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HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON DC

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MEMORANDUM FOR DISTRIBUTION C
MAJCOMs/FLDCOMs/FOAs/DRUs

FROM: SAF/FMC
1130 Air Force Pentagon, Suite 5E857
Washington DC 20330-1130

SUBJECT: Department of the Air Force Guidance Memorandum to Department of the Air Force Manual 65-506, *Economic Analysis*

By order of the Secretary of the Air Force (SecAF), this Department of the Air Force (DAF) Guidance Memorandum (DAFGM) immediately implements changes to Air Force Manual (AFMAN) 65-506, *Economic Analysis*. Compliance with this memorandum and its attachments is mandatory. To the extent its direction is inconsistent with other Department Air Force publications, the information herein prevails in accordance with DAFMAN 90-161, *Publishing Processes and Procedures*.

This publication applies to individuals and organizations at all levels of the Air Force, Space Force, Air Force Reserve and Air National Guard (ANG).

This memorandum was updated to align operations with changes to Department of Defense Financial Management Regulation (DoD 7000.14-R) Volume 2B Chapter 6 (Military Construction / Family Housing Appropriations). Additionally, this memorandum clarifies roles and responsibilities for real property projects, and other updates to terminology.

Ensure all records generated as a result of processes prescribed in this publication adhere to Air Force Instruction (AFI) 33-322, Records Management and Information Governance Program, and are disposed in accordance with the Air Force Records Disposition Schedule which is located in the Air Force Records Information Management System.

This memorandum becomes void after one year has elapsed from the date of this memorandum, or upon publication of an interim change (IC) or rewrite of the affected publication, whichever is earlier.

DAVID B. MARZO, SES, DAF
Acting Assistant Secretary of the Air Force
(Financial Management and Comptroller)

Attachment:
Attachment 1 - Economic Analysis

Attachment 1 - Economic Analysis

Current guidance in AFMAN 65-506, *Economic Analysis,* remains in effect with the following changes:

The instruction title is changed to DAFMAN 65-506 since it applies to both Air Force and Space Force resource decisions.

Opening Paragraph Applicability Sentence. Changed. This publication applies to individuals and organizations at all levels of the Air Force, Space Force, Air Force Reserve and Air National Guard (ANG).

4.5.3.3.1. Changed. Uniform Annual Cost is a method to compare alternatives with unequal lives by an average present value cost per year. UAC is the annuity required to equal the net present value (NPV) of an alternative's cash flows over the alternative's economic life. UAC is calculated by dividing the NPV of an alternative by the sum of the discount factors for the annual periods covering the economic life of that alternative.

4.5.3.3.2. Changed. The period of analysis under Uniform Annual Cost is equal to the economic life of the alternative with the longest economic life, but each alternative will use its own economic life for the UAC calculation.

7.4.2.2. Changed. Uniform Annual Cost (UAC): UAC is a method to compare alternatives with unequal lives by average present value cost per year. UAC is the annuity required to equal the NPV of an alternative's cash flows over the alternative's economic life. UAC is calculated by dividing the NPV of an alternative by the sum of the discount factors for the annual periods covering the economic life of that alternative.

A7.4. Changed. Uniform Annual Cost (UAC): Uniform Annual Cost is a method to compare alternatives with unequal lives. UAC is the annuity required to equal the NPV of an alternative's cash flows over the alternative's economic life. UAC is calculated by dividing the net present value of the costs of an alternative by the sum of the discount factors for the annual periods covering the life of each alternative in which costs were incurred. The following is a notional example showing the Uniform Annual Cost calculations for two alternative methods for meeting an objective. The first alternative has an economic life of 5 years, and the second alternative has an economic life of 10 years. The example uses a 2.7% midyear discount rate:

References

Changed. AFI 32-6000, *Housing Management,* 18 March 2020

DELETED. AFI 32-6004, *Furnishings Management Program,* 27 January 2016

DELETED. AFI 32-6005, *Unaccompanied Housing Management,* 29 January 2016

A11.1. Changed. Introduction. This Attachment provides guidance on the preparation of construction and repair comparative analyses required as part of the project justification process for Facility Improvement, Replacement, and New Construction projects IAW DAFI 65-501. Based on the guidance governing the requirement analyses, a comparative analysis for real property construction and repair is called an economic analysis. A thorough and well documented economic analysis is a critical factor in project approval and subsequent Congressional appropriation. The purpose of this manual is to assist in conducting and documenting the results of applying the economic analysis approach to real property decisions. In this area, the analyses that result are called economic analyses.

A11.1.1. Changed. Types of Projects Covered. The information contained in this section is relevant to construction and repair projects IAW DAFI 65-501.

A11.1.2. DELETED. Relevant projects include, but not limited to: administrative facilities, transient quarters, dormitories, maintenance facilities, warehouses, child care facilities, Military Family Housing and mission support facilities.

A11.2.3. Changed. Complete a full economic analysis or a waiver to an economic analysis for each facility project as determined by DAFI 65-501. The preliminary economic analysis is often the basis for this full economic analysis unless conditions surrounding the project have changed substantially.

A11.3. Changed. Analysis Coordination. According to DAFI 65-501, the primary responsibility for performing the economic analysis for MILCON lies with the Financial Management staff at the affected organizational level. Collateral responsibility lies with the Civil Engineering staff and the project user. Completing the economic analysis requires close coordination between Financial Management, Civil Engineering and the user. See Attachment 2 in DAFI 65-501 for the responsibility matrix of these organizations. See **Attachment 3** of this manual for the certification process for construction and repair economic analyses and for the approval process for economic analysis waivers.

Figure A11.1. DELETED

A11.5.5.3. Changed. Placing the facility in closed status. This option involves closing up the facility, disconnecting the utility lines and performing no future maintenance.; "mothballing" and "pickling" are colloquial terms for closed status. The utility disconnection and associated facility closing costs are included in the analysis.

A11.6.5. Changed. Other One-Time Costs. Accurate assessment and inclusion of other one-time costs is imperative to ensure a complete analysis. Examples of one-time costs include:

Figure A11.9. Changed. Summary of Data Sources for Construction and Repair Economic Analyses.

Data Type	Primary Source	Other Sources
Construction Costs	PACES	RS Means, Air Force Historical Cost, DoD Facilities Pricing Guide UFC 3-701-01, ECONPACK
Annual Maintenance & Repair Costs	NexGen IT, PACES, ECONPACK, BCE	DEMRC: Form 1133, BCE: RCS HAF LEE (SA) 7101, Whitestone, ECONPACK
Periodic Maintenance & Repair Costs	DUERS, NexGen IT, BCE	DEMRC: Individual facility jackets, RS Means OR Dodge, Whitestone, ECONPACK
Utility Costs	DUERS, NexGen IT, BCE	BCE: RCS HAF LEE (SA) 7101, MAJCOM Consumption Report, ECONPACK
Miscellaneous Operations and Maintenance Costs	Base Contracting, Facilities Management Office, Base Transportation	RS Means, Dodge, Whitestone, ECONPACK
Lease Costs	Base Real Property Office	Off-base real estate broker, GSA, ECONPACK
Basic Allowance For Housing	Financial Management Office	Housing Office, For rates: https://www.defensetravel.dod.mil/site/bah.cfm,
Per Diem	Base Billeting Office	For rates: https://www.defensetravel.dod.mil/site/bah.cfm
Discount Rates, Price Escalation Indices and Inflation Indices	Air Force Portal	

A11.6.11.2.1. Changed. Uniform Annual Cost uses a life cycle cost to measure the cost of each alternative. In addition, construction and repair economic analyses are required to report the life cycle cost of each alternative using the Uniform Annual Cost Method as well as the Terminal Value Method as described in Chapter 4 of this DAFMAN.

A14.8. Added. **Category Management Savings and Cost Avoidances Definitions**

A14.8.1. Added. The Savings and Cost Avoidance definitions in this DAFMAN include language specific to the context of a comparative analysis. This section provides additional guidance on defining Savings and Cost Avoidances as types of cost reductions that are tracked by Category Management reporting systems (i.e. for SAF/AM). These definitions were developed for appropriated funds cost reduction initiatives.

A14.8.2. Added. **Savings** – Reductions to a budget line / funded program because of a new policy, process or activity with no adverse impact on mission. For the execution year, the budget line is defined as the funded amount according to the Execution Plan / Initial Distribution. Projected savings for years beyond the execution year include reductions to a funded program within the Future Years Defense Program.

Attachment 1 - Economic Analysis

A14.8.3. Added. **Cost Avoidance** – Cost avoidances are the reduced need to incur funding increases in the future (above current funding levels) that would otherwise occur if current management practices were not changed. Cost avoidance also includes the organization's ability to resource validated requirements that were not previously funded in the Execution Plan / Initial Distribution. Cost avoidances also include productivity gains (measured in units other than dollars) that do not result in savings, such as a reduction in required man hours to provide a good or service that does not result in a deleted position.

A14.8.4. Added. Principles to assist in adjudication between Savings and Cost Avoidance

A14.8.4.1. Added. Savings are a reduction in resources allocated in the baseline (usually, the budget) that could, due to the cost-affecting action (policy, process, or activity), be transferred and used elsewhere while the original mission is still being accomplished.

A14.8.4.2. Added. Savings can be counted in future years if the baseline cost for those years would be affected/reduced.

A14.8.4.3. Added. If the cost reduction would not adjust the baseline cost, then the reduction would be considered a cost avoidance.

A14.8.4.4. Added. Cost avoidance can be counted in future years if those unfunded costs would have been incurred otherwise.

A14.8.4.5. Added. A cost reduction action can cause ***both*** savings and cost avoidance, depending on effect on the baseline budget.

A14.8.4.6. Added. This necessarily precludes fallout-funded programs from claiming "savings" in future years, because those funds are not in the baseline for those years; however, if an action was taken to reduce such "reasonably expected" costs in future years, that reduction could be a cost avoidance.

A14.8.4.7. Added. Similarly, if an action has some other monetizable benefit, but such would not be reflected in a reduction to the baseline budget, it could be a cost avoidance (e.g. an action that saves manpower hours but results in no loss of manpower positions).

BY ORDER OF THE SECRETARY OF THE AIR FORCE

AIR FORCE MANUAL 65-506

6 SEPTEMBER 2019

Financial Management

ECONOMIC ANALYSIS

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

ACCESSIBILITY: Publications and forms are available on the e-Publishing website at **www.e-Publishing.af.mil** for downloading or ordering

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OPR: SAF/FMCE

Certified by: SAF/FMC
(Ms. Pamela C. Schwenke)

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AFMAN 65-510, 19 October 2010

Pages: 166

This manual implements Air Force Instruction (AFI) 65-501, *Economic Analysis*, by providing information on applying the Economic Analysis (EA) approach to support Air Force decisions. This publication applies to all civilian employees and uniformed members of the Regular Air Force, the Air Force Reserve and the Air National Guard. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using AF Form 847, *Recommendation for Change of Publication*; route AF Forms 847 from the field through the appropriate functional's chain of command. The authorities to waive wing/unit level requirements in this publication are identified with a Tier ("T-0, T-1, T-2, T-3") number following the compliance statement. See AFI 33-360, *Publications and Forms Management*, for a description of the authorities associated with the Tier numbers. Submit requests for waivers through the chain of command to the appropriate Tier waiver approval authority, or alternately, to the Publication OPR for non-tiered compliance items. This publication may be supplemented at any level, but all direct Supplements must be routed to the OPR of this publication for coordination prior to certification and approval. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Air Force.

SUMMARY OF CHANGES

This manual combines AFMANs 65-506, *Economic Analysis,* and 65-510, *Business Case Analysis Procedures*. This manual clarifies that economic analysis is both an analytical approach to decision-making and one of many products resulting from the analytical approach. This manual includes a clarification that all Comparative Analysis products (e.g., Economic Analysis (EA), Cost Benefit Analysis, Analysis of Alternatives (AoA), Business Case Analysis (BCA)) fit under the umbrella of the economic analysis approach and are subject to this instruction (consistent with Department of Defense Instruction (DoDI) 7041.03, *Economic Analysis for Decision Making*). This manual clarifies that the level of rigor in an economic analysis will vary with multiple factors (e.g., maturity of the project, dollar value of the project)

This manual updated and added detail to the elements that must be addressed as part of the economic analysis approach. This manual includes an economic analysis process overview with tips on how to get started.

This AFMAN revised the chapter contents to more closely align with the elements that must be included in a comparative analysis. Chapter 2 was expanded to include: Background, Scope, Facts and Ground Rules. The Objective and Assumptions sections of Chapter 2 were clarified.

This manual made the instruction on alternatives into its own Chapter (Chapter 3). The Chapter expands upon the previous explanation of alternatives.

This manual expands the Chapter on cost (Chapter 4) to include more information on building the cost analysis. Chapter 4 includes a table to explain the different purposes of cost estimates and provide the context of how building the cost estimates for a comparative analysis differs from other cost estimates. Chapter 4 explains the incremental cost concept. Chapter 4 includes the basic steps for building a cost estimate and a brief description of a few common estimating techniques. Chapter 4 moved topics such as terminal value, discount factors, present value, and Uniform Annual Cost method to the section on "Other Considerations in the Cost Analysis."

The chapter on benefits (Chapter 5) now includes more information on building a benefit analysis. Chapter 5 added flexibility to allow for benefits to be expressed as either a narrative or on an ordinal scale. Chapter 5 includes more detail on developing a benefit hierarchy (if needed) and weighting benefits. Chapter 5 includes examples of benefit analysis summary tables.

The chapter on Uncertainty Analysis (sensitivity and risk analysis) (Chapter 6) now includes more information on building risk and sensitivity analyses. Chapter 7 now includes comparison of alternatives, providing results, documentation and post analysis activities. This chapter includes a requirement to provide an interpretation of results. The post analysis activities include such topics as: an implementation plan and stakeholder analysis. This manual moved special analyses to the attachments and expanded them. This manual updated the attachments to include a section on the Clinger-Cohen Act analyses (**Attachment 13**) and a section on Real Property Construction and Repair analyses (**Attachment 11**).

This manual moved the Economic Impact Analysis (EIA) to **Attachment 12**. The attachment was changed to adapt to the new source of multipliers. This update includes references to a new Excel Tool that implements the new method for performing the economic impact analysis.

This manual updates the form for submitting a waiver and the format for the Executive Summary.

This manual added information on the certification process that includes consideration of recent changes to Air Force organizations. This manual also updated the certificate of satisfactory economic analysis.

This manual updated the Economic Analysis Review Guide (**Attachment 6**), and the Preparer's Guides (**Attachment 5**). This manual updated the formulas for Factors and financial Indicators (**Attachment 7**).

This manual updates the sample formats for summary of costs (Format A and Format A-1) (**Attachment 8**). The update clarifies which costs should be included when using the Uniform Annual Cost Method versus the Terminal Value Method.

Chapter 1

ECONOMIC ANALYSIS PRINCIPLES

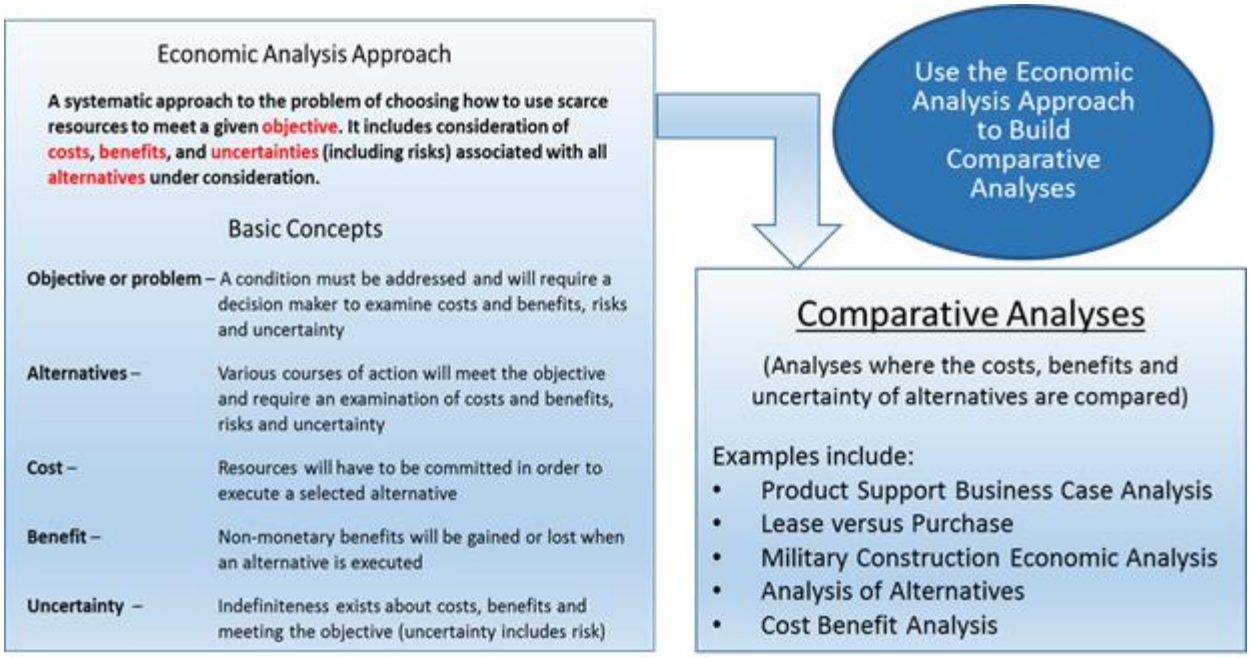
1.1. Economic Analysis Background

1.1.1. Economic analysis is a systematic approach to decide how to use scarce resources to meet a given objective. Properly using the economic analysis approach yields an impartial analysis of competing alternatives to meet an objective, and weighs the costs, and benefits and uncertainty for each alternative. The economic analysis approach does not replace the judgment of a decision maker, but rather provides an analytic and uniform foundation upon which sound decisions can be made.

1.1.2. Analyses that include costs and benefits to support decision making are performed under a variety of names (e.g., Cost Benefit Analysis, Analysis of Alternatives, Economic Analysis, Business Case Analyses). Any analysis that includes cost benefit and uncertainty considerations fits under the definition of "economic analysis" even though not specifically titled as such.

1.1.3. For the remainder of this manual, all analyses resulting from implementing the economic analysis approach will be referred to as "comparative analyses" or simply as "analyses" unless referring to a specific product whose name has been directed at a higher level (e.g., Product Support Business Case Analysis, Military Construction Economic Analysis). The conceptual approach to decision-making will be referred to as economic analysis to remain consistent with DoDI 7041.03.

Figure 1.1. Economic Analysis Approach and Comparative Analysis.



1.1.4. The economic analysis approach considers all significant anticipated effects of a decision across the entire organization, not just the financial ones. It also assesses the likelihood that those effects will occur as anticipated (i.e., uncertainty/risk).

1.1.5. Programs, projects, and initiatives evaluated using the economic analysis approach may include any significant decision that leadership is contemplating. The following is a sample (not all-inclusive) list of programs and situations for which the economic analysis approach can be used to assist in decision making:

1.1.5.1. Military construction (MILCON), military family housing and facility repair.

1.1.5.2. Tradeoffs between force structures, force size, modernization, fuel/energy consumption, and readiness.

1.1.5.3. Manpower analysis.

1.1.5.4. Projects to mechanize, automate, prevent obsolescence, improve workflow and layout, or increase capacity.

1.1.5.5. Acquiring, repairing, supporting, modifying or replacing weapon systems, information systems or information technology.

1.1.5.6. Acquiring or upgrading equipment to reduce operating and support costs.

1.1.5.7. Lease or purchase of general purpose real property, such as office buildings, warehouses, and associated land.

1.1.5.8. Consolidating facilities, such as warehouses, maintenance and storage depots, and repair activities to decrease cost for any reason or to add to mission effectiveness.

1.1.5.9. Business process improvement (business reengineering).

1.2. Elements of the Economic Analysis Approach.

1.2.1. The economic analysis approach will be driven by the context around the decision. Some of the drivers include: the stage a program or project is in its life cycle, the level of resources consumed in the project, the level of visibility, and the scope/significance of the objective. As a result, analysis may require a tailored approach to fit the project. Tailoring could include abbreviating some elements of the analysis, or going into greater depth on some elements, but in almost all cases the basic elements in 1.2.2 need to be included in some manner.

1.2.2. Unless otherwise stated, the elements below must be included when applying the economic analysis approach. **(T-2).**

1.2.2.1. Background/Objective/Scope – These areas provide the programmatic foundation upon which the analysis is built. The background provides the context for the analysis while the objective and scope define what the project or program under study seeks to attain.

1.2.2.2. Facts/Ground Rules/Assumptions – These areas identify parameters significant to the analysis. Facts are key known parameters that are significant to the analysis. Ground rules are general principles (often directive in nature) that provide bounds for the analysis. Assumptions are key parameters where the values and circumstances must be estimated because reliable knowledge is lacking. Without assumptions, analytical models would not be able to produce useful conclusions.

1.2.2.3. Alternatives – Solution sets evaluated to meet the objective.

1.2.2.4. Cost Analysis – Analysis of monetary costs/savings/revenue effects by alternative.

1.2.2.5. Benefit Analysis – Analysis of non-monetary attributes of each alternative.

1.2.2.6. Uncertainty Analysis

1.2.2.6.1. Sensitivity Analysis – Test of the assumptions to see how the results are impacted.

1.2.2.6.2. Risk Analysis – Analysis of risks by alternative.

1.2.2.7. Summary and Comparison of Alternatives – Evaluation and comparison of the alternatives and discussion of key findings in the analysis.

1.2.2.8. This list does not preclude an analyst from incorporating other relevant information when using the economic analysis approach to complete a comparative analysis.

1.2.3. The resulting comparative analysis product will be formatted with the following sections: a certification (when required by AFI 65-501, para 1.7), an executive summary, the analysis itself, supporting appendices and supporting documentation. **(T-2).**

1.3. Applying the Economic Analysis Approach: Overview.

1.3.1. Sources of guidance and support

1.3.1.1. When the need for a comparative analysis is identified, one of the first questions is where to get guidance and support. **Figure 1.2** illustrates primary support organizations for acquisition-related and all other analyses.

1.3.1.2. For Major Command (MAJCOM) and Installation organizations (outside of weapon system acquisition), the Air Force Installation and Mission Support Center Resource Management Cost Division (formerly the Financial Management Center of Expertise) or MAJCOM Cost Staff are the primary sources of guidance and support.

1.3.1.2.1. The scope and type of project may affect which organization ultimately assists with a comparative analysis project.

