (Years)		9						
Program/Project Costs								
Project Year	Non-Recurring			Recurring			TOTAL Recurring	Grand TOTAL
	Development	Purchase & Installation	TOTAL Non-Recurring	Maintenance	Utilities	License Fees		
2013	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2014	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2015	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2016	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2017	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2018	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2019	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2020	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2021	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>TOTAL</b>	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -

The following table is an example of a spreadsheet that can receive recurring and non-recurring totals from the previous spreadsheet, summarize all costs and any possible residual values, and calculate total discounted costs. Use one spreadsheet for each alternative. Make sure you use the correct discount factors for your project.

Cost Summary - Alternative 1: Status Quo					
1. Submitting Organization		(Organization)			
2. Type of Submission		(Initial)			
3. Project Title		(Title)			
4. Description of Project Objective		(Brief description of Objective)			
5. Title of Alternative		(Name, number of alternative/COA)			
6. Project Life (Years)		9			
7. Program/Project Costs		(NOTE: discount factors are rounded)			
a. Project Year	b. Non- Recurring Investment	c. Recurring Operations	d. Annual Cost	e. Discount Factor	f. Discounted Annual Cost
2011	\$ -	\$ -	\$ -	0.9936	\$ -
2012	\$ -	\$ -	\$ -	0.9808	\$ -
2013	\$ -	\$ -	\$ -	0.9682	\$ -
2014	\$ -	\$ -	\$ -	0.9558	\$ -
2015	\$ -	\$ -	\$ -	0.9435	\$ -
2016	\$ -	\$ -	\$ -	0.9314	\$ -
2017	\$ -	\$ -	\$ -	0.9195	\$ -
2018	\$ -	\$ -	\$ -	0.9077	\$ -
2019	\$ -	\$ -	\$ -	0.8960	\$ -
<b>8. TOTAL</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>8.4965</b>	<b>\$ -</b>
9. Total Discounted Project Cost: Line 8, Column F					\$ -
10. Uniform Annual Cost (without terminal value): Line 9 / Line 8, Column E					\$ -
11. Discounted Residual Value					\$ -
<b>12. NET TOTAL PROJECT COST (discounted): Line 9 - Line 11</b>					<b>\$ -</b>
13. Uniform Annual Cost (with residual value): Line 12 / Line 8, Column E					\$ -
14. Source/Derivation of Cost Estimates: Included in Appendix 1					
15. Principal Action Officer		Name & Title / DSN / Email			

## Appendix 7

### SAMPLE BENEFIT ANALYSIS

This analysis of non-quantifiable benefits was accomplished using inputs of a team consisting of members drawn from a variety of functional areas on the base: facilities engineering, security/force protection, safety, fleet & family readiness, personnel, and financial management. The team determined the benefit categories and the weights for each. Each member scored each individual benefit, and the scores for each benefit were then averaged and weighted.

Each benefit category was assigned a weighted value from 1 to 10, with 10 being the most important, and scored using a percent scale from 0% to 100%, with 100% representing the most benefit.

Scores were based on how well each alternative met each benefit criterion discussed above. Alternatives not meeting the criteria were given a score of zero.

The following are the benefits measured and the criterion used:

(1) Mission Readiness: Refers to how commute times at a base with an alert mission will be reduced depending on the option chosen and the location of the quarters.

(2) Security/Safety: Refers to how well the option provides for the security and safety needs of our service members.

(3) Meeting Standards: Refers to how well the quarters meet DoN standards.

(4) Morale: This benefit is a measure of the morale and retention factors.

Computations:

Benefit	Weight	Status Quo		Renovation		New Construction	
		Score	Wtd Score	Score	Wtd Score	Score	Wtd Score
Mission Readiness	10	50%	5.0	90%	9.0	100%	10.0
Safety/Security	9	30%	2.7	80%	7.2	100%	9.0
Meeting Standards	5	50%	2.5	50%	2.5	100%	5.0
Morale	4	25%	1.0	75%	3.0	100%	4.0
<b>Total Benefits Score</b>			11.2		21.7		28.0

Scoring was based on the following:

Mission Readiness: Status quo, renovation, and construct new options all provide adequate

housing in on-base locations. This ensures military personnel do not have to commute to the base, thus allowing quicker mobilizing capability and higher mission readiness.

Security/Safety: Status quo, renovation, and construct new options are located on base, therefore, affording the benefits of base security procedures and entry control. Security is improved with both options as service members would adequately reside within the confines of the base boundaries with subsequent security force response time being minimal. This measure also reflects the physical condition of the housing with respect to being a safe living environment for its occupants, with a minimum of design and maintenance-related hazards.

Meeting Standards: Improved living conditions would be provided with renovation, construct new and move off base options. Internal finishings and facilities are improved to high modern standards for the benefit of family enjoyment. The level of finishing standards in the refurbished quarters or the newly built housing units and their impact on the living patterns of occupants would greatly enhance morale. New construction materials and modern construction techniques will provide superior energy efficiency and hence a more comfortable environment at less cost. The status quo option, for the most part, has occupants residing in older-type dwellings, containing inferior materials and unsanitary utilities.

Morale:

The status quo option has substandard housing, poor parking and few playgrounds which cannot be addressed via the maintenance program and would continue to frustrate residents.

The renovation option upgrades existing facilities on base and also improves the overall appearance of the housing areas and is more inviting for newcomers.

Both the renovation and new construction options would enhance the community spirit with extended accommodation, improved parking facilities and playgrounds. Morale would be enhanced by providing our service members new facilities, thus forming a cohesive environment.

## **Appendix 8**

### **RECOMMENDED ELEMENTS FOR CHANGE MANAGEMENT TRAINING PLAN**

- 1.** A description of the scope of the training.
- 2.** A description of the training objectives.
- 3.** The training strategy.
- 4.** Background information such as a description of the desired skills outcome and a high-level overview of the curriculum.
- 5.** The training requirements such as the required skills, the audience(s), individuals or positions needing specific training, and the required time frame.
- 6.** The training roles and responsibilities.
- 7.** A method for evaluating the training.
- 8.** Existing sources for training.
- 9.** Training resources: any additional or future resources supporting training.
- 10.** Costs of training.
- 11.** Any constraints or limitations affecting the training.
- 12.** A description of the training environment.
- 13.** A description of the training materials.
- 14.** A course outline.
- 15.** A log for keeping track of who has received training.
- 16.** A process for updating the training materials.
- 17.** A recommendation on whether training should be accomplished in-house or by contractors.
- 18.** Any budget implications of the proposed training.