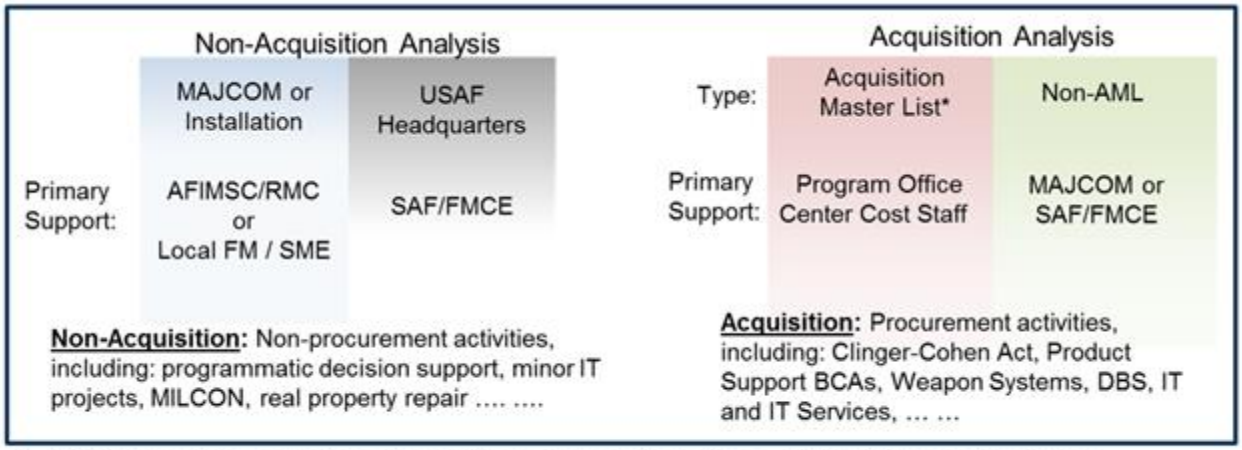
1.3.1.2.2. As an example, while an Installation Financial Office should contact the Air Force Installation and Mission Support Center Resource Management Cost Division for support with an analysis, that analysis may be passed to the Air Force Economics and Business Management Division (SAF/FMCE) for support if its scope crosses multiple MAJCOMs.

1.3.1.3. For Headquarters Air Force level organizations, SAF/FMCE is the primary source of guidance and support.

1.3.1.4. For weapon system acquisition programs on the Acquisition Master List or other Acquisition designations (e.g., Fiscal Year (FY) 17 National Defense Authorization Act section 804 programs), the primary source of guidance and support is the program's Center Cost staff.

1.3.1.5. For acquisition programs which are not included under paragraph 1.3.1.4 above, the primary sources of guidance and support are SAF/FMCE, MAJCOM Financial Management staff, or Center Cost staff.

Figure 1.2. Comparative Analysis Support.



* AML Programs, or other Acquisition designations (e.g., FY17 National Defense Authorization Act (NDAA) § 804 programs)

1.3.2. Build a Plan and Schedule

1.3.2.1. Build a plan for the analysis. Identify key personnel including the decision maker, functional experts, and other analysts and support. Confirm the objective and scope of the analysis and how it will be used. Identify sources for cost, performance, capability, and other benefit and uncertainty data, etc., as applicable. Verify the higher-level review and certification requirements. Identify the specific deliverables required.

1.3.2.1.1. Depending on the scope and the time available, hold a kickoff meeting with key stakeholders to determine the plan and schedule.

1.3.2.1.2. The elements in this section are important to consider even for an analysis which will not be formalized.

1.3.2.2. Timeliness is important in a comparative analysis. Particularly when there is a hard suspense (e.g., Program Objective Memorandum build), it is important to develop a schedule that meets the decision-maker's timeline. If the analysis is completed too late for the decision, it will not have an impact. When the suspense is softer, the analyst may be able to negotiate the schedule in order to provide a more robust analysis. This is a balance that will need to be addressed early in the program.

1.3.3. Foundation - Work with the requirement owner to develop foundational elements.

1.3.3.1. The foundational elements include: background, objective, scope, facts, assumptions, and ground rules.

1.3.3.2. These foundational elements guide the remainder of the estimate. It is important to understand that while they guide subsequent analysis, they can be revisited and updated if the update would lead to a more valuable analysis. In particular, the assumptions should be revalidated and updated during the analysis process.

Figure 1.3. Foundational Elements.

During the development of the foundational elements consider starting the executive summary (see Attachment 2). It will begin to give structure to the analysis and will be a good communication tool.

1.3.4. Alternatives – After these initial steps, the analyst will have the foundation needed to develop a set of alternatives that would satisfy the objective. Chapter 3 provides more details on developing an appropriate set of alternatives.

1.3.5. Cost/Benefits/Uncertainty – The foundation, together with the alternatives, will enable the analyst to begin building the cost analysis, benefit analysis, and uncertainty analysis. As part of the uncertainty analysis, the analyst should test the strength of the results using sensitivity analyses and may assess risk. See **Chapters** 4**,** 5**, and 6** for more detailed guidance on cost analysis, benefit analysis, and uncertainty analysis.

Figure 1.4. Data Collection.

Begin collecting data early for cost, benefit, and uncertainty analyses. Data impacts the types of techniques that can be used in cost benefit and uncertainty analysis. Better data facilitates a more defendable estimate. Obtaining data is a process of discovery. As an analyst goes through the comparative analysis process more data sources will be revealed. In addition, sometimes data can take time to obtain and normalize. By beginning data collection early in the process, the analyst will have a better chance of discovering and obtaining data sources that will facilitate a more reasonable and defendable estimate.

1.3.6. Summary and Comparison of Alternatives – With completed cost, benefit, and uncertainty analyses, the analyst will have sufficient information to compare the alternatives. In addition to comparing the alternatives, the analyst interprets the results. **Chapter 7** provides additional information on this step.

1.3.7. Documentation/Report – The analyst will finish the comparative analysis product (i.e., the documentation for the economic analysis) for delivery to the decision maker. **(T-2)**. More information on documentation is provided in **Chapter 7**.

1.4. Roles and Responsibilities. For a complete listing of the Roles and Responsibilities of developing an Economic Analysis, see section 1.4 of AFI 65-501. Roles and Responsibilities for certification are contained in **Attachment A3** of this manual.

Chapter 2

FOUNDATIONAL ELEMENTS: BACKGROUND, OBJECTIVE, SCOPE, FACTS, GROUND RULES AND ASSUMPTIONS

2.1. Background. The background provides a context for the analysis. The background should be concise. Some examples of items to include in background context are:

2.1.1. A brief project/program history, technical description (if applicable), and current state of the project/program. For a complex program, the technical description could include information about the maturity of the concepts and technology.

2.1.2. A brief synopsis of why the analysis is needed (e.g., problem that is being addressed, legislative compliance, Command directed).

2.1.3. Key milestone dates for the program, initiative, project, etc. that affect the timing or constrain the scope of the analysis.

2.1.4. The intended audience for the analysis.

2.1.5. Timeframe for the analysis.

2.1.6. Any other relevant information on how the analysis will be used (budgeting, contracting, etc.).

2.2. Objective of the Comparative Analysis. The objective of the comparative analysis is the purpose for which the analysis is being performed. When doing the analysis, the analyst should frequently reference the objective to ensure the analysis remains consistent with the purpose.

2.2.1. The objective statement should clearly and succinctly define and quantify, to the extent possible, what the project or program under study seeks to attain (e.g., obtain sufficient workspace for 200 people arriving on base as a result of gaining a new mission). It should state the goal or objective (i.e., mission or mission support requirement) to be met by the alternatives under study.

2.2.2. The objective should address the true problem to be solved. For example, do not limit the objective to insufficient manpower at the gate to check IDs when the problem to be solved is long lines (which may have a variety of solutions).

2.2.3. The objective should be stated broadly enough that it can be met by multiple alternatives and not in a way that favors or pre-supposes one particular alternative. A narrowed objective can sometimes introduce what is called pre-selection bias.

2.2.4. The objective statement should reflect the purpose of the project or program that is being analyzed. Conversely, it should not be a statement of the objective of the analysis.

Figure 2.1. Objective.

After developing the objective, measurement criteria should be established so that the relative costs, benefits and risks of each alternative can be compared and related directly to the objective. Measurement criteria should be added as early as possible to avoid bias. That being said, the analysis steps are iterative and there are legitimate reasons to adjust the measurement criteria as more information is revealed through the analysis process.

2.3. Scope.

2.3.1. The scope describes the content that is included in the analysis and the content that is excluded from the analysis. In assessing the scope, the analyst will need to determine the level of the objective (e.g., Society, Federal Government, Defense Department, Air Force, MAJCOM, Installation, Portfolio, or Program). The scope is a focusing mechanism for the analysis.

2.3.2. Be cautious of narrowing the scope unnecessarily. It is important to consider costs and benefits, including potential second and third order effects, experienced by all affected organizations.

2.3.3. Be cautious also of having a scope that is too broad or the analysis may become unwieldy.

2.4. Parameters of the Analysis (Facts/Ground Rules/Assumptions). All parameters must be explicitly stated. **(T-2).**

2.4.1. Facts - Facts are key parameters that will be significant to the analysis and for which the value is known.

2.4.1.1. Facts may include information about factors that may be relevant for an analysis. For example, in a vehicle lease versus buy analysis, a fact may be that there are currently excess vehicles in the inventory.

2.4.1.2. An analyst should include important facts in the background of the analysis.

2.4.2. Ground Rules - Ground rules are general principles that provide bounds for the analysis.

2.4.2.1. Some common examples of ground rules include: period of analysis and type of dollar used (base-year, then-year, and constant-year).

2.4.2.2. Ground rules can also involve the scope of the analysis. Certain areas can be excluded from the analysis by ground rule. When doing so, the analyst should have a rationale for the exclusion.

2.4.3. Assumptions - Assumptions are key parameters where the values and circumstances must be estimated because their values depend on future events or there is a lack reliable knowledge.

2.4.3.1. Only assumptions that are necessary and reasonable should be included in an analysis. 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.

2.4.3.2. Avoid making assumptions where facts should be used.

2.4.3.3. Assumptions should not be made for the convenience of the analyst or one of the stakeholders, or to unfairly favor one alternative over another.

2.4.3.4. The analyst should avoid treating assumptions as facts (e.g., past workload is a fact, projecting that workload into the future is an assumption). Any such assumptions should be explicitly stated in the Assumptions section of the analysis. Sometimes current facts can be used as a foundation for an assumption. For example, the fact that there are currently excess vehicles may be used to assume that the excess will persist in future years.

2.4.3.5. There are times when assumptions can appropriately narrow the scope of an analysis to manageable proportions, but they should not unduly constrain the analysis by eliminating otherwise reasonable alternatives.

2.4.3.6. Assumptions are one way to handle uncertainty in an analysis. A Sensitivity Analysis must be performed to test the effect that major assumptions have on analysis results. **(T-1).**

2.4.3.7. Examples of areas where assumptions are commonly made include: operations, organization, facilities, schedule, discount factors, inflation factors, manpower factors, production rates, utilization rates, workload, requirements and changes to requirements, estimated economic lives, future events, efficiency factors and reliability rates.

Chapter 3

ALTERNATIVES

3.1. Overview.

3.1.1. Alternatives are **reasonable** courses of action to attain the stated objective.

3.1.2. In developing the analysis, the analyst will consider (identify and discuss) all reasonable alternatives. All alternatives that are reasonable and feasible shall be fully analyzed. (**T-2**).

3.2. Baseline/Status Quo

3.2.1. Analyses almost always include a baseline alternative by which all other alternatives are compared. Typically, the baseline is the Status Quo alternative. The baseline describes how the program or process under study currently performs with respect to the objective.

3.2.2. If the analysis is on a new initiative, there may not be a baseline to measure against. In some cases, the Status Quo may be infeasible or unreasonable. (See **paragraph 3.3.4**) In those cases, another alternative, or modified status quo, is commonly set as the baseline in order to have a comparison point for the analysis.

3.3. Reasonableness and Feasibility

3.3.1. The analyst shall address all reasonable alternatives. **(T-2).**

3.3.2. Each reasonable alternative shall be evaluated for feasibility. **(T-2)**. Alternatives that are reasonable and feasible shall be fully analyzed. **(T-2)**.

3.3.3. If any reasonable alternative is deemed infeasible, the reasons shall be fully explained in this section. **(T-2).** After documenting reasonable alternatives that are infeasible, the infeasible alternatives do not need to be considered any further in the analysis. Documenting reasonable alternatives that are infeasible alternatives informs readers and reviewers that all reasonable alternatives were considered, and provides the rationale for deeming some alternatives as infeasible. If there are alternatives that are feasible, but excluded for some other reason, the rationale for exclusion must be explained in this section (e.g., see **paragraph 3.4**). **(T-2).**

3.3.4. Care must be taken to ensure a difference in capability or other benefits is not construed to mean infeasibility. Infeasibility means an alternative does not satisfy the required minimum level of acceptable performance (see **paragraph 5.4.7.1.2**). Mere differences in capabilities should be accounted for in the Benefits section. In the analysis, the decision maker can weigh the difference in benefits against any cost differences. One common pitfall is to define the objective too narrowly (see **Chapter 2**) such that the Status Quo cannot meet the requirement. For example, the objective may be defined too narrowly such that a new business system is the only alternative to meet that objective. Instead, a properly defined objective would allow for the status quo, or a modification to the status quo to be feasible, but not provide as many benefits.

Figure 3.1. Reasonable and Feasible Examples for Alternatives.

Reasonable and Feasible Examples for Alternatives

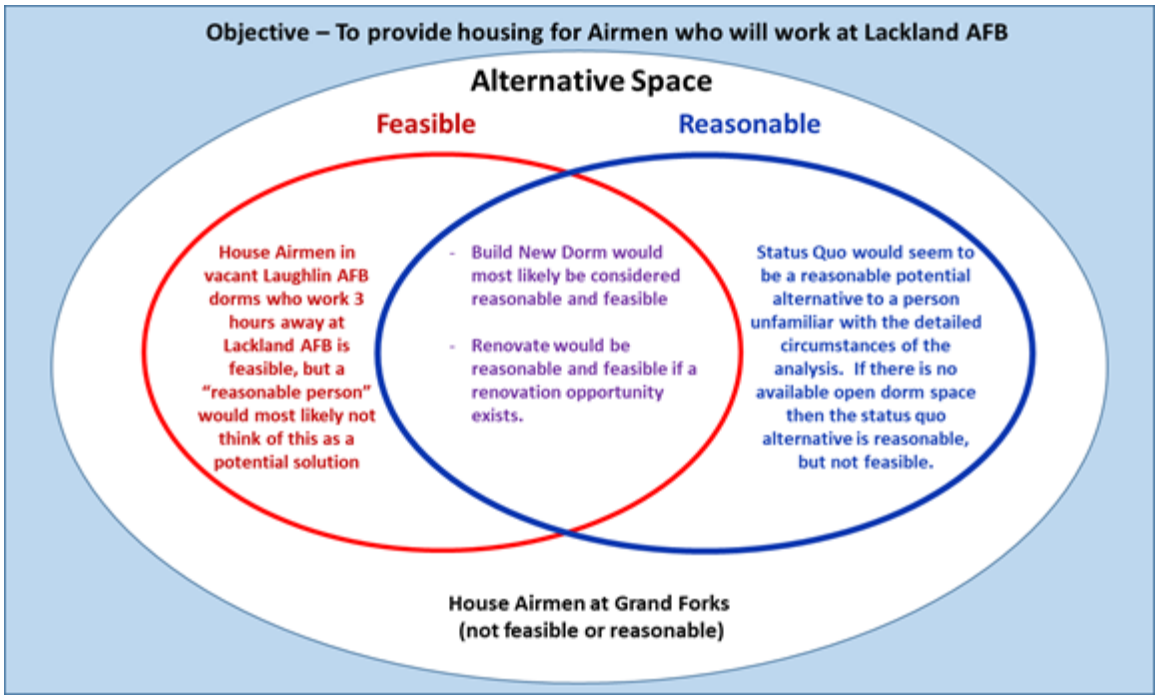
Determining the reasonableness of an alternative will require judgement on behalf of the analyst with the help of stakeholders/key personnel and is necessary in order to limit the number of alternatives. Consider the following fictional example.

The objective is to house Airmen who will be performing maintenance on aircraft at Lackland Air Force Base, Texas. There is an empty dorm at Laughlin Air Force Base, Texas. While the empty dorm would yield a low investment cost, the 3+ hour one way travel distance between Lackland and Laughlin renders Laughlin unreasonable to consider as an alternative even though it may be technically feasible. Further, if the empty dorm was at Grand Forks AFB, North Dakota, then the alternative would not be reasonable, or feasible.

An alternative may be reasonable to consider, but be discovered to be infeasible as more information is obtained. Consider the following fictional example.

The objective is to provide food for Airmen during meal times who will be performing maintenance on aircraft at Snowbound Air Force Base, Greenland. The dining hall nearest to the maintenance facility is two miles away. When developing and considering alternatives, the analyst may discover the status quo alternative is infeasible due to: (1) the road to the dining hall being five miles because it has to go around the flight line, (2) the speed limit on the road is 20 mph, and (3) the road often being closed due to snow. Someone not familiar with the base would not know these details. Therefore, the alternative should be included in the list of reasonable alternatives, and the relevant information should be provided so that someone unfamiliar with the base would be able to conclude that the alternative is infeasible.

Figure 3.2. Reasonable and Feasible Notional Illustration.



3.4. Completeness

3.4.1. Be thorough when developing alternatives. Make sure all reasonable alternatives are included. It is essential to leverage input from key personnel identified in section 1.3.2.1 to both identify and determine the reasonableness/feasibility of alternatives.

3.4.2. Use inputs from experts, critics, and supporters of various viewpoints. Be willing to use external parties such as: the commercial sector, Congressional reports, or academia.

3.4.3. Consider combinations of systems or approaches and solutions that involve outside agencies or organizations (e.g., community partnerships).

3.4.4. While considering a full range of alternatives, if the number of alternatives is too great to be manageable, screen out the most unlikely in order to keep the number of alternatives to a manageable level. Provide details regarding the down select methodology used.

3.4.5. Analysis is iterative, and as such, the set of alternatives may not be static. As the analysis progresses and new information becomes available, be open to expanding or reducing the set of alternatives.

3.5. Describing Alternatives

3.5.1. Fully explain what each alternative involves, especially those aspects that are likely to drive costs and benefits.

3.5.1.1. Explain how each process or procedure would work, what personnel, equipment, or facilities would be required, and what other changes from the Status Quo or baseline would be involved.

3.5.1.2. Each alternative should be fully described, to enable someone completely unfamiliar with the program to fully understand what would be involved in its implementation.

3.5.1.3. At a minimum, the description shall include attributes that will result in costs to the government. **(T-2).**

3.5.2. When describing the alternatives, the analyst should not include conclusions about the relative merit of the alternatives.

Chapter 4

COST ANALYSIS

4.1. Overview - Cost Analysis

4.1.1. Cost estimates/analyses support many different types of decisions and activities. The cost estimates in a comparative analysis are for the purpose of comparing the incremental costs that would be incurred by the decision over the period of the analysis.

4.1.2. The cost analysis includes those items traditionally understood to be monetary costs, revenues, and savings. As such, the cost analysis is really an analysis of monetary impacts both positive and negative.

4.1.3. Cost methodologies must be thoroughly documented so the analysis can be replicated if necessary. **(T-2).**

4.2. Purpose of Cost Analysis

4.2.1. The purpose of a cost analysis in a comparative analysis is different from its purpose in many other uses. Key areas where the cost analysis of comparative analyses may differ from other analyses include: the use of only incremental costs, the treatment of sunk costs, possibly varying periods of analysis and treatment of revenue and savings (sometimes referred to as monetary benefits). Cost analyses developed for another purpose need to be adjusted to account for the difference in purpose in a comparative analysis. Some prominent purposes for cost analyses and how they impact the cost calculations and presentation can be found in **Table 4.1**

Table 4.1. Cost and Purpose.

Purpose	Report Format	Years to Include	Goal
Comparative Analysis	Discounted Present Value	Period of Analysis (Future)	To compare incremental costs that would be incurred with each alternative if it were implemented.
Cost to Determine Required Funding	Then Year	Fiscal Year Defense Program (FYDP) (Possibly beyond)	To have a reasonable assurance that there will be sufficient funding for the Program / Project / etc.
Contract Negotiations	Then Year	Contract Years Under Negotiation	To have a realistic cost that can be used to ensure the government receives a fair and reasonable price from the contractor.
Evaluating Cost Growth (e.g., SAR Weapon System Cost Estimate)	Constant Year (Base Year)	All Years (Past, Present and Future)	To evaluate cost growth from previous estimates that cannot be attributed to the devaluation of the dollar (i.e., inflation).
Reimbursement	Then Year	Year(s) of Reimbursement	To provide an estimate that fully captures allowable reimbursable costs.

4.2.2. For comparative analyses, the cost analyses for the alternatives will be compared using dollars that have been discounted to present value. **(T-2).** This allows for an appropriate comparison of investment costs, typically occurring early in the period of analysis, with recurring costs which typically occur later in the period of analysis. The year selected for present value calculations is the first year investment funds will be required or the first year of the analysis. This is commonly referred to as the base year of the program or project.

4.2.3. The estimate includes **all costs incremental to the implementation of each alternative**.

4.2.3.1. Include incremental costs for those portions of the life-cycle covered by the period of analysis. Include the cost of design, development, procurement, operation, support, and disposal or residual value, as appropriate.

4.2.3.2. A comparative analysis normally includes all costs to the US government within the scope of the analysis, not simply those incurred by the function under study. The scope of the analysis should not be artificially drawn to exclude costs outside the Air Force. While thorough cost analyses is the goal, it may not be possible to understand and capture all of the effects a decision could have on other government agencies. The analyst will have to use judgement to determine the extent to which costs outside the Air Force are captured.

4.2.4. The cost analyses in a comparative analysis will only include costs for which funds have not yet been expended or irrevocably committed. **(T-2).** In other words, sunk costs are not included in a comparative analysis.

4.3. Basic Steps for the Cost Analysis

4.3.1. These steps are intended as a basic guide to developing cost analyses that fit within economic analyses and the framework of this manual. These steps are not intended to be a comprehensive guide to cost analysis. There are additional materials that provide more in-depth guidance. Examples of additional materials include on-line Defense Acquisition University courses (e.g., BCF130 Fundamentals of Cost Analysis), the Government Accountability Office Cost Estimating and Assessment Guide, and the Government Accountability Office Schedule Assessments Guide.

4.3.2. Review Foundational Elements

4.3.2.1. The cost analysis should be based on the objective statement and scope.

4.3.2.2. Reviewing the foundational elements will focus the analysis on the decision to be made.

4.3.3. Build Cost Element Structure

4.3.3.1. The cost element structure is the framework for building the estimate.

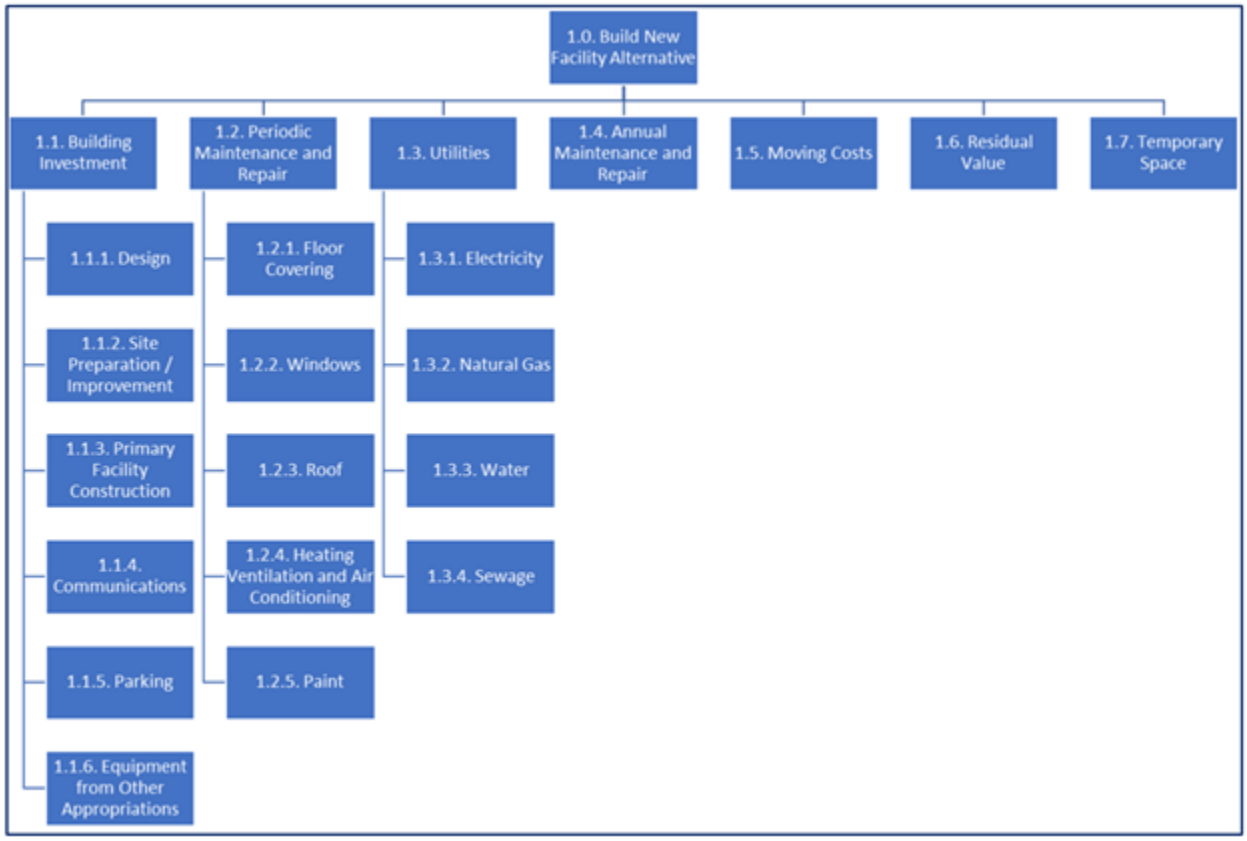
4.3.3.1.1. The cost element structure is a hierarchical breakdown of the program or project being estimated. Costs are estimated at the lowest level of the cost element structure. The cost element structure (and the estimating technique used) will be dependent on the data that is available. At times, the level of detail in the structure will be limited because the available data better support a higher level estimating approach.

4.3.3.1.2. It is important to understand the cost behavior of the cost elements when building the cost element structure. For example, recurring and non-recurring should not be included in the same cost element because the costs behave differently.

4.3.3.2. For a comparative analysis, each alternative may require different cost element structures.

4.3.3.3. In many comparative analyses, a cost estimate for a particular alternative may already exist. The analyst has to review the cost element structures across alternatives to ensure the content included for each alternative is comparable.

Figure 4.1. Example - Build New Facility Cost Element Structure.



Note: Cost elements in Figure 4.1 are only examples and not intended to be all-inclusive

4.3.3.4. The latest version of the Military Standard 881 (MIL-STD-881) contains weapon system related examples of work breakdown structures. Similarly, the Cost Analysis and Program Evaluation Operating and Support Cost-Estimating Guide contains a cost element structure for operations and support of weapon systems. While MIL-STD 881 and the Cost Analysis and Program Evaluation Guide provide excellent examples, they may not fit the circumstances of the alternative being estimated. As a result, the analyst may have to build a new cost element structure to fit the level of detail and unique circumstances of their estimate. **Figure 4.1** contains cost elements that may be used in a facility construction cost element structure.

4.3.4. Select Estimating Technique – will likely vary across cost elements

4.3.4.1. The estimating technique will depend on the data available.

4.3.4.2. The estimating technique can be different for each alternative and even each cost element.

4.3.4.3. It is critical that the analyst ensure that the alternatives remain comparable even when a unique estimating technique is selected for each alternative.

4.3.4.3.1. For example, an analogy-based estimate for one alternative may include a computer hardware refresh because it was included in the analogous program. Conversely, if another alternative was using an engineering estimate, the computer hardware refresh may need to be estimated separately in a different cost element.

4.3.4.3.2. As another example, extrapolation of actuals is a common approach for the Status Quo alternatives; while actuals are not available for new alternatives, the analyst may employ a parametric model to estimate the costs of an alternative. Caution should be taken to ensure that what is included in the actuals is comparable to the content of the parametric model to avoid biasing the analysis in favor of one alternative due to missing or overstated costs.

4.3.4.4. There are a variety of techniques that can be used to build the estimate. A list and brief description of some common techniques are provided below. Training courses are available with additional information on the estimating techniques. An example on-line training course from Defense Acquisition University is BCF130 (Fundamentals of Cost Analysis). The Government Accountability Office Cost Estimating and Assessment Guide is also a valuable source for information on cost estimating techniques.

4.3.4.4.1. Analogy – Under this technique, the analyst estimates cost based on historical data from a similar program. When using an analogy, the analyst should include a technical comparison between the existing and proposed systems in order to account for the difference between the analogous program and the program being estimated.

4.3.4.4.2. Engineering (also called grass roots and bottom up) – Under this technique, the analyst calculates labor and materials from the most detailed level of the program and aggregates those costs to get the total program cost. While it is very detailed, this method is generally more time intensive and includes a risk of missing some aspect of the program when building the estimate.

4.3.4.4.3. Parametric – Under this technique, the analyst estimates cost based on historical data from multiple past programs. Parametric estimates use cost estimating relationships that correlate programmatic characteristics (e.g., size, lines of code, weight) with cost. These cost estimating relationships can be developed either singly, or as part of a software package. The analyst estimates cost using the programmatic characteristics of the proposed program.

4.3.4.4.4. Extrapolation of Actuals – Under this technique, the analyst estimates future costs based on historical data from the program being estimated. This technique can only be used for programs that are on-going.

4.3.4.4.5. Catalog Prices/Vendor Quote – This technique is simply obtaining quotes from a vendor or catalog. This is commonly used to obtain a lease price in a lease/purchase analysis. It is important that the analyst understand exactly what is included in the vendor quote so that a proper comparison can be made across alternatives. This technique works best with commercially available products where multiple quotes can be obtained.

4.3.4.4.6. Factors – This technique is essentially a subset of the parametric technique or the analogy technique. Essentially, a single factor can result from a cost estimating relationship (e.g., Supervision Inspection and Overhead Cost as a percentage of Construction Cost).

4.3.5. Collect Cost Data and Apply Estimating Techniques

4.3.5.1. Data collection should occur as early as possible because it may be difficult to find good data. Similarly, data collection and the selection of estimating techniques is normally be done simultaneously because the estimating technique depends on available data.

4.3.5.2. As data is collected, use the selected estimating techniques to begin populating the cost estimate.

4.3.5.3. Document completely the source/origin of all data collected. **(T-2).**

4.3.6. Time Phasing, Escalation, Inflation, and Discounting

4.3.6.1. Time phasing the estimate is ensuring that costs are placed in the year the cost will be incurred. Proper time phasing requires that the costs be escalated to the appropriate year using a price escalation index so that the estimate is in then-year dollars. The price escalation index used must be documented. **(T-2).**

4.3.6.2. After the estimate is time phased and calculated in then-year dollars, the estimate must be converted to present value dollars. **(T-2).** This can be done one of two ways. The first way is to apply the nominal discount rate to the then-year dollars. The second way is to first convert the then-year dollars to constant year dollars using an inflation index and then use the real discount rate to convert the estimate to present value. Whichever method is selected, the calculation must be documented. **(T-2).**

4.3.6.3. For detailed instructions on escalation and inflation, consult AFMAN 65-502, *Inflation*.

4.4. Components of a Cost Analysis

4.4.1. It is important to understand what should be included in the cost analysis section of an economic analysis. The cost analysis should only include the costs, savings and revenue required as a result of selecting the alternative.

4.4.2. Sunk cost

4.4.2.1. Any cost incurred in the past, to include future costs that have been irrevocably committed. An example of a future cost that has been irrevocably committed would be work on a contract that has been performed, but not yet paid.

4.4.2.2. Such costs have no bearing on any decision to be made, and so should not be included in a comparative analysis. Life cycle cost estimates will need to be adjusted to remove sunk costs when being used for comparative analyses. **(T-2).**

4.4.3. Wash costs (also called Common costs)

4.4.3.1. Any cost that will be incurred identically across alternatives. Wash costs are optional to include, but should be treated the same across alternatives (i.e., either included or excluded) and documented completely.

4.4.3.2. Wash costs may be excluded for simplicity. This is sometimes called a "delta estimate."

4.4.3.3. Wash costs may be included so the decision-maker can get a full appreciation of the magnitude of the cost of an alternative.

4.4.3.4. It may be necessary to include wash costs when using some estimating techniques and data sources.

4.4.4. Average cost

4.4.4.1. The average cost is the total cost divided by the number of units that make up the total.

4.4.4.2. When using these types of averages, make sure they are appropriate for the analysis and will not bias the results. For example, the cost of a Captain in AFI 65-503 is an average expected cost of all the Captains in the Air Force. If the study only involves one location, it may be better to use the local Basic Allowance for Housing cost instead of the average Basic Allowance for Housing listed in AFI 65-503.

4.4.5. Non-recurring cost

4.4.5.1. One-time costs or costs that are not expected to continue beyond the investment phase. These costs usually take the form of initial capital or other unique expenditures.

4.4.5.2. Types of non-recurring costs include:

4.4.5.2.1. Research and Development Costs

4.4.5.2.2. Investment costs. These are costs associated with the acquisition of equipment, real property, nonrecurring services, nonrecurring operations and start- up costs, and other one-time outlays.

4.4.5.2.3. Costs of acquisition, rehabilitation, or modification of assets such as: land, buildings, machinery, equipment, furniture and one-time computer software costs.

4.4.5.2.4. Temporary facilities/swing space.

4.4.5.2.5. Costs of plant rearrangement and tooling associated with the project.

4.4.5.2.6. Nonrecurring services received from others, both internal and external to the Air Force.

4.4.5.2.7. Cost to cancel or terminate any existing arrangement that would result if a different alternative were implemented.

4.4.6. Recurring cost

4.4.6.1. Recurring costs are cost that are incurred repeatedly.

4.4.6.2. Types of recurring costs include:

4.4.6.2.1. Annual recurring cost: A cost incurred every year (e.g., membership dues). Recurring costs many times occur at time intervals of less than one year (e.g., utilities). Commonly these costs are aggregated and treated as annual recurring costs.

4.4.6.2.2. Periodic recurring cost: A cost incurred in a period greater than one year long, like Programmed Depot Maintenance, or replacement of heating, ventilation and air conditioning equipment that may be replaced every 20 years.

4.4.7. Fuel/Energy Costs: The fully burdened cost of delivered energy shall be used in analyses conducted for all Department of Defense tactical systems with end items that create a demand for energy. **(T-0).** Be sure to only include those costs that are incremental to a decision.

4.4.8. Induced Costs: Induced costs are those costs that the execution of a given project or program alternative impose on another Air Force or government program. For example, if a proposal to move an activity into facilities currently occupied by a second activity causes expenditures by the second activity for real property acquisition or improvement, then those expenditures are induced costs that should be taken into account in the decision to move the first activity.

4.4.9. Costs incurred in foreign currency: The cost analysis portion of comparative analyses will be performed in United States dollars. **(T-1).** See **attachment 14** for additional details.

4.4.10. Opportunity cost

4.4.10.1. Opportunity cost is the cost of a resource measured in terms of its value in the best alternate use. One way opportunity costs are accounted for in comparative analyses is through the discount rate. Some projects may experience additional opportunity costs specific to that project.

4.4.10.2. For example, the value of an existing asset may be included when there is an opportunity cost associated with the asset. As an example, assume a piece of equipment valued at $1,000 is being used in the Status Quo process. In the process for Alternative 1 the equipment is not needed; however, the same equipment was programmed to be purchased by another organization. This other organization will be able to forego the purchase and use the existing equipment if Alternative 1 is selected. In this case, the equipment could be counted as a negative cost in the cost analysis for Alternative 1 because the other organization now does not need to purchase the equipment.

4.4.11. Depreciation expense.

4.4.11.1. 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.

4.4.11.2. Normally, depreciation will not be included as a cost in an Air Force 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. Depreciation 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 Treasury.

4.4.12. Savings

4.4.12.1. Savings are not typically identified as a separate cost element. Instead, they are reflected as the reduced cost of an alternative.

4.4.12.1.1. For example, if four people are required for a task in Alternative 2 instead of the five required for status quo, the analyst would include the cost of four people for Alternative 2. This will show up as a lower cost (savings) for that alternative.

4.4.12.1.2. Continuing the example, if hours are saved from multiple positions, but a position is not deleted (or re-purposed), then there are no savings and the cost should be recorded as five people for Alternative 2. In this case, the reduced hours are accounted for in the benefit analysis. This benefit is commonly referred to as cost avoidance.

4.4.12.2. Generally speaking, an analyst should only show the cost of the alternatives and not make a statement about savings.

4.4.12.2.1. Savings, when calculated, can only be calculated from a currently approved (funded) program as the baseline. Although approved funding is limited to the Future Years Defense Program, reductions reasonably likely to occur beyond the Future Years Defense Program period are also savings because they are reducing cost for a program or function that is assumed to be approved.

4.4.12.2.2. The status quo should represent the currently approved (funded) program (plus extension beyond the FYDP). Sometimes, in addition to the status quo, an analysis will contain a Status Quo Prime. One reason to include a Status Quo Prime is to reflect a shortfall in funding. If this is done, the analyst should not leave the impression that the resulting difference between Status Quo Prime and the alternatives reflects savings. If an alternative were selected and executed, the amount between Status Quo Prime and Status Quo would be cost avoidance and the difference between Status Quo and the alternative would be savings.

4.4.12.2.3. If savings are calculated, they should be categorized into three time periods: budget year, FYDP, and beyond FYDP. This structuring of savings allows for recognition of the level of certainty of the funding.

4.4.13. Revenue

4.4.13.1. In the context of a Comparative Analysis, revenues are funds remitted to the US government as a result of a service performed or good provided in one of the alternatives.

4.4.13.2. Revenue should be included as a “negative cost” in the cost analysis.

4.5. Other Considerations in the Cost Analysis

4.5.1. Base year: Usually defined as the FY in which a program was/will be initially funded. This will normally be the Start Year of the analysis. When reporting costs in constant dollars, they should be reported in the dollars of the base year of the analysis. Do not confuse this Base Year of Analysis with the base year of an Acquisition program, which is often set for the Selective Acquisition Report at Milestone B.

4.5.2. Economic life: The economic life of a project or asset is the time during which benefits from the project or asset may reasonably be expected to accrue to the Air Force. The economic life of a project or asset is set by the shortest of its physical life, technological life, or mission life. Economic lives of assets can often be found in functional area directives for planning, programming, and budgeting for resources. Appendix 3 of Office of Management and Budget (OMB) Circular A-76 also has a Useful Life and Disposal Value table.

4.5.2.1. Physical life: The number of years a facility or piece of equipment can physically be used before it wears out.

4.5.2.2. 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.

4.5.2.3. Technological life: The period before improved technology makes an asset obsolete.

4.5.3. Period of analysis: Economic life plus project lead-time determine the period of analysis for a comparative analysis. If the alternatives do not have equal lives, there are multiple methods of selecting a period of analysis:

4.5.3.1. Terminal Value Method

4.5.3.1.1. The Terminal Value Method uses the terminal value or “salvage” value to account for unequal economic lives of assets.

4.5.3.1.2. This method sets the period of the analysis to the duration of the alternative with the shortest economic life.

4.5.3.1.2.1. The terminal and residual values of assets are included as inflows, or negative cost 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. See **section 4.5.8** for more information about the remaining value of an asset at the end of its useful life.

4.5.3.1.2.2. 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. For example, an engine replacement program may plan to sell the status quo engines for scrap when they reach the end of their economic lives.

4.5.3.1.2.3. The analyst also needs to know the residual values of the asset(s) for the alternative(s) with longer economic life (lives). For example, an engine replacement program would include the residual value of the replacement engines when comparing those engines against the status quo.

4.5.3.2. Common Denominator Method

4.5.3.2.1. This 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 the analysis.

4.5.3.2.2. 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).

4.5.3.3. Uniform Annual Cost (also called Equivalent Annual Cost)

4.5.3.3.1. The Uniform Annual Cost method reflects a present value estimate of the average annual cost for each alternative. In this method, the present value of the costs are divided by the years in the economic life.

4.5.3.3.2. The period of analysis under Uniform Annual Cost is equal to the economic life of the alternative with the longest economic life.

4.5.3.3.3. This method can be used in place of the Terminal Value Method.

4.5.4. Incremental Cost

4.5.4.1. The intent of this section is to better describe incremental costs, or the difference in costs that will be expended between the base case (usually the Status Quo alternative) and the other alternatives.

4.5.4.2. For each alternative, the estimate will include the incremental change in cost that will have to be expended in order to execute the alternative being evaluated. The cost that is included should be the incremental cost to the decision. In other words, only include costs that will change as a result of the decision. **(T-2).**

4.5.4.3. Sunk costs and wash costs fit in the category of costs that are not incremental to the decision.

4.5.4.4. Another category of costs that are commonly not incremental to the decision are overhead costs. Depending on the magnitude change resulting from the decision, there may be no change in overhead costs at all. However, if the change is large enough, then there may be changes in infrastructure, base operating support, and other overhead that need to be included in the analysis.

Figure 4.2. Incremental Cost Example.

Example of How to Determine Incremental Costs

Problem: Air Force leadership is trying to decide if the mission of an F-16 squadron should be performed by Active Component Airmen or Reservist Airmen. The mission is currently performed by Active Component Airmen.

Background: Since it is not known which specific Airmen will be used for this mission, the cost analyst chose to use an average cost per Airman in making the comparison between Active and Reserve Airmen. Given current facilities, the Reserve will require hangars to be built whereas the Regular Air Force has sufficient hangar space. The F-16s are procured and flying.

What should the cost estimate include? Potential costs identified above are: Aircraft Procurement, Military Construction, and Military Pay.

Evaluation of Costs:
Procurement – One might look at historical costs and find that historically, the average procurement cost for Reserve Aircraft is lower than the procurement cost for Active Aircraft. The problem with including average procurement cost is that the procurement cost of the aircraft is both a sunk cost (i.e., the aircraft in inventory have already been procured, the money has already been spent, and it will not be spent in the future) and a wash cost (i.e., if aircraft are procured in the future for this squadron, the same aircraft will be procured for the Active and Reserve Components). It is not an incremental cost associated with the decision (i.e., applicable to only one decision, or different costs depending on the alternative implemented). If the squadron switches from Regular Air Force to Reservist, the procurement cost of the F-16 will not change. Since the procurement cost of the F-16 does not change with the alternative selected, it is not incremental to the decision and should not be included.
MILCON – Similar to aircraft procurement, one might look at historical costs for MILCON and find that historically, the Reserve cost for MILCON per Reservist is much lower than the MILCON cost per Regular Air Force Airman. Again, the problem is that the MILCON costs for the active component are sunk and, therefore, irrelevant to the decision. However, MILCON costs will be incurred if the Reserve Alternative is chosen. As a result, MILCON is an incremental cost for the Reserve option and should be included for that option.
Military Pay – Military Pay is relevant to the decision because Regular Air Force Airman and Reservists are paid differently given that some portion of the Reservists will be part time. Also, the number of available Reservists will be different given that some portion of the Reservists will be part time. So for this case, the incremental cost for the Reserve Alternative is the increase in Reserve Military Pay Cost directly associated with owning the F-16 Mission. The incremental cost for the Regular Air Force Alternative is the military pay cost that would no longer be incurred if the mission was transferred to the Reserve. An important point is that, on the active component side, shared costs between the F-16 squadron and other organizations that would not go away if the Squadron transfers should not be considered incremental to the decision and as a result, should not be included in the analysis.

4.5.5. Confidence Levels

4.5.5.1. If cost risk was assessed in the estimate for one alternative, cost risk should also be included for other alternatives, where appropriate, and all alternatives should be evaluated at similar confidence levels.

4.5.5.2. Common methods for assessing cost risk include:

4.5.5.2.1. Enhanced Scenario-based method: the analyst quantifies what can go right and what can go wrong with a program/project from a high-level perspective (as opposed to the more detailed level perspective common to simulation). The result provides an estimated cumulative probability for the true program cost. More information can be obtained from the Joint Agency Cost, Schedule, Risk and Uncertainty Handbook.

4.5.5.2.2. Simulation is also used to evaluate risk in cost estimates. There are a variety of software packages that can be used to assist with using simulation to evaluate cost risk. Two common methods of applying simulation to cost risk are the Cost Informed by Schedule Method and the Fully Integrated Cost/Schedule Method. More information can be found on these methods in the Joint Agency Cost, Schedule, Risk and Uncertainty Handbook.

4.5.6. Monetary Benefits

4.5.6.1. Monetary Benefits include revenues and savings as defined in the glossary to this manual. Monetary benefits are included in the cost analysis. This does not include benefits that could be dollarized, but would not result in revenue or savings.

4.5.6.2. Benefits that could be dollarized, but would not result in revenue or savings should be recorded in the benefit analysis as per **paragraph 5.3.2.2**

4.5.7. Discounting and Present Value.

4.5.7.1. Discounting is a method of calculating the value today (present value) of a future cost or stream of future costs.

4.5.7.2. The Air Force evaluates decisions using present value dollars (discounted dollars).

4.5.7.3. Discount Rates – Discount rates are the rates used to calculate present value in a comparative analysis. In order to simplify the present value calculation, the rates are sometimes converted to discount factors. The simplification is that the present value can then be easily calculated by multiplying the discount factors with the stream of dollar values.

4.5.7.4. Where to find discount rates. Comparative Analyses 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.

4.5.7.4.1. Rates used for analysis are interest rates on Treasury notes and bonds with maturities of 3, 5, 7, 10, 20 and 30 years. The rate to be used should correspond to the period of analysis for the project. Projects with terms different from those listed should use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Projects with durations longer than 30 years may use the 30-year interest rate.

4.5.7.4.2. Interest rates on Treasury securities are cited on both a real and nominal basis. For an estimate in constant year dollars, use a real rate. For an estimate in then-year dollars, use the nominal rate.

4.5.7.5. Discount Factors. Discount factors for use in comparative analyses are derived from the discount rate used, using the formulas found in **Attachment 7**. There are two kinds of discount factors that are common in Air Force comparative analyses.

4.5.7.5.1. Midyear Factors: When costs and benefits occur in a steady stream, applying midyear discount factors is more appropriate. Midyear factors approximate actual disbursement patterns--i.e., funds are typically disbursed throughout a given FY 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 should be used in Air Force comparative analyses unless there is good reason to use other factors, in which case the reason(s) should be explained in the analysis.

4.5.7.5.2. End-of-Year Factors: These factors implicitly assume that costs and benefits occur as lump sums at year-end.

4.5.8. Remaining value at the end of an asset's useful life (i.e., physical life, mission life, or technological life).

4.5.8.1. 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 is done only to estimate the remaining value of existing assets, and for no other purpose.

4.5.8.2. There are three terms used to describe the value of an existing asset that remains at the end of its useful life: salvage value, residual value and terminal value.

4.5.8.2.1. Salvage value is the value of an asset at the end of its physical life (scrap value). Salvage value is often offset by the cost to dispose of the asset.

4.5.8.2.2. Residual value is the value of an asset at any point in time before the end of its economic life.

4.5.8.2.3. 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.

Chapter 5

BENEFIT ANALYSIS

5.1. Overview – Benefit Analysis

5.1.1. An essential and critical element of an economic analysis is the consideration of benefits. Without a consideration of benefits, the analysis is a cost comparison, not a comparative analysis.

5.1.2. For the purpose of a comparative analysis, the benefit analysis section is generally limited to non-monetary impacts. That is, the benefit analysis includes those aspects of the alternatives that are not represented as a cash flow within the analysis.

5.1.3. There can be both qualitative and quantitative benefits and both types are important to consider. Quantifying an otherwise qualitative benefit is useful for analysis, but does not eliminate subjectivity. Weighting benefits is an important way to assess their relative value to the decision.

5.1.4. All benefit elements that are analyzed should be fully explained so that someone unfamiliar with them can fully understand the benefit and its measurement.

5.2. Role of Benefits

5.2.1. The purpose of benefit analysis is to identify, measure, and evaluate the benefits provided by each of the proposed alternatives.

5.2.2. Since benefits reflect the performance of the organizational mission or service desired, they are the primary reason for a project. 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 receives for the resources input. Considering benefits is essential to a comparative analysis. Benefits or results are the reasons for the investment, but there can also be benefits that are ancillary to the objective. These ancillary benefits can be recognized in the analysis, but should be secondary to those benefits that are directly related to the project objective.

5.2.3. The selection of any particular alternative should be based on a full economic evaluation, in which costs and benefits are appropriately weighed and compared. An alternative with the lowest cost may not be the preferred alternative after costs and benefits are considered together.

5.3. Types of Benefits

5.3.1. The benefits section focuses on non-monetary impacts. If implementing an alternative would result in a reduced operating cost, then that reduced cost should be reflected in the cost analysis, not the benefit analysis. Similarly, if one of the alternatives results in revenue to the Air Force, then that should be reflected in the cost analysis, not the benefit analysis.

5.3.2. There are two types of benefits – quantitative and qualitative.

5.3.2.1. Quantitative benefits

5.3.2.1.1. Quantitative benefits are any benefits that can be measured quantifiably such as a reduction in military man-hours. Characteristics like product or service performance (e.g., miles/hour, orders/hour) or work environment (e.g., average noise level, mishaps/week) often can be quantified. In such cases, these benefits should be quantified to the greatest extent possible, and direct comparisons for each of these measures across alternatives should be made.

5.3.2.1.2. Express these quantitative benefits in the units they naturally occur (e.g., military overtime hours, miles/hour) instead of converting the benefit into dollars. Converting the benefit into dollars may mislead the decision maker into thinking that such quantifications represent actual dollar cash flows.

5.3.2.1.3. Quantitative benefits in their unit, or raw, form should not be aggregated across benefits. Since they are in different units, they should be presented as individual benefits instead of an aggregated measure. If the quantitative benefits are converted to percentages (e.g., 500 parking spaces out of 1,000 desired equals 50% of the desired spaces) and weighted (see **section 5.4.6**), then they may be aggregated into a single benefit score.

5.3.2.1.4. Cost Avoidance Benefits.

5.3.2.1.4.1. Cost avoidances are areas where someone may think the budget will be affected when, in fact, it will not be. As a result, cost avoidance is accounted for as a benefit.

5.3.2.1.4.2. There are two types of cost avoidance.

5.3.2.1.4.2.1. The first type of cost avoidance is productivity gains that do not result in budget savings, such as man-hour savings that do not result in a deleted position. Productivity efficiencies should be accounted for in their naturally occurring metric (e.g., hours) instead of being converted to dollars.

5.3.2.1.4.2.2. The second type is a reduction in some future resource requirement which: (a) has not been included in an approved (funded) Air Force program or function within the Future Years Defense Program, and (b) would not be reasonably assumed to be included in an Air Force approved program beyond the Future Years Defense Program. This type of cost avoidance benefit is the only benefit that should be measured in terms of dollars. While the Air Force would not experience a reduction in funding from this benefit, it represents the reduction in a potential liability. For example, if the status quo anticipates the purchase of certain hardware which has not been included in an approved and funded Air Force program, but implementation of the preferred alternative does not require its purchase, there is a cost avoidance.

5.3.2.1.4.3. Cost avoidances can accrue at any time during the life cycle.

5.3.2.2. Qualitative benefits

5.3.2.2.1. Qualitative benefits are not naturally measured in quantities (e.g., mission effectiveness, security, organizational morale). These benefits are usually subjective in nature and generally do not lend themselves to quantitative analysis.

5.3.2.2.2. There are techniques available which attempt to determine the comparative desirability of each alternative with respect to each benefit and also attempt to measure the magnitude of the differences in desirability between alternatives. While these techniques do not measure qualitative benefits in an objectively quantitative way, this approach allows us to establish a numeric basis of comparison. See **Section 5.4.7** and **Figures 5.2**, **5.3** and **5.4**.

5.4. Basic Steps for Benefit Analysis

5.4.1. The steps for doing a benefit analysis are iterative in that the information gained from a subsequent step may require the analyst to go back to a prior step.

5.4.2. **Review Foundational Elements**

5.4.2.1. The benefit analysis should be based on the objective statement and scope. Reviewing the foundational elements will help keep the analysis focused on the decision to be made.

5.4.2.2. The benefits developed should be benefits to the government within the scope of the analysis, not simply those incurred by the function under study.

5.4.3. **Identify Benefit Elements**

5.4.3.1. The benefit element structure is the framework for building the benefit analysis.

5.4.3.2. The benefit element structure varies depending on the analysis. Structures can vary from a list of high level benefits to a hierarchical breakdown of the benefits for the project being analyzed. The benefits included in the structure must be mutually exclusive.

5.4.3.3. The analyst should receive input on identifying benefits from multiple stakeholders representing multiple viewpoints. As an example, consider a proposal to provide temporary lodging. From the viewpoint of the facility manager, benefits include: capacity, housekeeping productivity and security. For the customer, benefits include: location, comfort, security, and amenities. More broadly, the government may also have a concern about the environmental impact. This highlights the need to include multiple stakeholders when measuring benefits.

5.4.3.4. In developing the list of benefits, care must be taken to avoid double-counting impacts which are accounted for in the cost analysis, and, if included, the risk analyses. For example, reduced manpower positions are captured in the cost analysis; the hours associated with those positions should not be captured as a benefit. Risk sometimes can be assessed in the benefits section; however, if a separate risk analysis is included, ensure that the benefit analysis does not assess the same risks.

5.4.3.4.1. While an analyst should be careful not to double count, there may be some elements in the analysis that impact both costs and benefits.

5.4.3.4.2. As an example, while the cost associated with reduced fuel consumption is accounted for in the cost analysis, there are aspects of it that could be considered a benefit such as reduced pollution.

5.4.4. **Select Benefit Measurement Technique**

5.4.4.1. The analysis technique will depend on the available data, time available and the ability of the technique to provide the decision-maker with an accurate view of the benefits received by alternative.

5.4.4.2. The following are different types of measurement.

5.4.4.2.1. Quantitative Measures

5.4.4.2.1.1. Quantitative benefits are measured in a variety of units. Measures could include physical counts of tangible items, but it can also include other measures, such as the square feet of a building, the age of a building, the speed of an aircraft, or the weight of an aircraft. Many times the interpretation of quantitative data is intuitive and can be easily used in calculations, but that is not always the case.

5.4.4.2.1.2. Some benefit data requires additional consideration in how it is interpreted and used in calculations. As an example, with reduced fuel consumption there are aspects of it that could be considered a benefit both in terms of reduced pollution and in terms of the logistical footprint of a deployed unit. Additionally, when measuring fuel consumption of an aircraft, the analyst should understand that the consumption is not linear over a flight. Instead, more fuel is consumed in takeoff (per unit of time) than while cruising. As a result, saving one hour in a ten hour flight will not result in consuming 10% less fuel.

5.4.4.2.1.3. For some data the distance between values is meaningful, but the ratio between two values is not. As an example, engine temperature (as measured in Fahrenheit) is an interval measure. The interval between 100 degrees and 101 degrees is meaningful, but 200 degrees is not twice as hot as 100 degrees because 0 degrees Fahrenheit does not represent the absence of heat.

5.4.4.2.1.4. Another simple but important concern is understanding the unit of measure used (e.g., Fahrenheit versus Kelvin, miles versus kilometers, tons versus long tons).

5.4.4.2.1.5. How data has been calculated/normalized prior to receiving it is important to understand as well. If an analyst was provided the average deployment days for different types of units, it would be good to know how the average deployed days was calculated. Deployed days across all people divided by total days available for all people will yield a different answer than the average length of deployment (in days) for those who deployed.

5.4.4.2.2. Qualitative Measures

5.4.4.2.2.1. Ordinal measures

5.4.4.2.2.1.1. Ordinal measures of benefits can be arranged in an order (e.g., ranking of outstanding/good/satisfactory/inadequate, high to low, 1 to 5 star hotels).

5.4.4.2.2.1.2. These subjective values may not be on a linear scale and may be numeric or descriptive.

5.4.4.2.2.1.3. Even though the measurement may be numeric, it is not appropriate to do calculations with the raw measurement.

5.4.4.2.2.2. Narrative descriptions

5.4.4.2.2.2.1. With narrative benefits, the merits of each alternative are qualitatively described for each benefit element.

5.4.4.2.2.2.2. Even with narrative benefits, the analysis can provide a weight for each benefit to show the level of importance attributed to each benefit element in the assessment.

5.4.4.3. The level of measurement at which benefits data will be collected is important because it defines the subsequent analysis that can be done with the data. For example, with narrative descriptions applying a weight to each benefit would be the only possible computation that could be applied.

5.4.4.4. It is important to note that assigning numeric values to an otherwise qualitative benefit (e.g., morale) induces a measure of an individual or group's opinion, but it does not eliminate subjectivity. (See **paragraph 5.4.7.2.5** for more information on assigning numeric values to benefits that are otherwise qualitative). Further, when assigning numeric values to these benefits, it is important to understand and document the substantive impact behind the measurement (e.g., the new building has greater physical security because it is 50 meters behind a fence line and thus less vulnerable to terrorist attack).

5.4.5. **Collect Benefit Measurement Data**

5.4.5.1. Data collection applies to benefits as well as costs. For benefits, data can take a wide variety of forms from quantitative performance measures (e.g., miles per hour) to more subjective measures (e.g., morale). Data collection should occur as early as possible because it may be difficult to find good data. Similarly, data collection and the selection of benefit analysis techniques are normally done simultaneously because the technique depends on available data.

5.4.5.2. As data is collected, use the selected estimating techniques to begin populating the analysis.

5.4.5.3. Because of the comparative nature of economic analysis, quantification of benefits or outputs can be very helpful. When results are quantitative, they can be measured which may facilitate comparison of the alternatives.

Figure 5.1. Quantifying Benefits.

One caution to quantifying benefits that are not intrinsically numerical is that the number can mask the true impact of the benefit. As an example, assume the benefits of a project are summarized numerically so that the "Status Quo" receives a score of 50 and "Alternative 1" receives a score of 57. Without further information, the decision maker has no substantive information by which to judge the relative merits of the Status Quo vs. Alternative 1. The rationale behind the scores must be clearly explained.

A second caution when quantifying benefits is to understanding that there is a diminishing marginal utility to additional benefits. As an example, suppose there are two facility leasing alternatives being considered and, Alternative 2 offered twice the square meters as Alternative 1. In this case, the analyst probably would not assign a benefit value for Alternative 2 that is twice that of Alternative 1. In fact, if Alternative 1 already exceeded the facility requirements for the organization, Alternative 2 may not have any additional benefit value than Alternative 1.

5.4.6. **Prioritize (Weight) Benefits**

5.4.6.1. Understanding the priority and relative value of the benefits is a critical step. The analyst must rely on feedback from the different stakeholder viewpoints discussed under measuring benefits. While the prioritization of benefits is subject to the approval of the decision authority, often the analyst is the person to propose a prioritization. The development of priorities should have traceability back to the stakeholder viewpoints.

5.4.6.2. In this step, the analyst is trying to determine the intrinsic value of one benefit relative to other benefits for the decision.

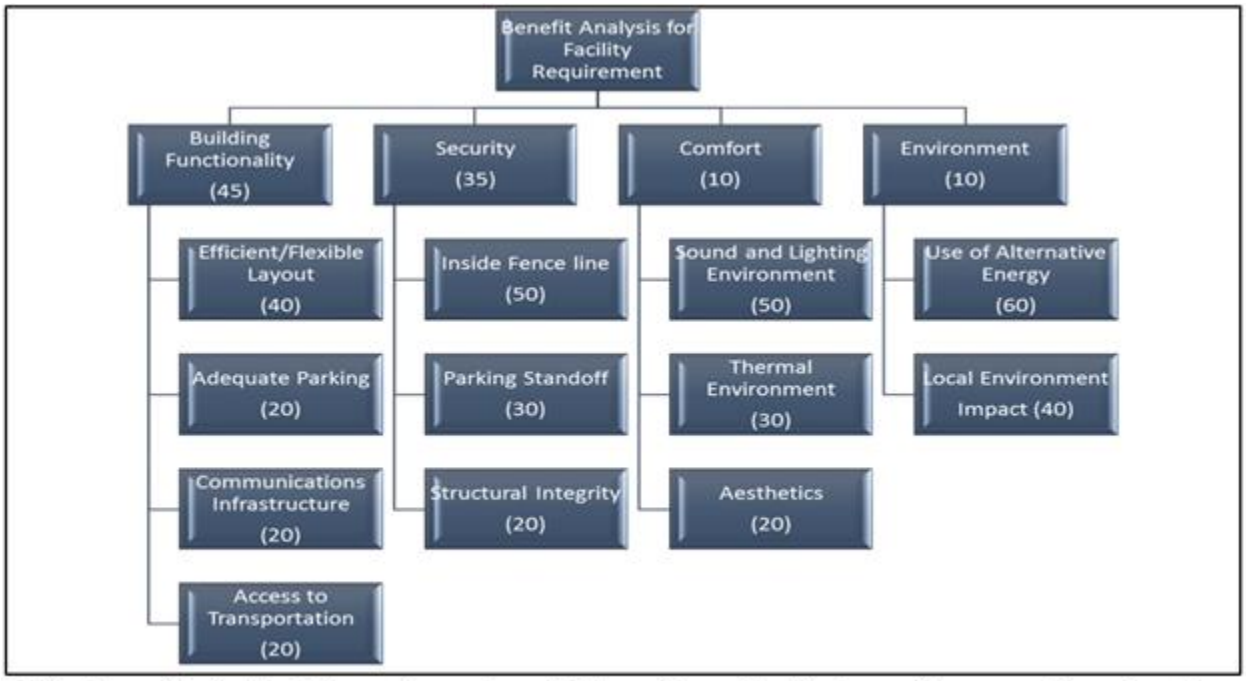
5.4.6.2.1. Realizing that some benefit elements will have greater influence than others on a particular decision, the analyst or decision-maker should consider developing a method of assessing the degree of influence through prioritization.

5.4.6.2.1.1. When benefits are only addressed narratively, they are not required to be prioritized; by default this leaves prioritization up to the decision-maker by the analysis being silent.

5.4.6.2.1.2. If a prioritization method is used for some benefits, it must be applied to all benefits. **(T-3).** When an analysis uses both scored and narrative benefits, prioritization is required for all benefits.

5.4.6.2.2. One common method of prioritizing is to give a numerical weight to the benefits an ordinal ranking may also be used. If the benefits are organized in a hierarchy, then each level of the hierarchy is weighted. **Figure 5.1** provides an example of benefit weighting. In this approach, the percentages allocated to the elements at the second level in the hierarchy must sum to 100% and the percentages allocated to the children benefits within each of the second level elements must sum to 100%.

Figure 5.2. Benefit Weighting Example.



* The benefits in the hierarchy and weights assigned to the benefits are notional and strictly for illustrative purposes.

5.4.7. **Evaluate Benefits by Alternative**

5.4.7.1. Identifying Infeasible Alternatives

5.4.7.1.1. Commonly alternatives are vetted early in the comparative analysis process to determine their feasibility. However, through additional research, an analyst may discover that an otherwise feasible alternative may be identified as infeasible as a result of the benefits analysis.

5.4.7.1.2. Satisficing

5.4.7.1.2.1. Satisficing is one method for identifying infeasible alternatives before completing the entire benefits analysis.

5.4.7.1.2.2. Satisficing uses absolute minimum requirements or maximum limits to eliminate alternatives. Once the benefits for the analysis have been identified, determine if there are any alternatives that do not satisfy minimum performance standards for each benefit. If an alternative fails to meet the minimum requirement for even one benefit, it is an unacceptable or infeasible alternative. The infeasible alternative can be eliminated from further consideration in the economic analysis. The reason for eliminating the alternative should be stated in the narrative of the analysis. Continue the benefits analysis considering only the remaining feasible alternatives.

5.4.7.2. Benefit Evaluation and Comparison

5.4.7.2.1. There are several ways to compare the benefits of the alternatives. The complexity of the comparison can vary significantly. A few ways to compare benefits are described below.

5.4.7.2.2. Dominance

5.4.7.2.2.1. If one alternative is rated the best under every attribute considered in the analysis, that alternative dominates the others.

5.4.7.2.2.2. If the alternative that was dominant in the benefits analysis is also the least costly, the interpretation of the results of the analysis may be straight forward (unless a sensitivity analysis raises concerns).

5.4.7.2.3. Comparison of Raw Quantitative Measures

5.4.7.2.3.1. Raw quantitative measures may be used to compare alternatives (e.g., aircraft cargo hold size, aircraft range). The drawback to using raw quantitative measures is that they do not provide the decision-maker with information on how other stakeholders (e.g., users of the system) value the measure.

5.4.7.2.3.2. Using this technique depends on the decision-maker being able to understand the value the measure provides to the Air Force. When the quantitative measures are further evaluated (e.g., in a weighted point rating), the raw measures should still be noted in the analysis so the decision-maker has an understanding of the raw benefits the Air Force will receive.

5.4.7.2.4. Relative Ranking

5.4.7.2.4.1. Relative ranking requires the collection of ordinal data.

5.4.7.2.4.2. This system is based on two assumptions: (1) all alternatives are at least adequate in all benefit areas, and (2) no two alternatives provide the exact same level of value for a particular benefit element.

5.4.7.2.4.3. Each alternative is evaluated in direct competition with all other alternatives, and is placed in a relative ranking position with all other alternatives for a particular benefit element. No two alternatives can be ranked in the same position; each must be ranked above or below all others.

5.4.7.2.4.4. In Relative Ranking without weighting, it is assumed that all benefit elements have equal value. An example is provided in **Figure 5.2** below. In the example, a higher rank (higher number) represents a more desired alternative.

Figure 5.3. Relative Ranking without Weights.

	Alternatives			
Benefit Elements	A	B	C	D
Building Functionality	2	3	1	4
Security	3	2	1	4
Comfort	1	4	3	2
Environment	3	4	2	1

5.4.7.2.5. Relative Ranking with Weights

5.4.7.2.5.1. Assigning weights to each benefit element signifies that each of the benefit elements are valued differently. For example, if security and functionality are benefits elements in the analysis, an analyst would give security a greater weight in the study if it was more important to the decision than functionality.

5.4.7.2.5.2. An example summary table from using the Relative Ranking with Weights technique is provided in **Figure 5.3**. The weights associated with the benefit elements could be key information for the decision-maker. As shown below, while Alternative B is ranked very highly in both comfort and environment, the weights for these benefit elements is low. As a result, the decision-maker may discount those scores for Alternative B. Conversely, Alternative D may be considered more important because it was ranked highly in benefit elements that carried a higher weight.

Figure 5.4. Relative Ranking with Weights.

		Alternatives			
Benefit Elements	**Weight**	A	B	C	D
Building Functionality	4.5	2	3	1	4
Security	3.5	3	2	1	4
Comfort	1.0	1	4	3	2
Environment	1.0	3	4	2	1

5.4.7.2.6. Weighted Point Rating

5.4.7.2.6.1. The weighted point rating technique requires the analyst, stakeholders and/or decision-maker to examine their individual valuation, preferences, etc. with respect to the alternatives and assign values to the benefits for each alternative.

5.4.7.2.6.2. There is a significant amount of subjectivity involved in this approach, while, at the same time, it provides a single numerical score for the total value of all benefits which appears to be objective. When using this method, it is critical to ensure the analysis presents the meaning of the benefits behind the scores. The mathematical score presented without any additional information can provide the appearance of certainty without giving the decision maker substantive information about the benefits.

5.4.7.2.6.3. The weighted point rating system is a comprehensive evaluation method that involves:

5.4.7.2.6.3.1. Value – The establishment of a numerical value for each benefit that would result from executing an alternative. In the figures below (**Figures 5.3** and **5.4**), the values are referred to as a score and expressed as a percent. Expressing values as a percent is a typical method of measuring the benefit elements using a common measure so they can be aggregated later.

5.4.7.2.6.3.1.1. This numerical value could be assigned directly by those determining the value of each alternative by benefit element.

5.4.7.2.6.3.1.2. A more rigorous method would take a two-step process. The first step is to measure the benefit. This works well for benefits that already have quantitative measures (e.g., number of training deficiencies). The second step is to use a value function to determine the stakeholder's relative value for the different levels of performance for each measure over the range needed to evaluate the alternatives. For example, how much more valuable is it to the organization if personnel exit training with only 2 training deficiencies versus 20.

5.4.7.2.6.3.1.3. Whether assigning values directly, or using the two step process, the analyst should provide an intuitive explanation of the resulting value. Just seeing a number without context will not be meaningful to a decision-maker.

5.4.7.2.6.3.2. Weight – The assignment of weights to each benefit element accounts for the fact that each of the benefit elements are valued differently. For example, if security and morale are benefits elements in the analysis, an analyst would give security a greater weight in the study if it was more important to the decision than morale.

5.4.7.2.6.3.3. Composite – The calculation of a composite score (using value and benefit element weight) for ranking of the alternatives.

5.4.7.2.6.4. The weight of each benefit should reflect how important each benefit is relative to the others, while the value should measure how well the alternative provides that benefit. The weight multiplied by the score equals the composite score. These are then summed to show the various alternatives' overall weighted benefit score.

5.4.7.2.6.5. Many times the benefits are weighted and scored at a summary level. When benefits are weighted and scored as a hierarchy, the calculations are a bit more complex.

5.4.7.2.6.6. **Figure 5.4** shows benefits evaluated at a summary level. This is a common method of benefit evaluation.

Figure 5.5. Weighted Benefits Score Evaluated at a Summary Level.

		Status Quo			Renovation			New Construction	
Benefit Element	Weight	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score
Building Functionality	45	28%	**12.6**		48%	**21.6**		82%	**36.9**
Security	35	10%	**3.5**		81%	**28.35**		100%	**35**
Comfort	10	52%	**5.2**		68%	**6.8**		94%	**9.4**
Environment	10	40%	**4**		56%	**5.6**		76%	**7.6**
Total			**25.3**			**62.35**			**88.9**

5.4.7.2.6.7. **Figure 5.5** shows benefits evaluated as a hierarchy. In this case, benefits are evaluated at the lowest level of the hierarchy and then aggregated. The aggregated scores for each benefit element are then multiplied by the weight for the element to obtain an element weighted score. The sum of the element weighted scores by alternative equals the total benefit score for each alternative.

Figure 5.6. Benefits Evaluated as a Hierarchy.

		Weight		Status Quo			Renovation			New Construction	
Benefit Element	Benefit Sub-Element	Element	Sub-Element	Score	Weighted Score		Score	Weighted Score		Score	Weighted Score
Building Functionality		45		28%	**12.6**		48%	**21.6**		82%	**36.9**
	Efficient Layout		0.4	20%	0.08		30%	0.12		100%	0.4
	Adequate Parking		0.2	10%	0.02		30%	0.06		80%	0.16
	Communications Infrastructure		0.2	20%	0.04		80%	0.16		100%	0.2
	Access to Transportation		0.2	70%	0.14		70%	0.14		30%	0.06
Security		35		10%	**3.5**		81%	**28.35**		100%	**35**
	Inside Fenceline		0.5	0%	0		100%	0.5		100%	0.5
	Parking Standoff		0.3	20%	0.06		70%	0.21		100%	0.3
	Structural Integrity		0.2	20%	0.04		50%	0.1		100%	0.2
Comfort		10		52%	**5.2**		68%	**6.8**		94%	**9.4**
	Sound and Lighting		0.5	50%	0.25		70%	0.35		100%	0.5
	Thermal		0.3	50%	0.15		70%	0.21		100%	0.3
	Aesthetics		0.2	60%	0.12		60%	0.12		70%	0.14
Environment		10		40%	**4**		56%	**5.6**		76%	**7.6**
	Alternative Energy		0.6	20%	0.12		60%	0.36		100%	0.6
	Local Impact		0.4	70%	0.28		50%	0.2		40%	0.16
Total					**25.3**			**62.35**			**88.9**

5.4.7.2.7. Narrative Benefit Comparison

5.4.7.2.7.1. Alternatives can be compared using narrative-only descriptions of how the alternatives perform under each of the benefit elements. Narrative-only descriptions should provide the decision-maker with a rich understanding of what each alternative will provide and the context behind why one alternative is superior to (or equal to) another for each benefit element.

5.4.7.2.7.2. The Narrative benefit elements can also be given weights based on the significance of the benefit element. The purpose of weighting this type of benefit would be to give the decision-maker additional information on which benefits merit more attention.

5.4.8. **Time Phasing and Discounting**

5.4.8.1. When scoring benefits, the person evaluating the benefit should take into account the value of the benefit over time.

5.4.8.2. In doing so, the analyst will have accounted for the benefit over the entire period of analysis.

5.5. Other Benefit Considerations

5.5.1. Individual benefits to be analyzed are best selected, weighted and scored by knowledgeable personnel from relevant functional areas, like civil engineering, safety, security forces, financial management or services, etc.

5.5.2. In the analysis, each benefit should have a brief separate paragraph describing what the benefit is, what is being measured, and the rationale used in determining the score for each.

5.5.3. The sources and derivation of quantitative benefits must be documented in the same level of detail as costs, and should include all interim calculations as appropriate. **(T-2).**

5.5.4. Realized Benefits – This is the benefit equivalent of sunk costs. The analysis should only include benefits over the period of analysis. Benefits realized prior to the period of analysis are excluded from consideration. In situations where questions on realized benefits might arise, they should be documented in the analysis.

5.5.5. Wash (Common) Benefits – Wash benefits are also referred to as common benefits. This is the benefit equivalent of wash costs. These are benefits that will be realized regardless of the alternative implemented. Wash benefits are optional to include in an analysis.

Chapter 6

UNCERTAINTY (RISK AND SENSITIVITY) ANALYSIS

6.1. Uncertainty Analysis Overview

6.1.1. Estimates of costs and benefits contain uncertainties. Since estimating errors can be introduced into the analysis because of the uncertainty, the potential impact of these errors must be analyzed.

6.1.2. Uncertainty, and the related errors introduced, in comparative analyses is primarily addressed through risk and sensitivity analyses. It is important to have an understanding of how the Department of Defense defines risk and sensitivity analysis.

6.1.2.1. Risk is the probability an unfavorable outcome or event will occur. Risk analysis evaluates the probability and severity of the potential unfavorable outcomes.

6.1.2.2. Sensitivity is the magnitude of impact that particular inputs have on an analysis and its results. Sensitivity analysis is an evaluation of the effect that uncertain elements of an analysis have on the outcome.

6.1.2.3. Every comparative analysis must have a separate sensitivity analysis (see **section 6.2 of this manual). (T-1).** An analyst can also assess the risk associated with each alternative (see **section 6.3.2** of this manual).

6.1.3. Assumptions of any type and level, by virtue of not being facts, introduce uncertainty into the analysis. Sensitivity analysis examines the impact to the analysis of changing the level or value of the assumption. If the baseline value of the assumption assumed for the analysis is not just uncertain (i.e., its value is not known with certainty) but, if it is also too optimistic/pessimistic, it introduces risk around the alternative(s), (i.e., increases the probability that the alternative will not execute in the same manner as the analysis presents). In the case of optimistic/pessimistic assumptions, sensitivity analysis is required. If a risk analysis is included in the analysis, optimistic/pessimistic assumptions should be included.

6.2. Sensitivity Analysis

6.2.1. Sensitivity analysis identifies key assumptions and variables within an economic analysis and determines how changes in value of those assumptions and variables affect the results of the analysis. 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 assumptions and the values of variables (e.g., due to estimating errors that stem from uncertainty) affect the analysis results. A sensitivity analysis can be particularly important when the results of the cost and benefit analysis do not clearly favor one of the alternatives.

6.2.1.1. A decision is insensitive to uncertainties regarding a variable if that variable's value can vary over a wide range without affecting the results of the alternatives relative to each other. A sensitivity analysis demonstrates the stability (or instability) of the results.

6.2.1.2. Two major limitations of sensitivity analysis are that (1) it only analyzes the assumptions and variables that have been considered and (2) each assumption or variable is analyzed in isolation. These limitations emphasize that critical thinking and dialogue with experts is crucial to preparing a quality analysis.

6.2.2. Sensitivity analyses are commonly performed:

6.2.2.1. On uncertain assumptions that can impact the estimates of costs or benefits.

6.2.2.2. On major cost drivers, those parameters of the analysis that have the largest impact on the discounted life cycle cost. In some cases, there may be a cost element that is a high percentage of program cost, but is actually a "passenger," meaning that it is driven by a cost driver but has no parameter itself that can be adjusted to actually impact the cost of the program. In this case, the sensitivity analysis would not be performed on the passenger. Instead, the analyst would perform analysis on the parameter that is driving cost.

6.2.2.3. On major benefit drivers, those parameters that have a large impact in a weighted point benefit assessment.

6.2.3. To perform a sensitivity analysis, vary an uncertain assumption or variable value within what is considered 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. Several iterations can be accomplished, varying the assumption or variable value at whatever interval (e.g., every 2%) the analyst thinks is appropriate. Continue until the assumption or variable value being varied becomes too unreasonable. Make sure to document the reasoning and show calculations and intermediate steps. This level of documentation may be either in the comparative analysis report, or in an appendix that would be made available if needed. If a sensitivity analysis yields a change in the cost or benefit ranking of alternatives, report the value at which the change occurs. If no change in alternative ranking occurs, report that, as well, so the decision maker will understand the stability of the alternative rankings. If the sensitivity analysis of a discount rate results in a change in the cost ranking of alternatives, report the rate at which the change occurs.

6.2.4. Scenario Analysis

6.2.4.1. A scenario analysis is similar to a sensitivity analysis. In a sensitivity analysis, one variable is allowed to change so that a decision maker can understand the effect that variable has on the results of the analysis.

6.2.4.2. In a scenario analysis, the analyst allows multiple variables to change simultaneously to gain insight into their combined impact. This can be a particularly effective tool if there are multiple assumptions or cost drivers that the analyst considers particularly questionable in the baseline analysis or if changing one variable almost always impacts a related variable in the analysis.

6.3. Risk Analysis

6.3.1. A risk analysis can assess uncertainty in a manner different from sensitivity analysis.

6.3.2. When to include a risk analysis:

6.3.2.1. Through the analysis process, if the analyst develops an understanding through conversations with subject matter experts and stakeholders that the level of risk associated with any alternative has a reasonable likelihood of being a key consideration for the decision-maker, then a risk analysis should be performed.

6.3.2.2. A risk analysis should be included when required by the type of analysis or the decision-maker.

6.3.3. A risk matrix is a common mechanism for evaluating risk. (See **paragraph 6.3.10** Risk can also be expressed narratively in the analysis).

6.3.4. Risk can occur in many forms. Some examples include: optimistic assumptions, insufficient funding, schedule delays, immature technology, legislative requirements, biased data, or contractor inability to execute. Risk can be found in a variety of areas. There is some risk that the benefits expected from an alternative may not be achieved. There is also risk of project execution that may not be easily expressed within the benefit element framework.

6.3.5. A risk analysis can include an evaluation of the level of confidence associated with assumptions in the benefit analysis. In this case, the risk analysis is evaluating the probability of not achieving the benefit attributed to a particular alternative. A risk analysis could also focus on those benefit elements that have a particularly large impact on the results.

6.3.6. Cost risk is often assessed within the cost estimate. If the cost estimate includes an assessment of cost risk, do not include a separate assessment of cost risk in this section of the analysis (See **paragraph 4.5.5**).

6.3.7. Political risk (the risk associated with Congressional action or inaction) should only be included when directed by an Air Force senior leader. Any assessment of political risk should be provided by qualified subject matter experts (e.g., legislative liaison).

6.3.8. If a risk element is assessed low for an alternative because a mitigation is anticipated, then the cost of mitigation should be addressed either in the cost analysis, or as a sensitivity analysis. For example, the Air Force may have a risk of not obtaining data rights to a weapon system, but as a mitigation, the program office believes the system could be reverse engineered to the extent that maintenance could be performed organically. In this case, if the risk is being evaluated as low due to the mitigation, then the cost of the mitigation should be included in the cost estimate, or at least addressed as a sensitivity analysis.

6.3.9. If one of the alternatives is evaluated as having zero risk for a particular risk element, that measurement of zero risk should be included in subsequent aggregation and assessment of risk.

6.3.10. Risk Matrix

6.3.10.1. A risk matrix is a common approach for assessing both the probability and severity of a risk element or undesirable events. Risk matrices can help prioritize uncertainties that could negatively impact program cost, schedule and benefits. Subject matter experts familiar with the program define the risk factors, probabilities, and resulting impact to cost, schedule, and performance.

6.3.10.2. An example risk matrix is provided in **Figure 6.1**. Additional explanation is provided in AFI 90-802, *Risk Management*. In this example, the matrix was built so that a higher risk item would have a higher score. An evaluation using the risk matrix would be conducted for each risk element and each alternative. For the example in **Figure 6.1**, once risk is evaluated for a specific risk element/alternative, the relative risk associated with each alternative for that risk element can be assessed by multiplying the values assigned to the different levels of Likelihood and Consequence.

6.3.10.2.1. The vertical axis is an evaluation of the likelihood of the risk.

6.3.10.2.2. The horizontal axis is an evaluation of the severity of the consequence should the undesirable event occur.

Figure 6.1. Risk Matrix Example.

RISK MATRIX			CONSEQUENCE				
			Insignificant	Minor	Moderate	Major	Severe
			1	3	5	7	9
LIKELIHOOD	Almost Certain	0.9	0.90	2.70	4.50	6.30	8.10
	Highly Likely	0.7	0.70	2.10	3.50	4.90	6.30
	Moderate	0.5	0.50	1.50	2.50	3.50	4.50
	Unlikely	0.3	0.30	0.90	1.50	2.10	2.70
	Rare	0.1	0.10	0.30	0.50	0.70	0.90

6.3.10.3. When using a risk matrix, the analyst should provide definitions for the categories of risk listed in the risk matrix so that the reader knows how the risk categories are being applied to this analysis. Examples are below.

Figure 6.2. Definitions for Likelihood Categories.

DEFINITIONS FOR LIKELIHOOD		
SCORE	CATEGORY	DEFINITION
0.9	Almost Certain	81-99% chance the risk event will occur
0.7	Highly Likely	61-80% chance the risk even will occur
0.5	Moderate	41-60% chance the risk event will occur
0.3	Unlikely	21-40% chance the risk event will occur
0.1	Rare	Less than 20% chance the risk event will occur

Note: A probability can be recorded as zero for an alternative if the risk event will not occur

Figure 6.3. Definitions for Consequence Categories.

DEFINITIONS FOR CONSEQUENCE		
SCORE	CATEGORY	DEFINITION
9	Severe	Severe degradation in supportability; will jeopardize program success or will cause the system availability threshold to not be met.
7	Significant	Major shortfall in supportability with a moderate impact on program success. Sustainment levels are unacceptably below goals.
5	Moderate	Moderate shortfall in supportability with limited impact on program success. Sustainment will not meet goals, but approaching unacceptable levels.
3	Minor	Minor reduction in supportability can be tolerated with little impact on program success. Sustainment will be below goals but within acceptable limits.
1	Minimal	Minimal consequence to supportability but not overall impact to the program success. A successful outcome is not dependent on this issue; the sustainment goals will still be met.

6.3.10.4. Summarizing the Risk Assessment Results

6.3.10.4.1. **Figure 6.4** shows an example summary of the results. Notice that each alternative has a risk rating for each risk element.

6.3.10.4.2. If these risk elements are also benefit elements, then the risk score reflects not being able to meet the benefit score provided in the benefit analysis. This means that an alternative may only have a low risk score because of the low benefit expectation. If benefits were normalized across alternatives, the risk of achieving the benefit would be higher. When risk scores are related to the benefit evaluation, the implications should be explained in the documentation.

6.3.10.4.3. If these risk elements are not also benefit elements, then the risk score reflects an absolute comparison among the alternatives.

6.3.10.4.4. In **Figure 6.4**, the "Prob" columns are the likelihood measure from the risk matrix. The "Conseq" columns are the consequence measure from the risk matrix. The score is the assessment from combining likelihood and consequence. The rating column follows the color scheme in the risk matrix with green being low risk, yellow being moderate risk and red being high risk.

6.3.10.4.5. The scores are aggregated to an average score by alternative.

Figure 6.4. Summary of Risk Analysis.

	Alternative 1 - Status Quo				Alternative 2 - Upgrade Current				Alternative 3 -			
Risk Element	Prob	Conseq	Score	Rating	Prob	Conseq	Score	Rating	Prob	Conseq	Score	Rating
Data Accuracy	0.3	7	2.1		0.1	7	0.7		0.3	7	2.1	
Data Availability	0.7	7	4.9		0.5	7	3.5		0.3	7	2.1	
Schedule	0	1	0.0		0.5	1	0.5		0.7	1	0.7	
User Complexity	0.5	7	3.5		0.3	7	2.1		0.1	7	0.7	
Average			2.6				1.7				1.4	

6.3.10.4.6. Similar to defining the risk categories, the risk elements should also be defined. **Figure 6.5** provides an example of risk element definitions.

Figure 6.5. Risk Element Definitions.

Risk Element Definitions	
Risk Element	**Definition**
Data Accuracy	Risk of legacy data future data not being recorded accurately in the new system.
Data Availability	Risk of not having reporting mechanisms that meet analysis needs of the users.
Schedule	Risk of the project being delayed.
User Complexity	Risk of the users not using the system appropriately because of a complex user interface.

Chapter 7

CONCLUDING THE ANALYSIS: SUMMARY AND COMPARISON OF ALTERNATIVES AND POST-ANALYSIS ACTIVITIES

7.1. Once the cost, benefit and uncertainty analyses are completed for each alternative: The results must be analyzed, and the alternatives compared. **(T-2).** This section of the comparative analysis includes a summary of the analysis results and a comparison of the results. The summary of analysis presents and summarizes the key aspects of the cost, benefit, and uncertainty analyses to then enable comparison of the alternatives. In the comparison of alternatives, the analyst compares and interprets results. The analyst should provide more than just an explanation of the analysis results. The analyst should provide insights into the behavior of the alternatives' costs and benefits from which the decision-maker could draw reasonable conclusions. The analyst is not required to recommend an alternative, but may provide a recommendation.

7.2. Provide summary tables for: The cost analysis, benefit analysis, and uncertainty analysis for areas where the analyses have been expressed in quantitative terms.

7.2.1. The cost summary should include a table(s) with the present value of the alternatives, new funding required by alternative, and any other financial measures used to evaluate the alternatives.

7.2.2. Benefits - The benefit summary should include a summary table if the benefits were measured using: physical counts, an index/ratio, or a rating scale. If benefits were evaluated using narrative descriptions, then those descriptions should be summarized in this section.

7.2.3. Uncertainty – A summary of the results of the sensitivity analysis should be included. If a risk assessment was performed, this also is the appropriate section to summarize those results. If risk was measured quantitatively, a table should be included.

7.3. Provide a brief narrative explanation of: The summarized cost and benefit analyses and uncertainty assessment, as well as any measurements and indicators.

7.4. Every comparative analysis must: Compare the alternatives and interpret the results. **(T-2).**

7.4.1. Compare the relative strengths and weaknesses of each alternative with respect to cost as well as how well each alternative meets the objective. Provide insights from the comparison. A few examples of this type of insight are pointing out whether a particular alternative dominates in terms of costs, benefits and risks or providing the interpretation of the results that achieving a particular benefit will cost XX dollars over the status quo. The analyst can highlight the tradeoffs between the alternatives and explain the conditions under which the rankings of alternatives change.

7.4.2. There are measures to assist with comparing alternatives; some apply to costs, some to benefits, and some to a combination of the two. The measures below provide some useful methods by which to make comparisons between alternatives.

7.4.2.1. Comparison of Present Value (PV):

7.4.2.1.1. Present Value 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 amount for each year by the corresponding discount factor, and summing the results. Present value is the best measure for comparing cash flows over time.

7.4.2.1.2. Net Present Value (NPV) refers to the present value of the gains (revenue) minus the present value of the investment. Government comparative analyses often do not have a revenue stream but may have gains through reduced costs.

7.4.2.2. Uniform Annual Cost: Uniform Annual Cost is calculated by dividing the net present value of the costs of an alternative by the sum of the discount factors for the periods covering the life of each alternative in which costs were incurred.

7.4.2.3. Savings/Investment Ratio: The present value of the total return generated by an investment divided by the present value of the initial investment amount.

7.4.2.4. Return On Investment: A ratio that evaluates the return relative to the investment. See **Attachment 7** for a more detailed explanation.

7.4.2.5. Weighted Benefit Score: The result of the scoring of benefits of a given alternative, weighted by the relative importance of each individual benefit. Multi-Objective Decision Analysis (MODA) is an example of weighted benefit scoring.

7.4.2.6. Cost/Benefit Ratio: The ratio of the life cycle cost of an alternative to its weighted benefit score or other quantitative measure of benefits.

7.4.2.7. Payback Year: The year in which the cumulative revenue or savings generated by a project is expected to equal its investment costs.

7.4.3. As a minimum, a present value comparison must be included for all analyses that are required by AFI 65-501 for which the period of analysis is greater than one year. **(T-2).**

7.4.4. A narrative explanation and comparison of the benefits is a minimum requirement for all analyses. **(T-2).**

7.4.5. See attachments for specific requirements related to special analyses.

7.4.6. As part of interpreting the results, the analyst should provide insights and conclusions based on the comparison of alternatives.

7.5. If the analyst provides a recommendation: Then the rationale behind the recommendation must be explained. **(T-2).**

7.6. The decision-maker at each level may: Want to include a memo with the comparative analysis that indicates the selected alternative.

7.7. Documentation Requirements. Comparative analyses must be thoroughly documented. **(T-2).**

7.7.1. A key element of credible analysis is sufficient documentation of method and information sources so that, with the same material, a reader not familiar with the study could arrive at essentially the same result without having to look elsewhere for any information used to perform the analysis. The documentation in a comparative analysis must meet this standard. **(T-2).**

7.7.2. A comparative analysis is documented in a comparative analysis report. If supporting documents are too voluminous for inclusion in the comparative analysis report, they must be cited in sufficient detail so that the exact document(s) may be found by an independent reviewer or reader if they need to reference them. **(T-2).**

7.7.3. See **paragraph 1.2** for elements to include in the documentation.

7.7.4. Analyses involve calculations or adjustments used to turn raw source data into information used in the analysis. Since these calculations are commonly done in Excel®, or specialized estimating software, the files should be retained by the analyst with the documentation.

7.8. Information and Activities that are Important for Implementing a Decision

7.8.1. While decision implementation is the responsibility of the functional organization for which the decision is being made (or its implementing partner), there are aspects of the comparative analysis which may be helpful for implementation and change management.

7.8.2. Implementation Plan – In building a comparative analysis, the analyst needs to understand the assumed schedule and end state of the selected alternative. In fact, the requirement to cost out the transition and end state often brings more rigor into the planned alternatives. As such, the plan used in the analysis process to estimate costs could also be used to build the framework of the implementation plan.

7.8.3. Stakeholder Analysis – Information gathered from stakeholders during the comparative analysis process may be helpful in building a stakeholder action plan and communication plan needed to implement the alternative selected by the decision-maker. In particular, the benefit analysis and uncertainty analysis processes may identify stakeholder perspectives and/or concerns with each alternative.

7.8.4. Performance Measures and Outcomes – The cost, benefit, and uncertainty measures from the comparative analysis provide a framework from which performance measures and outcomes can be developed. These performance measures and outcomes could be used as a baseline against which the results of the change are compared and as a starting point for lessons learned.

Chapter 8

ANNUAL ECONOMIC ANALYSIS REPORT

8.1. Annual Economic Analysis Report (RCS: HAF-FMC [A] 9501): Each MAJCOM, direct reporting unit (DRU), field operating agency (FOA), and similar Air Force organization will prepare and forward a copy of an annual report concerning their economic analysis program to SAF/FMCE by 1 December annually. **(T-2).** This report (see **Attachment 10**) will provide information on economic analysis activity in the previous FY.

JOHN P. ROTH
Assistant Secretary of the Air Force
for Financial Management and Comptroller

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 32-6001, *Family Housing Management,* 21 August 2006

AFI 32-6004, *Furnishings Management Program,* 27 January 2016

AFI 32-6005, *Unaccompanied Housing Management,* 29 January 2016

AFI 33-360, *Publications and Forms Management,* 1 December 2015

AFI 65-501, *Economic Analysis*, 29 October 2018

AFI 65-503, *US Air Force Cost and Planning Factors,* 13 July 2018

AFI 90-802, *Risk Management*, 1 April 2019

AFMAN 33-363, *Management of Records,* 1 March 2008

AFMAN 65-502, *Inflation*, 13 May 2015, Corrective Actions applied on 30 October 2018

AFPAM 63-123, *Product Support Business Case Analysis*, 1 June 2017

DoDI 5000.02, *Operation of the Defense Acquisition System*, 7 January 2015

DoDI 5000.74, *Defense Acquisition of Services*, 5 January 2016,

DoDI 7041.03, *Economic Analysis for Decision-Making, 9* September 2015

Title 20 United States Code § 7701 et. seq. *Elementary and Secondary Education Act of 1965*

Title 40 United States Code Subtitle III, *Information Management Technology*

Military Standard 881D, *Work Breakdown Structures for Defense Materiel Items,* 9 April 2018

Government Accountability Office Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs, 2 March 2009

Government Accountability Office Schedule Assessment Guide: Best Practices for Project Schedules, 22 December 2015.

Joint Agency Cost Schedule Risk and Uncertainty Handbook, 12 March 2014.

National Defense Authorization Act for Fiscal Year 2017, *Public Law 114-328,* Enacted 13 August 2018

NAVFAC Pub 442, *Economic Analysis Handbook*, November 2013

NIST Handbook 135, *Life-Cycle Costing Manual for the Federal Energy Management Program*, 1995 (supplemented annually)

NISTIR 85-3273-xx, *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis*, updated annually

OMB Circular A-76, *Performance of Commercial Activities,* 4 August 83

OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, 29 October 92

Adopted Forms

AF Form 847, *Recommendation for Change of Publication*

DD Form 1391, *FY___ Military Construction Project Data*

Abbreviations and Acronyms

ACAT—Acquisition Category

AFI—Air Force Instruction

AFIMSC—Air Force Installation and Mission Support Center

AFMAN—Air Force Manual

AML—Acquisition Master Listing

AoA—Analysis of Alternatives

BAH—Basic Allowance for Housing

BCA—Business Case Analysis

CBA—Cost Benefit Analysis

CIO—Chief Information Officer

CRIS—Commander's Resource Integration System

DEAMS—Defense Enterprise Accounting and Management System

DoE—Department of Energy

DRU—Direct Reporting Unit

EA—Economic Analysis

EIA—Economic Impact Analysis

FM—Financial Management

FMA—Financial Management Analysis

FNDH—Foreign National Direct Hires

FOA—Forward Operating Agency

FTE—Full Time Equivalent

FY—Fiscal Year

FYDP—Fiscal Year Defense Program

GPC—Government Procurement Card

HQ—Headquarters

IT—Information Technology

LCC—Life Cycle Cost

LCCE—Life Cycle Cost Estimate

MAJCOM—Major Command

MILCON—Military Construction

MIL-STD—Military Standard

MOA—Memorandum of Agreement

NDAA—National Defense Authorization Act

NPV—Net Present Value

NSS—National Security System

O&M—Operations and Maintenance

O&S—Operations and Sustainment

OCR—Office of Collateral Responsibility

OMB—Office of Management and Budget

OPR—Office of Primary Responsibility

PV—Present Value

RIMS II—Regional Input-Output Modeling System

ROI—Return on Investment

SIR—Saving to Investment Ratio

TDY—Temporary Duty

UAC—Uniform Annual Cost

Terms

Alternative—One possible method of obtaining the stated project/program objective.

Automated Information System—See DoDI 5000.02 Table 1 Note 4. A system of computer hardware, computer software, data or telecommunications that performs functions such as collecting, processing, storing, transmitting, and displaying information. Exclusions are computer resources, both hardware and software, that are (1) an integral part of a weapon or weapon system; (2) used for highly sensitive classified programs (as determined by the Secretary of Defense); (3) used for other highly sensitive information technology (IT) programs (as determined by the DoD CIO; or (4) determined by the DAE or designee to be better overseen as a non-Acquisition Information System program (e.g., a program with a low ratio of RDT&E funding to total program acquisition costs or that requires significant hardware development).

Base Year—Usually defined as the FY in which a program was/will be initially funded.

Benefits—Measures of an alternative's non-monetary value to the United States Government. The only benefit measured in terms of dollars is a reduction in some future resource requirement which: (a) has not been included in an approved (funded) Air Force program or function within the Future Years Defense Program, and (b) would not be reasonably assumed to be included in an Air Force approved program beyond the Future Years Defense Program. See **Chapter 5**.

Benefits Analysis—Analysis to identify, measure and evaluate the non-monetary benefits for each proposed alternative.

Business Case Analysis—See **Comparative Analysis**

Clinger-Cohen Act Compliance—Requirement for all programs that acquire information technology (IT), including National Security Systems (NSS), at any Acquisition Category (ACAT) level, that the Milestone Decision Authority not initiate a program or an increment of a program, or approve entry into any phase of the acquisition process that requires formal acquisition milestone approval, and that the DoD component not award a contract for the applicable acquisition phase until the sponsoring DoD component or Program Manager has satisfied the Clinger Cohen Act requirements. The Milestone Decision Authority and Component Chief Information Officer (CIO), or designee, approve Clinger Cohen Act compliance

Comparative Analysis—An impartial analysis that uses the economic analysis approach to support a decision on how to allocate scarce resources. A comparative analysis identifies alternative methods of solving a problem or accomplishing a stated objective, and compares them by weighing the costs, benefits, and uncertainties for each alternative. Comparative analyses are referred to by a variety of names including, but not limited to, economic analysis, business case analysis, cost benefit analysis, lease vs. purchase, and analysis of alternatives.

Comparative Analysis Product—The document produced through the process of performing a comparative analysis. It identifies the competing alternatives for solving a problem or accomplishing a stated objective, and presents the costs, benefits and uncertainties for each alternative. It interprets the results of the comparative analysis and highlights aspects in favor of and against each alternative. It can include a recommendation, but one is not mandatory.

Constant Year Dollar—The value or purchasing power of a dollar in any specific year, which may or may not be the base ear. Constant year dollars do not contain any inflationary changes that occurred or are forecast to occur outside of the reference year to which the analyst is normalizing. Constant year dollars are not influenced by outlay profiles (Expenditure Patterns). Also known as real dollars.

Constraints—Limitations of any kind to be considered in planning, programming, scheduling, implementing or evaluating programs, projects, initiatives, etc.

Cost Avoidance—Areas where someone may think the budget will be affected when, in fact, it will not be. There are two categories of cost avoidance. The first category is productivity gains that do not result in budget savings such as man hour savings that do not result in a deleted position. The second category is a reduction in some future resource requirement which: (a) has not been included in an approved (funded) Air Force program or function within the Future Years Defense Program and (b) would not be reasonably assumed to be included in an Air Force approved program beyond the Future Years Defense Program.

Cost-Benefit Analysis or Cost-Effectiveness or Cost-Capability Analysis—See **Comparative Analysis**.

Defense Business System—See DoDI 5000.75, *Business Systems Requirements and Acquisition*. Business systems are information systems that are operated by, for, or on behalf of the Department of Defense, including: financial systems, financial data feeder systems, contracting systems, logistics systems, planning and budgeting systems, installations management systems, human resources management systems, and training and readiness systems. A business system does not include a national security system or an information system used exclusively by and within the defense commissary system or the exchange system or other instrumentality of the DoD conducted for the morale, welfare, and recreation of members of the armed forces using non-appropriated funds.

Delta Estimate—A cost estimate that includes only the costs that are different from the funded status quo.

Discount Rate—The interest rate used to translate future costs or benefits into Present Value. It is a measure of the time value of money.

Discounting—The process of using the discount rate to determine the present value of costs.

Economic Analysis—A systematic approach to the problem of choosing how to use scarce resources to meet a given objective. It includes consideration of costs, benefits, and uncertainties associated with all alternatives under consideration. At times, the term economic analysis is used in reference to the product/document that results from applying the economic analysis systematic approach. This resulting document is also referred to as a comparative analysis product.

Economic Analysis Document—See **Comparative Analysis Product**.

Economic Life—The period of time over which the benefits to be gained from a project may reasonably be expected to accrue. It is the shortest of physical, technological or mission life.

Effectiveness—Ability of a project to meet objectives.

Efficiency—The amount of output per unit of input. Alternatively, it is the quality whereby one alternative uses less input per unit of output than other alternatives.

Feasible Alternative—An alternative that is considered practical and realistic to execute by someone familiar with the conditions surrounding the project. A feasible alternative will satisfy the minimum performance necessary to meet the objective.

Formalized Comparative Analysis—A comparative analysis which satisfies the following criteria: 1) All of the elements of the economic analysis approach are included; 2) The analysis is documented from the sources of the raw data, through the interim calculations to the final conclusions so that a reader would be able to reach the same conclusions using only the information in the document; 3) The analysis is certified when required by AFI 65-501 and in accordance with AFMAN 65-506; 4) The analysis includes a comparison of final costs expressed in present value dollars.

Historical Cost—The cost of any item, based on actual dollar (or equivalent) outlay, ascertained after the fact.

Incremental Cost—The change in cost that results from an alternative being selected.

Induced Costs—Those costs that execution of a given project or program alternative impose on another Air Force or government program.

Investment Costs—Costs associated with the acquisition of equipment, real property, nonrecurring services, nonrecurring operations and maintenance (start-up) costs, and other one-time outlays. Commonly investment costs are broadly referred to as any costs in the RDT&E and Procurement Appropriations. For the purpose of a comparative analysis, the implementing investment costs are those costs that are those initial investment costs (e.g., land purchase, architectural design, facility construction) required to build the product (e.g., facility) under evaluation. For clarity, the savings to investment ratio and the internal rate of return use the term implementing investment.

Lease-Purchase Analysis—An analysis of the decision whether to lease or purchase the services of an asset. After the decision to acquire the services of an asset has been made, there may be a need to analyze the decision whether to lease or purchase the asset.

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.

Mission Life—The estimated number of years that the need for an asset is anticipated before the mission either changes or is no longer required.

National Security System (NSS)—See US Code Title 40 Subtitle 3 Section 11103. A telecommunications or information system operated by the Federal Government, the function, operation, or use of which: (A) involves intelligence activities; (B) involves cryptologic activities related to national security; (C) involves command and control of military forces; (D) involves equipment that is an integral part of a weapon or weapons system; or (E) subject to paragraph (2), is critical to the direct fulfillment of military or intelligence missions.

Non-monetary Benefit—Benefit whose value is not represented as cash flow within the analysis.

Non—recurring Costs - One-time costs or costs that are not expected to continue beyond the investment phase.

Objective Statement—A statement of what a project or program seeks to accomplish. In economic analysis, objectives are to be stated such that there is no bias toward a particular alternative.

Opportunity Cost—The cost of a resource, measured in terms of its value in the highest alternate use.

Output—Goods and services produced or provided.

Physical Life—The number of years an asset can physically be used before it wears out.

Present Value—The value today of a future amount or series of future amounts, discounted to reflect the time value of money. Present value comparisons are used in economic analysis to meaningfully compare different cash flows.

Program Evaluation—Economic analysis of ongoing actions to determine how well the stated objectives are being accomplished. Program evaluation studies entail a comparison of actual with intended performance.

Qualitative Benefit—Benefit not naturally measured in quantities. These benefits are usually subjective in nature.

Quantitative Benefit—Non-monetary benefit which can be measured quantifiably. These benefits are usually objective in nature.

Real Property—Land, buildings, structures, utility systems, improvements. Includes equipment attached to and made part of buildings and structures (such as heating systems) but not movable equipment (such as plant equipment).

Reasonable Alternative—Alternatives that a reasonable person (who is unfamiliar with the detailed unique circumstances of the analysis) would consider as a potential solution to the objective. Unreasonable alternatives do not need to be addressed in an Economic Analysis.

Recurring Costs—Expenses incurred on a repeated basis, either annually or periodically.

Residual Value—The expected value of an asset at any point in time before the end of its economic life.

Risk—The probability of a loss or injury.

Savings—The reduction of required funding for a currently approved (funded) program or function, within the time period covered by the Future Years Defense Program. Additionally, when the same type of reduction that would have led to a reduction within the Future Years Defense Program occurs beyond the Future Years Defense Program period, these reductions are also savings because they are reducing cost for a program or function that is assumed to be approved (funded). A reduction in monetary cost from the approved and funded Status Quo (i.e., baseline) alternative is considered savings. Savings result from the cost analysis and should be discussed in the Comparison of Alternatives

Sensitivity Analysis—Examination of the effects obtained by changing the direction and magnitude of assumptions, key variables or other factors in an analysis.

Sunk Cost—Sum of past expenditures or irrevocably committed funds related to a project. Such costs are generally not relevant to decision making as they reflect previous, rather than present, choices.

Technological Life—The estimated number of years before improved technology will make an existing or proposed asset obsolete.

Terminal Value—The expected value of assets at the end of their economic life.

Then-Year Dollar—Reflects the amount of funding needed (expected to be needed) when the expenditure for goods and services were (are expected to be) made. Then-year dollars include inflation and escalation.

Uncertainty—The indefiniteness about the outcome of a situation. Uncertainty includes both risks (i.e., the probability of a loss or injury) and opportunities (i.e., favorable events or outcomes).

Uniform Annual Cost—The average cost per year for a given alternative. It is calculated by dividing the total net present cost (for the full-time life cycle) by the sum of the discount factors of the years in which benefits accrue (economic life).

Wash (Common) Benefit—Any benefit that will be incurred identically across alternatives.

Wash (Common) Cost—Any cost that will be incurred identically across alternatives.

Attachment 2

EXECUTIVE SUMMARY FORMAT REQUIREMENT

A2.1. An Executive Summary is required for comparative analyses.

A2.2. Use the format below: When creating the Executive Summary for a comparative analysis.

Figure A2.1. Executive Summary Format.

EXECUTIVE SUMMARY

INSTALLATION/MAJCOM: *(For Overseas include the country.)*

PROJECT TITLE: *(If applicable, include project number.)*

PROJECT OBJECTIVE: *(State what the project or program under study seeks to attain.)*

BACKGROUND: *(Provide a concise summary of the circumstances surrounding the project.)*

SCOPE: *(Describe the content that is included and the content that is excluded from the analysis.)*

ALTERNATIVES: (*Briefly describe the reasonable alternatives and explain any dismissed as infeasible.)*

Alternative 1:
Alternative 2:
Alternative 3:

SUMMARY OF ANALYSIS RESULTS: *(Include a brief summary of costs, benefits and uncertainty.)*

Costs - The cost summary should include a table(s) with the present value of the alternatives, new funding required by alternative, and any other financial measures used to evaluate the alternatives.

Benefits - The benefit summary should include a summary table if the benefits were measured using: physical counts, an index/ratio, or a rating scale. If benefits were evaluated using narrative descriptions, then those descriptions should be summarized in this section.

Uncertainty - A brief description of the sensitivity analyses should be included in this section. This also is the appropriate section to summarize results for the risk assessment if included. If risk was measured quantitatively, a table should be included.

COMPARISON OF ALTERNATIVES

In this section, the analyst should provide a comparison of alternatives that includes an interpretation of the results that is logically consistent with the costs, benefits and uncertainty documented in the analysis. If a recommendation is included in the analysis, it should be included in this section along with the rationale behind the recommendation.

Attachment 3

COMPARATIVE ANALYSIS CERTIFICATION AND WAIVER APPROVAL

A3.1. Introduction.

A3.1.1. Comparative Analysis Certification is the Air Force's standardized method of assuring comparative analyses are completed in accordance with the instructions outlined in AFI 65-501 and this manual, and that both functional and financial management reviewers at each stage of the review coordinate on the assumptions made and techniques used to produce the analysis results.

A3.1.2. Certification must follow the format and certification process in this Attachment, and, at a minimum, incorporate all statements and information included in this Attachment unless excepted by the criteria **A3.1.6 (T-1).** Functional managers and reviewers at each stage of the review process must sign the Certificate of Satisfactory Comparative Analysis. **(T-1).** Comparative analyses forwarded to the Air Staff or Secretariat must give evidence of intermediate levels of certification. **(T-1).**

A3.1.3. The standup of Air Force Installation and Mission Support Center (AFIMSC) in 2015 as Air Force Materiel Command's sixth center, created a gap in Air Force comparative analysis certification policy. This realignment in conjunction with a Headquarters reduction left some MAJCOMs without the ability to adequately review and certify comparative analysis documents developed within their MAJCOM. As a result, command financial management offices now have the option of forming a memorandum of understanding with the Air Force Materiel Command financial management cost office to certify their comparative analyses. See AFI 65-501, paragraph 1.4.4.

A3.1.4. The Waiver Approval process is the Air Force's standardized method of determining if a project or program that would normally require a comparative analysis in accordance with AFI 65-501, paragraph 1.5, can be exempted due to meeting the criteria outlined in AFI 65-501, paragraph 1.6. The Waiver Approval process requires all functional and Financial Management (FM) offices to coordinate on (i.e., agree with) the initiating office's claim that the project or program meets the criteria outlined in AFI 65-501, paragraph 1.6.

A3.1.5. Waiver Approval must follow the coordination process in this Attachment. **(T-1).** The format of the "Request for Waiver from a Comparative Analysis" form is in **Attachment 4**. Functional and financial managers and reviewers at each stage of the review process must sign the Request for Waiver from a Comparative Analysis. **(T-1).** All waiver requests must be forwarded to the Air Staff or Secretariat for final forwarding to, and approval by, SAF/FMCE. **(T-1).**

A3.1.6. Applicability

A3.1.6.1. The requirement for certification applies to comparative analyses required by AFI 65-501, paragraph 1.5.

A3.1.6.2. The process for certifying comparative analyses detailed in this Attachment applies to most types of comparative analyses. However, processes can vary depending on the type of program or funding.

A3.1.6.2.1. The process for certification described in this chapter does not apply to Clinger-Cohen Act comparative analyses done for programs on the acquisition master list or with other acquisition designations, (e.g., Middle Tier of Acquisition Programs). For these programs, see **Attachment 12** to this manual.

A3.1.6.2.2. Certification of Product Support Business Case Analyses is accomplished through the governance approval process specified in Air Force Pamphlet 63-123.

A3.1.6.2.3. If unsure of the process, the financial management office developing the comparative analysis should consult with the MAJCOM financial management office of primary responsibility to determine the appropriate process.

A3.1.6.3. The approval process for comparative analysis waivers allowed in accordance with AFI 65-501, paragraph 1.6, follows many of the same steps as the process for comparative analysis certification.

A3.2. Roles and Responsibilities – Table A3.1 below highlights the key roles and responsibilities for the Comparative Analysis Certification Process. **Table A3.2** shows the key roles and responsibilities for the Comparative Analysis Waiver Approval Process.

Table A3.1. Comparative Analysis Certification Process Roles and Responsibilities.*.

ROLE		RESPONSIBILITIES
Installation	Installation Functional Office or Tenant	• Certifies the document as functional user, making sure all assumptions are valid and appear reasonable
	Installation FM Office *(Document Owner)*	• Certifies the document as the base financial certifier • Maintains record of completed and certified analysis
MAJCOM	MAJCOM FM Office	• Reviews the document, requests clarification, and suggests modifications, as appropriate • Certifies the comparative analysis IAW AFI 65-501
	MAJCOM Functional Office	• Reviews the document, requests clarification, and suggests modifications, as appropriate. • Certifies the comparative analysis IAW AFI 65-501 • Serves as the conduit for forwarding comparative analyses requiring higher headquarters approval.
	AFMC/FMC	• Responsibilities align with those defined for MAJCOM FM • Offers certifying service upon agreement with other MAJCOMs
HAF	HAF Functional Office	• Receives comparative analysis from MAJCOMs and reviews the document from their functional perspective • Coordinates correspondence between SAF/FMC and MAJCOM • Certifies the comparative analysis IAW AFI 65-501
	SAF/FMCE	• Reviews and certifies all comparative analyses that will be forwarded to SecAF, USecAF, CSAF, VCSAF or outside the AF • Reviews and approves/disapproves all requests for waivers from comparative analysis requirements

* **Note**: Table A3.1 is presented as if the comparative analysis is always initiated at the Installation level.
For comparative analyses initiated at the Center level, the Center takes on the role of the Installation.
For comparative analyses initiated at the MAJCOM level, the MAJCOM takes the role of the Installation and Headquarters Air Force (HAF) takes the role of the MAJCOM in the table.

Table A3.2. Request for Waiver from a Comparative Analysis Process Roles and Responsibilities.*

ROLE		RESPONSIBILITIES
Installation	Installation Functional Office or Tenant	• Certifies the document as functional user, making sure all assumptions are valid and appear reasonable
	Installation FM Office *(Document Owner)*	• Certifies the document as the base financial certifier • Maintains record of completed and certified analysis
MAJCOM	MAJCOM FM Office	• Reviews the document, requests clarification, and suggests modifications, as appropriate • Certifies the comparative analysis IAW AFI 65-501
	MAJCOM Functional Office	• Reviews the document, requests clarification, and suggests modifications, as appropriate. • Certifies the comparative analysis IAW AFI 65-501 • Serves as the conduit for forwarding comparative analyses requiring higher headquarters approval.
	AFMC/FMC	• Responsibilities align with those defined for MAJCOM FM • Offers certifying service upon agreement with other MAJCOMs
HAF	HAF Functional Office	• Receives comparative analysis from MAJCOMs and reviews the document from their functional perspective • Coordinates correspondence between SAF/FMC and MAJCOM • Certifies the comparative analysis IAW AFI 65-501
	SAF/FMCE	• Reviews and certifies all comparative analyses that will be forwarded to SecAF, USecAF, CSAF, VCSAF or outside the AF • Reviews and approves/disapproves all requests for waivers from comparative analysis requirements

* **Note**: Table A3.1 is presented as if the comparative analysis is always initiated at the Installation level.
For comparative analyses initiated at the Center level, the Center takes on the role of the Installation.
For comparative analyses initiated at the MAJCOM level, the MAJCOM takes the role of the Installation and Headquarters Air Force (HAF) takes the role of the MAJCOM in the table.

A3.3. Meaning of Certification with respect to a Comparative Analysis

A3.3.1. Certification by financial management personnel means that a comparative analysis has been prepared in accordance with this manual and AFI 65-501. Certification by financial management personnel attests to the reasonableness of the data in the comparative analysis, the proper use of economic principles in the analysis and the adequacy of documentation such that the comparative analysis is a stand-alone document. All factors and data in the comparative analysis must be current as of the signing of the certification. Certification by financial personnel does not mean that the financial organization endorses the conclusions contained in the comparative analysis.

A3.3.2. Certification by functional personnel indicates that the assumptions, reasoning and cost and benefit assessments in the comparative analysis are consistent with their area of technical expertise. Certification does not mean that the functional organization endorses the conclusions contained in the comparative analysis.

A3.4. Meaning of Coordination with respect to a Request for Waiver from a Comparative Analysis

A3.4.1. Coordination on a request for waiver from a comparative analysis by functional and financial management personnel means that the project or program meets the criteria outlined in AFI 65-501, paragraph 1.6, and the specific reason(s) on the "Request for Waiver from a Comparative Analysis" form selected by the initiating office is valid.

A3.4.2. Coordination on a waiver request also means that clear and convincing justification for the reason(s) selected are included in the waiver request package.

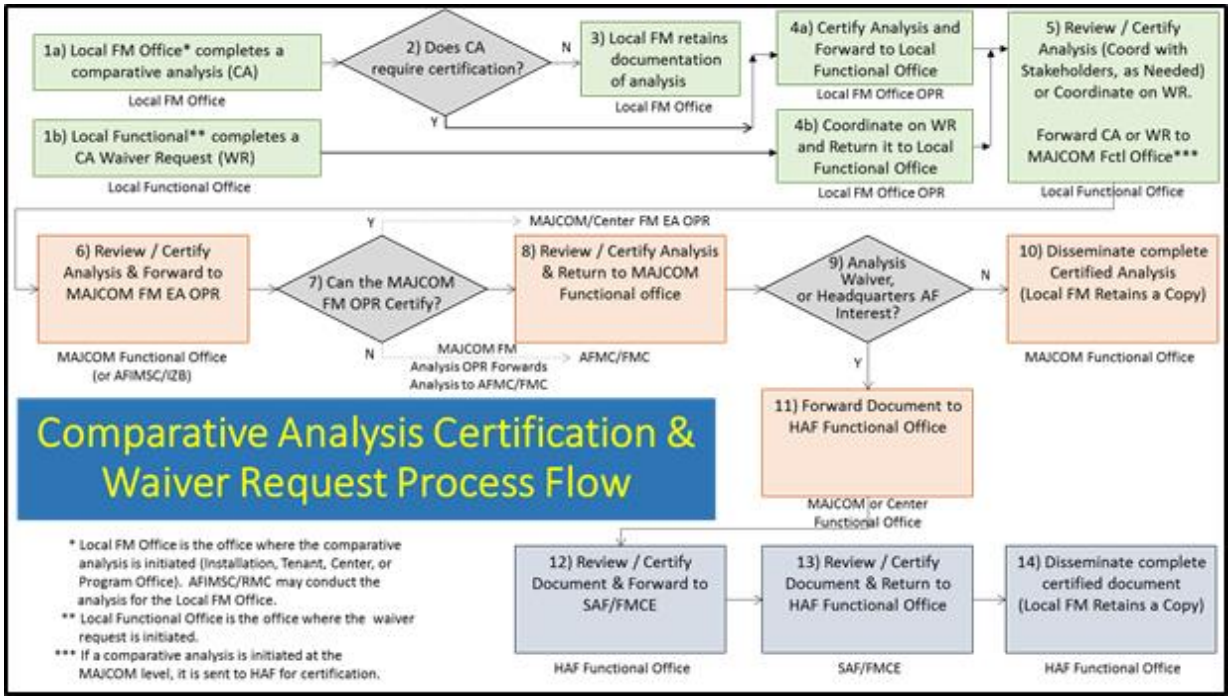
A3.5. Process Description

A3.5.1. Entrance Criteria to the process – The Comparative Analysis Certification Process and the Request for Waiver from a Comparative Analysis Process are initiated in accordance with AFI 65-501 and based on one of the following criteria:

A3.5.1.1. There is a requirement for a comparative analysis to be certified

A3.5.1.2. There is a requirement for a comparative analysis with justification for a waiver to be approved.

Figure A3.1. Comparative Analysis Certification and Waiver Request Process Flow.



A3.5.2. Comparative Analysis Certification Process Steps

A3.5.2.1. Overview - The following section outlines the process steps in the Comparative Analysis Certification Process except those specified in A3.1.6.2.

A3.5.2.2. **Figure A3.1** provides a top level process flow. **Table A3.3** provides further detail for each step in the process.

Table A3.3. Steps for the Comparative Analysis Certification and Waiver Request Processes.

Step	Who Does It	What Happens	
1a	Local FM Office (i.e., Installation, Tenant, Center, Program Office)	**Local FM Office completes comparative analysis. Air Force Installation and Mission Support Center Resource Management Cost Division (AFIMSC/RMC) may assist the Local FM Office in completing the comparative analysis.** Proceed to step 2	
1b	Local Functional Office (i.e., Installation, Tenant, Center, Program Office)	**Local Functional Office, with Local FM Office assistance, completes request for waiver from comparative analysis requirement.** Proceed to step 4b	
2	Local FM Office (i.e., Installation, Tenant, Center, Program Office)	**Does the comparative analysis require certification under this Attachment?** See **paragraph 3.1.6.**	
		If Yes:	**If No:**
		Proceed to step 4a	Proceed to step 3
3	Local FM Office	**Retain documentation of analysis. The (process ends here for analyses not requiring any certification.**	
4a	Local FM Office OPR	**Certify comparative analysis and forward to Local Functional Office.** As the FM certifier, the local FM Office certifies the comparative analysis. Proceed to step 5	
4b	Local FM Office OPR	**Review/coordinate on waiver request & return it to the Local Functional Office for forwarding to the MAJCOM Functional Office.** The Local FM Office OPR coordinates on the waiver request.	

<table>
<tr><th>Step</th><th>Who Does It</th><th>What Happens</th></tr>
<tr><td>5</td><td>Local Functional Office</td><td colspan="2">Review/certify comparative analysis or coordinate on the waiver request. Forward to MAJCOM Functional Office.

The Local Functional OPR certifier certifies the comparative analysis or coordinates on the waiver request.</td></tr>
<tr><td>6</td><td>MAJCOM or Center Functional Office or AFIMSC/IZB</td><td colspan="2">Review/certify comparative analysis or review/coordinate on waiver request & forward to MAJCOM or Center FM comparative analysis OPR

The certifier in the MAJCOM Functional Office certifies the comparative analysis.
The MAJCOM Functional Office must coordinate on waiver requests. (T-1).

If MAJCOM, proceed to step 7. Otherwise, proceed to step 8.</td></tr>
<tr><td>7a</td><td>MAJCOM FM Comparative Analysis OPR</td><td colspan="2">For Comparative Analysis Certification, proceed to step 7b. For waiver requests, proceed to step 8</td></tr>
<tr><td rowspan="3">7b</td><td rowspan="3">MAJCOM FM Comparative Analysis OPR</td><td colspan="2">Can the MAJCOM FM OPR certify?
The MAJCOM FM comparative analysis OPR must decide whether the MAJCOM FM Office can properly certify its analysis. (T-1).</td></tr>
<tr><td>If Yes:</td><td>If No:</td></tr>
<tr><td>The MAJCOM FM comparative analysis OPR certifies the comparative analysis
Proceed to Step 9.</td><td>The MAJCOM FM comparative analysis OPR forwards the request for assistance to Air Force Material Command Cost Analysis (AFMC/FMC) comparative analysis OPR.</td></tr>
<tr><td>8</td><td>MAJCOM or Center FM Comparative Analysis OPR or AFMC/FMC Comparative Analysis OPR</td><td colspan="2">Review/certify comparative analysis or review/coordinate on waiver request & return to MAJCOM Functional Office.

If AFMC/FMC certifies the comparative analysis, they return the document to the MAJCOM FM office who forwards the document to the MAJCOM Functional.

The MAJCOM FM Office must coordinate on waiver requests. (T-1).</td></tr>
</table>

<table>
<tr><th>Step</th><th>Who Does It</th><th colspan="2">What Happens</th></tr>
<tr><td rowspan="3">9</td><td rowspan="3">MAJCOM or Center Functional Office</td><td colspan="2">Does the comparative analysis/waiver request require Headquarters Air Force certification/approval?

All waiver requests require HAF approval.

Certain comparative analyses require HAF certification because the analysis has visibility at the level of the Secretary or Under Secretary of the Air Force or the Chief of Staff or Vice Chief of Staff of the Air Force. A comparative analysis also requires HAF certification if the analysis is anticipated to have an audience outside of the AF. Additionally, comparative analyses initiated at the MAJCOM or Center level require HAF certification.

The MAJCOM Functional Office OPR must determine if the comparative analysis requires HAF certification. (T-2).</td></tr>
<tr><td>If Yes:</td><td>If No:</td></tr>
<tr><td>The MAJCOM or Center Functional Office prepares the comparative analysis and any required supporting information or the waiver request for transmittal to HAF functional staff (proceed to Step 11).</td><td>No additional action required (proceed to Step 10).</td></tr>
<tr><td>10</td><td>MAJCOM or Center Functional Office</td><td colspan="2">Disseminate complete certified comparative analysis.

The MAJCOM Functional Office provides copies of the completed (certified) comparative analysis back to the Local Functional Office and the Local FM Office. The local FM retains a copy.
Process ends after this step.</td></tr>
<tr><td>11</td><td>MAJCOM or Center Functional Office</td><td colspan="2">Forward document to HAF Functional Office.

The MAJCOM or Center Functional Office transmits certified comparative analysis and documentation or coordinated waiver request to HAF Functional Office.</td></tr>
</table>

Step	Who Does It	What Happens
12	HAF Functional Office	**Review/approve document & forward to SAF/FMCE.** For comparative analyses, the appropriate HAF Functional Office receives the certified comparative analysis from the MAJCOM or Center, reviews the package from their functional perspective, certifies and forwards the comparative analysis to SAF/FMCE. If the Functional or SAF/FMCE review produces questions, the HAF Functional Office forwards these questions to the MAJCOM or Center office proposing the project. The HAF Functional Office also coordinates all correspondence between SAF/FMCE and the MAJCOM. For waiver requests, the HAF Functional Office reviews and concurs/non-concurs, as appropriate, with MAJCOM requests for waivers from comparative analysis requirements. Then, the HAF Functional Office forwards all waiver requests to SAF/FMCE.
13	SAF/FMCE	**Review/approve comparative analysis or approve/disapprove waiver & return to HAF Functional Office.** SAF/FMCE reviews and approves the comparative analysis or returns it with questions/comments, as appropriate. SAF/FMCE reviews and approves/disapproves the request for waiver from comparative analysis requirements. When complete, SAF/FMCE returns document(s) to the HAF Functional Office.
14	HAF or Center Functional Office	**Disseminate complete certified document or approved waiver.** The HAF Functional Office provides copies of the completed (certified) comparative analysis or approved waiver to the MAJCOM functional OPR, who will provide completed copies to the Local Functional Office and the Local FM Office. The Local FM retains a copy. *Process ends after this step.*

A3.6. Deliverables

A3.6.1. The deliverable for the Comparative Analysis Certification Process is a completed and certified comparative analysis.

A3.6.2. The deliverable for the Request for Waiver from a Comparative Analysis Process is a completed and coordinated comparative analysis waiver.

A3.7. Exit Criteria - Exit criterion for the comparative analysis certification process or the request for waiver from a comparative analysis process is the completion and distribution of the deliverable(s).

A3.8. Required Format

A3.8.1. Use the format below for certifying comparative analyses unless otherwise specified. For the alternatives listed on the certificate, include the feasible alternatives considered in the analysis.

A3.8.2. Use the format in **Attachment 4** for coordinating on a Request for Waiver from a Comparative Analysis unless otherwise specified.

Figure A3.2. Certificate of Satisfactory Comparative Analysis.

CERTIFICATE OF SATISFACTORY COMPARATIVE ANALYSIS

Installation/MAJCOM:

Project Title:

Project Number (if applicable):

A comparative analysis has been prepared for this project. The following alternatives have been considered:

1.

2.

3.

Financial Management Certification: This comparative analysis follows the instructions in AFI 65-501and the procedures in AFMAN 65-506. Significant changes to project scope, major assumptions, or estimated costs will invalidate this certificate and require revision of this analysis.

Functional Office Certification: The assumptions, reasoning, and functional technical assessments in this comparative analysis are sound with respect to the function implementing this program/project.

Base/Installation-Level Certification:		
(As Applicable)	Base Functional Office Requestor:	(Signature) (Name/Office Symbol/DSN Date)
	Base-Level Financial Analysis:	(Signature) (Name/Office Symbol/DSN Date)
	Base-Level FM:	(Signature) (Name/Office Symbol/DSN Date)
	Other Base-Level Office: (As Applicable)	(Signature) (Name/Office Symbol/DSN Date)
MAJCOM or Center Level Certification:		
(As Applicable)	MAJCOM Financial Management Office	(Signature) (Name/Office Symbol/DSN Date)
	MAJCOM Functional Office	(Signature) (Name/Office Symbol/DSN Date)
	Other MAJCOM Office	(Signature) (Name/Office Symbol/DSN Date)

Attachment 4

REQUEST FOR WAIVER FROM THE COMPARATIVE ANALYSIS REQUIREMENT

A4.1. Use the format below to request a waiver from the comparative analysis requirement. Detailed instructions on waiver criteria are found in AFI 65-501, paragraph 1.6. The Waiver Request approval process is described in **Attachment 3** of this manual.

A4.2. Supporting justification and documentation is required to: Be attached to all waiver requests.

Figure A4.1. Request for Waiver from a Comparative Analysis.

REQUEST FOR WAIVER FROM A COMPARATIVE ANALYSIS

Date of Request:
Project Title:
Requesting Organization: (Functional Organization)

We request a waiver from the comparative analysis requirement on this project for the following reason:

___a. The costs of formalizing the analysis clearly outweigh the potential informational benefits accruing to the decision maker.
___b. There is only one method possible to accomplish the objective.
___c. The project and the method to accomplish it was directed by_____.
___d. The project results from legislation which also directs the method of accomplishment.
___e. The project corrects problems or violations involving health, safety, fire protection, pollution, or security which are serious, urgent and hazardous, and performing a comparative analysis would unreasonably delay the implementation of this project.
___f. Other (List specific reasons why analysis was not prepared).

Base/Installation-Level Certification:		
(As Applicable)	Base Functional Office Requestor:	(Signature) (Name/Office Symbol/DSN/Date)
	Base-Level Financial Analysis:	(Signature) (Name/Office Symbol/DSN/Date)
	Base-Level FM:	(Signature) (Name/Office Symbol/DSN/Date)
	Other Base-Level Office: (As Applicable)	(Signature) (Name/Office Symbol/DSN/Date)
MAJCOM or Center Level Certification:		
(As Applicable)	MAJCOM Financial Management Office	(Signature) (Name/Office Symbol/DSN/Date)
	MAJCOM Functional Office	(Signature) (Name/Office Symbol/DSN/Date)
	Other MAJCOM Office	(Signature) (Name/Office Symbol/DSN/Date)
HAF-Level Certification:		
	HAF Functional Office	(Signature) (Name/Office Symbol/DSN/Date)
	SAF/FMCE	(Signature) (Name/Office Symbol/DSN/Date)

Attachment 5

COMPARATIVE ANALYSIS PREPARER'S GUIDE

A5.1. This is a guide for preparers of comparative analyses. It is intended to assist in performing a comparative analysis. It is like a checklist, but the intention is for it to go beyond the mere listing of items that must be included in the comparative analysis document. It provides a narrative description of the thought processes behind performing a comparative analysis, and is organized consistent with the organization of a comparative analysis so the preparer can use it as an outline when developing and documenting the comparative analysis.

A5.2. What is a Comparative Analysis?

A5.2.1. A comparative analysis is a decision analysis that identifies alternatives and presents defendable economic and technical arguments (to include costs, benefits, and uncertainty) for and against each alternative leading to an assessment of each alternative's ability to achieve stated objectives and the associated costs.

A5.2.2. Names for comparative analyses include Economic Analysis, Business Case Analysis, Cost-Benefit Analysis, Capability Analysis, and Analysis of Alternatives, among others.

Figure A5.1. Format of a Comparative Analysis.

Format of a Comparative Analysis

- Certificate of Satisfactory Economic Analysis (As described in Attachment 3)
- Executive Summary (As described in Attachment 2)
- Table of Contents
- Analysis
  - a. The Objective
  - b. Background
  - c. Scope
  - d. Facts, Ground Rules and Assumptions
  - e. Alternatives
  - f. Cost Analysis
  - g. Benefit Analysis
  - h. Uncertainty (including risk and Sensitivity Analysis)
  - i. Comparison of Alternatives and Interpretation of Results
- Supporting Appendices
- Supporting Documentation

A5.3. Certificate of Satisfactory Comparative Analysis: This is the first page of a typical comparative analysis package. It should follow the format shown in the sample Certificate of Satisfactory Comparative Analysis at the end of **Attachment 3**. In the Certificate:

A5.3.1. Each FM certifier must certify that the comparative analysis complies with the guiding regulations (AFI 65-501 and AFMAN 65-506) and that it reasonably reflects the costs and benefits of the alternatives presented.

A5.3.2. Each Functional OPR certifier must certify that the assumptions, reasoning and functional technical assessments in the comparative analysis are sound and are consistent with their functional area of technical expertise.

A5.3.3. Make sure that: The certificate follows the format shown in the sample Certificate of Satisfactory Comparative Analysis at the end of **Attachment 3**.

A5.3.3.1. It states the Installation name, MAJCOM, and Project Title. If the project has a Project Number (e.g., MILCON economic analyses), it should be included, as well.

A5.3.3.2. It states all feasible alternatives that were considered in the analysis.

A5.3.3.3. It includes this statement, which describes what the FM certifier is certifying about the analysis: "This comparative analysis follows the instructions in AFI 65-501and the procedures in AFMAN 65-506. Significant changes to project scope, major assumptions, or estimated costs will invalidate this certificate and require revision of this analysis."

A5.3.3.4. It also includes this statement, which describes what the Functional certifier is certifying about the analysis: "The assumptions, reasoning, and functional technical assessments in this comparative analysis are sound with respect to the function implementing this program/project."

A5.3.3.5. There are signature blocks for the installation Financial Management Analysis (FMA), FM, and Functional office. For simple administrative reasons, it may be simpler to do MAJCOM certification on a separate certificate, but if not, the certificate should have signature blocks for MAJCOM FM and functional offices. Signatures for other offices should be included as applicable to the analysis.

A5.4. Executive Summary: The Executive Summary briefly summarizes the comparative analysis and its results.

A5.4.1. It should follow the format in **Attachment 2**.

A5.4.2. For additional guidance on a Real Property Construction and Repair Analysis executive summary, see **Attachment 11**.

A5.5. The Objective: The objective should state the requirement each alternative must meet. Make sure that:

A5.5.1. The objective stated is the objective of the program or project, not of the comparative analysis. It should state the requirement that each alternative is designed to fulfill, like "The objective is to provide family housing that meets Air Force standards to 350 military families at Yodel AFB." Note that the objective in this example should not be to conduct a comparative analysis on military family housing. The objective revolves around what the analyst is trying to obtain or accomplish.

A5.5.2. The objective stated addresses the root problem. Seeking solutions to the wrong problem, or a poorly stated problem, often leads to the wrong solution due to missed alternatives, faulty assumptions, etc. Pictorial displays of processes or data (e.g., a flow chart) can assist in ensuring a complete understanding of the problem.

A5.5.3. The objective stated is not so narrow that it eliminates reasonable alternatives.

A5.5.4. The objective is not slanted in such a way that the comparative analysis that follows naturally leans towards preferring any particular alternative (also known as "pre-selection bias"), nor does it unreasonably rule out others.

A5.6. Facts, Ground Rules, and Assumptions: Make sure that:

A5.6.1. Facts are documented and sources are provided.

A5.6.2. Assumptions are not used in place of discoverable facts.

A5.6.3. All assumptions are reasonable and not too restrictive. Do not use assumptions that unduly restrict the study by eliminating possible significant alternatives or by narrowing the scope of consideration. Likewise, assumptions should not unfairly penalize one or more alternatives. If there is any question, include a brief explanation about why each assumption was made.

A5.6.4. The period of analysis is consistent with the type of analysis.

A5.6.5. The most recent discount rates are used.

A5.6.6. The most recent applicable inflation rates are used.

A5.6.7. Applicable/appropriate escalation indices are used to normalize and forecast costs.

A5.6.8. There is a ground rule about the type of dollars used in the document (e.g., FY19 constant year dollars).

A5.6.9. There are assumptions about economic life, depreciation, and residual value.

A5.6.10. Assumptions made in the analysis can reasonably be expected to represent the most likely condition, and are properly supported.

A5.6.10.1. When an assumption is given a value in the analysis, ensure the baseline value is reasonable and not too optimistic or pessimistic.

A5.6.11. The analysis does not assume away costs, especially significant ones. If minor costs are assumed away, include a reasonable explanation.

A5.6.12. Assumptions are examined to determine if they should be included in the Uncertainty Analysis. Assumptions impose a limitation or a judgment. It is important to assess the impact of limitations and judgments contained in significant assumptions. Uncertainty analysis examines the effect that major uncertainties in assumed values have on analysis results.

A5.7. Alternatives: This section of the comparative analysis should list and describe all reasonable methods of satisfying the objective. Make sure that:

A5.7.1. All reasonable alternatives are discussed. It is important to discuss all seemingly reasonable alternatives even if some are subsequently determined to be infeasible. That way, later readers/reviewers will know that all reasonable alternatives were considered.

A5.7.2. All alternatives determined to be infeasible have a convincing explanation as to why that is the case. Explain how the determination of infeasibility was arrived at. The explanation should assume the reader is not familiar with the project or program, or the location at which the project or program will be implemented. Infeasible alternatives are not analyzed any further after this point.

A5.7.3. Alternatives are sufficiently different from each other as opposed to a superficial restructuring of a single course of action.

A5.7.4. Contract and other government agency alternatives are considered where reasonable.

A5.7.5. The status quo is used as a baseline for alternative evaluation where possible.

A5.7.6. The explanation of each alternative describes what would have to be done to implement the alternative if it were to be selected, and that the explanation is written as if the reader were unfamiliar with the project. Make sure that all aspects of the alternative that differentiate it from other alternatives in ways that influence costs and benefits are adequately described.

A5.7.6.1. Use the standard that the descriptions should not leave readers/reviewers confused over why certain costs or benefits are included in some alternatives, but not others.

A5.7.6.2. For example, when a Supply Warehouse comparative analysis includes acquisition costs for new material handling equipment in Alternative 2 but not any other alternatives, the description of Alternative 2 should explain the reason, such as this equipment is required only if the warehouse function were to relocate to a different facility, due to the different configuration of that facility.

A5.7.7. When faced with an environment where key variables in the analysis are changing, or are expected to change in the near future, these changes are incorporated into the base case. In this situation, the analysis may include just this "revised" base case, or both a status quo without the changes and a base case with the changes.

A5.7.8. All significant interfaces with existing systems or projects are adequately considered in developing the alternatives. Proper treatment of alternatives requires careful examination of how the proposed alternatives affect and are affected by related systems or projects. This examination is crucial in areas such as transportation and management information systems.

A5.7.9. Combinations of Systems or Projects are considered among the alternatives. Consider viable alternatives based on mixtures of two or more efforts that combine the best features of each. For example, in a management information system analysis, one alternative might be a manual system and another might be an automated system. If feasible, a third might be a combination of a manual and an automated system.

A5.8. Cost Analysis: This section of the comparative analysis describes the cost estimating methodologies used in the analysis and presents the costs and revenues, as applicable, for each alternative. Make sure that:

A5.8.1. The costs and revenues are labeled with their type of dollars as well as the associated FY (e.g., then-year FY18 dollars, FY12 constant dollars). Check that all totals and other calculations are completed with the same type of dollars.

A5.8.2. Each alternative's costs and revenues are, as a minimum, reported in present value dollars. The report may also include reporting in other types of dollars.

A5.8.3. Revenue estimates are based on realistic assumptions, are computed in the same type dollar as any costs in the same alternative and have realistic phasing.

A5.8.4. If part of the analysis report identifies funding required by FY in order to facilitate budget preparation, those dollars are presented in then-year dollars for that section of the analysis and analysis report.

A5.8.5. Investment costs and recurring costs are properly categorized.

A5.8.6. The costs and revenues for each alternative are estimated as if that alternative was actually going to be implemented, and ALL relevant costs and revenue that are incremental to the decision are included. Exceptions are noted in **paragraphs** A5.8.1.13 and A5.8.1.14.

A5.8.7. Direct and indirect costs all have been considered and included, as appropriate.

A5.8.7.1. Ensure the level and details of costs in the analysis provide enough information for the decision maker.

A5.8.7.2. Ensure costs and related estimating techniques are adequately described and the alternatives remain comparable even when different estimating techniques are used for each alternative.

A5.8.7.3. Items determined to be cost avoidance are not included in the cost analysis. For example, productivity improvements sometimes lower costs and results in savings when compared to other alternatives, but sometimes productivity improvements result in cost avoidances, not savings. If an alternative is estimated to save 100 hours per year, but no manpower positions would be eliminated, then the manpower costs are not reduced. In this situation, productivity improvements are cost avoidance benefits and are captured as hours in the Benefits Analysis section.

A5.8.7.4. Cost avoidance also includes a reduction in some future resource requirement which: **(a)** has not been included in an approved (funded) Air Force program or function within the Future Years Defense Program, and **(b)** would not be reasonably assumed to be included in an Air Force approved program beyond the Future Years Defense Program. These cost avoidances are also not included in the cost analysis. They are incorporated into the benefit analysis.

A5.8.8. All discounting calculations are correct.

A5.8.8.1. As required by **paragraph 4.5.7.4.1**, use midyear discount factors (vice End-of-Year factors).

A5.8.8.2. Any use of End-of-Year or other factors should be explained in the Assumptions section.

A5.8.9. Appropriate inflation and cost escalation indices are used, and that they are applied properly. AFMAN 65-502 provides information on how to appropriately make these adjustments.

A5.8.10. The time phasing of cash flows is realistic.

A5.8.11. Cost collection aggregation and normalization is reasonable.

A5.8.12. Confidence levels are reported for any cost estimate that assessed cost risk. If cost risk was assessed in the estimate for one alternative, cost risk is included for other alternatives, where appropriate, and all alternatives are evaluated at similar confidence levels.

A5.8.13. Common costs are treated the same for all alternatives. These costs need not be included in the comparative analysis. Since these costs are common to all alternatives, there is no value added to comparing them across alternatives, although there is no problem with including them, and for obvious cost items, they often are. Later readers (e.g., Commanders, reviewers) may wonder why there is no cost for an obvious cost element when they read the comparative analysis.

A5.8.14. Only differential costs are included if the cost estimate is a delta estimate. To avoid confusion for those readers who may be unfamiliar with this concept, its use should be explained as a ground rule and in the cost section. If there are multiple alternatives, the differential costs should all be taken from the same reference point, typically the status quo.

A5.8.15. Sunk costs are not included in the analysis. These costs will be incurred regardless of any decision the decision-maker makes. The purpose of comparative analyses is to help decision-makers make choices about resource allocation, and any costs beyond the control of the decision-maker should not play a part in the decisions.

A5.8.16. Costs incurred in foreign currency are converted at the known or estimated exchange rate of the base year of the analysis, NOT the Foreign Currency Fluctuation Account budget rate. Include an explanation of the exchange rate being used and its source. The Assumptions section is a typical location for this explanation.

A5.9. Benefit Analysis: This section of the comparative analysis identifies, measures, and evaluates the non-monetary benefits of the proposed alternatives. Make sure that:

A5.9.1. The Benefits Analysis includes all non-monetary benefits.

A5.9.1.1. Generally speaking, only non-monetary benefits are included in this section. The only benefit measured in terms of dollars is a reduction in some future resource requirement which: (a) has not been included in an approved (funded) Air Force program or function within the Future Years Defense Program, and (b) would not be reasonably assumed to be included in an Air Force approved program beyond the Future Years Defense Program.

A5.9.1.2. Reduced costs and increased revenues are included in the Cost Analysis. Although these are positive, beneficial attributes, they are monetary in nature and are not addressed in the Benefit Analysis.

A5.9.1.3. Any items identified as cost avoidance are included in the Benefit Analysis and not included in the Cost Analysis.

A5.9.2. Benefits primarily relate to the project objective. There may also be ancillary benefits gained from a particular alternative. These ancillary benefits can be recognized in the analysis, but should be secondary to those benefits that are directly related to the project objective.

A5.9.3. Benefits realized in the past are not included in the analysis. Similar to sunk costs, these have already been received and the decision cannot change that.

A5.9.4. Benefits are clearly defined and that they are mutually exclusive. The analysis should not double count anything. To avoid double counting, review benefits to ensure they are not already captured in another benefit or in the Cost Analysis.

A5.9.5. A weighting system is used if all benefit measures are not of equal importance in the analysis/decision. A weight system adjusts the level of impact each benefit has on the analysis.

A5.9.6. Quantitative benefits are included in the analysis in the units in which they naturally occur, unless they are converted to percentages.

A5.9.7. Benefit measuring techniques are properly defined and supported.

A5.9.7.1. Ensure that prioritization (i.e., weighting) of benefits is logical and consistent.

A5.9.7.2. For any scored benefits, ensure the scoring approach is applied consistently across alternatives and the assigned scores are reasonable.

A5.9.8. The timing of the benefits is considered for future systems. The benefits of a proposed future system often depend on when it will be available for operational use and the total operational life span (economic life) of the system. In examining the effect of the time dimension on benefits, pay particular attention to the time between the present and the initial operational availability of the complete system.

A5.9.9. The impact of other operations are considered. Sometimes the system or organization interfaces with other systems or organizations to the point where its operations affect and are affected by the operations of the other. For example, peak use of power, or vehicles, or people may have detrimental effects on related projects or activities. Consider the "ripple effect."

A5.9.10. If risk elements are analyzed (see **section 6.3.2** of this manual) and are analyzed as part of the benefits analysis, ensure their treatment is consistent with the treatment of other benefits to the maximum extent possible. If consistent treatment is not possible, (e.g., risk assessment is narrative while other benefits are quantified), explain how the risk elements are to be evaluated in the overall benefits analysis.

A5.10. Uncertainty Analysis, Including Sensitivity Analysis and Risk: An Uncertainty Analysis includes a Sensitivity Analysis and may include a Risk Analysis. A Sensitivity Analysis tests the effect that uncertain assumptions have on the results of the alternatives relative to each other. A Risk Analysis evaluates risk to program execution (cost, schedule, performance) and risk to the Air Force for each alternative. Make sure that:

A5.10.1. A sensitivity analysis is performed on all assumptions that have a great deal of uncertainty and a significant impact on analysis results.

A5.10.1.1. For quantitative assumptions, a useful technique is to vary the value of the assumption across the range of probable values. This type of analysis will show not only how sensitive results are to changes in the assumption's value, but should also reveal the nature of the relationship between the assumption's value and analysis results (e.g., linear, exponential).

A5.10.1.2. For qualitative assumptions, a useful technique is to try to make other plausible major assumptions. If these invalidate the study's results, then the results are not robust in this area. Ensure this is discussed in the analysis.

A5.10.2. A sensitivity analysis is considered for all cost elements that constitute a high percentage of total life cycle costs. Similarly, ensure a sensitivity analysis is considered for benefits with a large relative weight.

A5.10.3. If the benefits derived in the analysis depend on the assumptions, some consideration has been made to determine the degree of dependence. Generally a good analysis will show the degree of dependence through various kinds of sensitivity analyses.

A5.10.4. If the PVs of the two lowest-cost alternatives are close, a sensitivity analysis is performed on the most uncertain assumption(s) of the alternatives, and if it shows a change in the cost ranking of alternatives, this should be pointed out in the Summary and Comparison of Alternatives section. Identify the crossover points for each assumption.

A5.10.5. Scenario analysis is considered if the decision-maker would benefit from the information gained by analyzing changes to multiple variables simultaneously or if a change in one variable almost always impacts a different variable and they should be examined together.

A5.10.6. The comparative analysis describes what was done in the Sensitivity Analysis and, at least briefly, state its results. Do not just rely on graphs and charts. Explain what they mean.

A5.10.7. The study includes adequate sensitivity analyses in light of the time and resources allotted to the study, the magnitude of the proposed investment, and the likelihood additional analyses would significantly affect the study results. At the minimum, assumptions with uncertainty and a large effect on analysis results and variables comprising a large percentage of costs should be considered for a Sensitivity Analysis.

A5.10.8. A risk analysis is included, if warranted.

A5.10.8.1. Is there reason to believe that the level of risk associated with any alternative will likely be a key consideration for the decision-maker?

A5.10.8.2. Is significant execution risk (i.e., cost, schedule, or performance) associated with the alternatives?

A5.10.8.3. Did the decision-maker direct a risk assessment?

A5.10.8.4. Is there significant uncertainty associated with the assumptions in the benefits analysis?

A5.10.9. If a risk assessment is included:

A5.10.9.1. Adequately explain the risks.

A5.10.9.2. Ensure subject matter expertise underlies the risk assessment.

A5.10.9.3. Only assess political risk if the requirements of section 6.3.7 are met.

A5.10.9.4. If risk mitigation measures are assumed when assessing the risk of an alternative, include the costs of those mitigation measures in the cost analysis.

A5.10.9.5. Include elements rated as zero risk in the overall assessment of risk unless they are common among all alternatives. Leaving those elements out biases the risk assessment.

A5.10.9.6. Include the risk assessment results in the Summary and Comparison of Alternatives.

A5.11. Summary and Comparison of Alternatives: This is where the analyst summarizes the results of the Cost Analysis, Benefit Analysis, and Uncertainty Analysis for each alternative compares the strengths and weaknesses of each alternative with respect to the other alternatives, and explains the implications of the results. Make sure that:

A5.11.1. Summary tables for the cost analysis, benefit analysis, and uncertainty analysis are provided for areas where analyses have been expressed in quantitative terms.

A5.11.2. Analyses expressed in qualitative terms are summarized in narrative form.

A5.11.3. A brief narrative explanation of the summarized cost and benefit data and uncertainty assessment, as well as any measurements and indicators, is included.

A5.11.4. All criteria for comparison are identified. The criteria, or characteristics of cost, schedule, and performance, are the bases for the conclusions.

A5.11.5. All criteria are stated clearly. Decisions will likely be based on them.

A5.11.6. Each alternative's relative strengths and weaknesses are compared.

A5.11.6.1. At a minimum, ensure comparison of the present value of costs and revenues for all alternatives.

A5.11.6.2. At a minimum, ensure benefits of all alternatives are narratively compared.

A5.11.6.3. Ensure present value calculations and other comparison metrics are accomplished in accordance with **Attachment 7**.

A5.11.6.4. Ensure any requirements for special analyses are adhered to (e.g., inclusion of a return on investment calculation for economic analyses required for Clinger-Cohen Act certification).

A5.11.7. Ensure the alternative comparison techniques are appropriate for the project being evaluated.

A5.11.8. Any interpretation in this section is consistent with the interpretation in the Executive Summary. Sometimes, changes made in one of these do not catch up to the other sections before the documentation is finalized.

A5.11.9. The rationale behind any recommendation is explained. A recommendation is not required, but may be provided by the analysis team.

A5.11.10. The analyst/comparative analysis preparer should encourage the decision-maker at each level to prepare a memo stating which alternative they prefer. All such memos should be included with the comparative analysis.

A5.12. Attachments & Appendices - Supporting Documentation: This is everything that serves as the basis for the analysis. Each comparative analysis should be a stand-alone document. Therefore, it should include copies of source data and all calculations used to turn the source data into comparative analysis inputs (e.g., normalization calculations). A reviewer should be able to understand the comparative analysis without having to look at anything else. They should be able to replicate the comparative analysis using the source data and documentation.

A5.13. This is the end of the Preparer's Guide. For more assistance in preparing a comparative analysis, contact the MAJCOM's FM Office, AFIMSC/RMC, or SAF/FMCE.

Attachment 6

COMPARATIVE ANALYSIS REVIEWER/CERTIFICATION GUIDE

A6.1. This is a guide for reviewers and certifiers of comparative analyses. It is like a checklist, but the intention is for it to go beyond the mere listing of items to check. It provides a narrative description of the thought processes behind a comparative analysis review, and is organized consistent with the organization of a comparative analysis, so that a reviewer can go through the guide while going through the comparative analysis. It takes the form of questions, followed by a brief identification of the issue being highlighted.**A6.2 It will help to begin by describing what a Comparative Analysis is:**

A6.2. A comparative analysis is : A decision analysis that identifies alternatives and presents defendable economic and technical arguments (to include costs, benefits, and uncertainty) for and against each alternative leading to an assessment of each alternative's ability to achieve stated objectives and the associated costs. Names for comparative analyses include Economic Analysis, Business Case Analysis, Cost-Benefit Analysis, Capability Analysis, and Analysis of Alternatives, among others.

A6.3. Certificate of Satisfactory Comparative Analysis: This is the first page of a typical comparative analysis package. It should follow the format shown in the sample Certificate of Satisfactory Comparative Analysis at the end of **Attachment 3**.

A6.3.1. There should be signature blocks for the installation FMA, FM, and functional office. For simple administrative reasons, it may be simpler to do MAJCOM certification on a separate certificate, but if not, the certificate should have signature blocks for MAJCOM FM and Functional offices.

A6.3.2. Check to see that all FM and Functional Office OPRs at lower levels have certified (i.e., signed) the comparative analysis. It should be certified by all FM and Functional Office OPRs at lower levels before the reviewer assesses the document at the current level.

A6.3.2.1. Each FM certifier certifies that the comparative analysis complies with the guiding regulations (AFI 65-501 and AFMAN 65-506) and that it reasonably reflects the costs and benefits of the alternatives presented.

A6.3.2.2. Each Functional OPR certifier certifies that the assumptions, reasoning and functional technical assessments in the comparative analysis are sound and are consistent with their functional area of technical expertise.

A6.3.2.3. The FM or Functional reviewer will be expected to certify (i.e., sign) the analysis when thereview is complete. By doing so, the reviewer will be acknowledging agreement with either **paragraph A6.3.2.1** or **A6.3.2.2**, depending on whether the reviewer is an FM certifier or a Functional OPR certifier.

A6.3.3. What to look for: The certificate should:

A6.3.3.1. Follow the format shown in the sample Certificate of Satisfactory Comparative Analysis at the end of **Attachment 3**.

A6.3.3.2. State the Installation name, MAJCOM, and Project Title. If the project has a Project Number (e.g., MILCON economic analyses), it should be stated, as well.

A6.3.3.3. State all alternatives that were considered in the analysis, even if any of them were deemed infeasible.

A6.3.3.4. Include this statement, which describes what the FM certifier is certifying about the analysis: "This comparative analysis follows the instructions in AFI 65-501, and the procedures in AFMAN 65-506. Significant changes to project scope, major assumptions, or estimated costs will invalidate this certificate and require revision of this analysis."

A6.3.3.5. Include this statement, which describes what the Functional certifier is certifying about the analysis: "The assumptions, reasoning, and functional technical assessments in this comparative analysis are sound with respect to the function implementing this program/project."

A6.4. Executive Summary: The Executive Summary should briefly summarize the comparative analysis and its results.

A6.4.1. The Executive Summary should follow the format in **Attachment 2**.

A6.4.2. For additional guidance on a Real Property Construction and Repair analysis executive summary, see **Attachment 11**.

A6.5. Objective: The objective should state the requirement each alternative must meet. It is the reason the project has been proposed. What to look for:

A6.5.1. Does the stated objective address the real problem? Critical to the successful completion of a comparative analysis is the identification and clear statement of the correct objective. Often symptoms and not the disease are believed to be the problem. Seeking solutions to the wrong problem, or a poorly stated problem, almost always leads to the wrong solution due to missed alternatives, faulty assumptions, etc.

A6.5.2. Is the objective statement too narrow? Does it unnecessarily eliminate reasonable alternatives?

A6.5.3. Does the objective statement favor one alternative over another?

A6.5.4. Does the objective statement identify all significant pieces of the problem? The analysis addresses the objective statement. Therefore, the objective statement must fully identify, consider, and address all facets of the problem. Look for significant problem components that are not identified and addressed.

A6.6. Facts, Ground Rules, and Assumptions: What to look for:

A6.6.1. Are all assumptions identified? Look for assumptions that are not identified since assumptions imply a limitation or a judgment. Assessing the impact of limitations and the validity of judgments contained in all assumptions is necessary. A common assumption, seldom made explicit, is that a given organization or system operates by itself. Such an assumption can contribute to inadequate consideration of support provided and complementary outputs produced by related systems. This can lead to improper measurement of total costs and benefits and erroneous conclusions. As a minimum, this section should:

A6.6.1.1. Identify facts and their sources.

A6.6.1.2. Include a ground rule about the type of dollars used in the analysis (e.g., FY19 constant year dollars).

A6.6.1.3. State the inflation and escalation rates used and their sources.

A6.6.1.4. State the discount rates used. They should be the most recent discount rates published in OMB Circular A-94, Appendix C.

A6.6.1.5. Include assumptions about economic life, depreciation, and residual value.

A6.6.2. Are any assumptions used in place of discoverable facts?

A6.6.3. Are the major assumptions reasonable? All major assumptions should be examined at each level of review by either a FM or Functional OPR to determine if they are reasonable with respect to their area of expertise.

A6.6.4. Are the assumptions unduly restrictive? Assumptions, when properly used, narrow the scope of a comparative analysis to manageable proportions. However, the assumptions should not unduly restrict the study, thereby eliminating possible significant alternatives or narrowing the scope of consideration. This examination should continue throughout the review of the analysis and not only during the initial review of the stated assumptions.

A6.6.5. Do any of the major assumptions incorrectly treat a variable whose value has inherent uncertainty as a fact?

A6.6.5.1. Uncertainty can be defined as the lack of reliable knowledge to assign values or probabilities to factors influencing analysis results. Uncertainties can be quantitative or qualitative.

A6.6.5.2. The reviewer should be alert to major assumptions, either stated or implied, assigning fixed values to variables subject to uncertainty--the assigned values then being treated in the analysis as facts.

A6.6.5.3. Examples of quantitative variables that have inherent quantitative uncertainty are: projected workloads, personnel retention rates, equipment usage rates, and availability and reliability rates. If a quantitative variable's value that has inherent uncertainty is treated as a fact, check to see if the assumption is included in the Uncertainty Analysis (addressed in **Chapter 6**). Major qualitative uncertainties treated as assumptions can also affect results.

A6.6.5.3.1. Examples of variables that have inherent qualitative uncertainty are: availability of community services, availability of spare part manufacturers, and advances in technology that lead to new equipment capabilities.

A6.6.5.3.2. Political considerations, such as availability of base rights, assurance of overflight permission, and the character of future environmental standards are also examples of qualitative variables with inherent uncertainty, and can sometimes make the difference between an alternative being feasible or not. Treatment of these kinds of uncertainties is not easy, but if they are important to analysis results, a good analysis will address them, even if only narratively. Sometimes these variables' values can have a limited number of discrete values (e.g., "yes" or "no"; "low", "medium" or "high"). For this type of qualitative variable, the Uncertainty Analysis can show how different assumptions have an impact on analysis results. A study of alternative waste disposal systems thus might investigate the effects of increasingly severe environmental standards and the possible use of improved filtration processes.

A6.6.5.4. Does the analysis assume away any costs? The analysis cannot simply assume away costs. A red flag should go up any time a reviewer see something like this. If minor costs are assumed away, ensure there is a reasonable explanation. Depending on the reasons given, it may be justified, but ensure it passes the sanity check.

A6.7. Alternatives: This section of the comparative analysis should list and describe all reasonable methods of satisfying the objective. What to look for:

A6.7.1. Are all seemingly reasonable alternatives considered?

A6.7.1.1. If the reviewer can think of an alternative that could achieve the objective, but that was not mentioned and discussed in the comparative analysis, then the analysis should probably be returned for further work. If the alternative is feasible, it should be included in the analysis. If the alternative is not feasible, it should be mentioned and the reasons for its infeasibility explained. It is the analyst's responsibility to state the relevant facts and explain why the alternative is infeasible.

A6.7.1.2. Are all feasible alternatives analyzed?

A6.7.2. Are current capabilities or the "base case" adequately considered?

A6.7.2.1. Current capabilities should be considered when constructing alternatives except for clearly stated valid reasons. Valid reasons may include inability of the current system to accomplish the proposed objective. Current capabilities, where applicable, should also be considered as part of a proposed alternative.

A6.7.2.2. If the current system is included as an alternative in an analysis, it should be identified as the Status Quo, or the baseline or base case. The analysis should concentrate on the differences in costs and benefits expected to result from the implementation of the other proposed alternatives versus the baseline. This is proper provided the base case is a feasible alternative; that is, capable of achieving the stated objectives.

A6.7.2.3. If key variables (e.g., projected workload, legislation) in the base case are changing, or are expected to change in the near future, does the base case adequately address the evolving environment? One possible way the analysis can consider the changes is for it to include a "revised" or "modified" base case, or both a status quo without the changes and a base case with the changes.

A6.7.3. Is the implementation of each alternative described? It should be clear to the reviewer what will have to be done to implement each alternative if it were to be selected. Ensure, at a minimum, that aspects of the alternative that differentiate it from other alternatives in ways that influence costs and benefits are adequately described.

A6.7.3.1. The reviewer should not be confused over why certain costs or benefits are included in some alternatives, but not others.

A6.7.3.2. For example, when a Supply Warehouse comparative analysis includes costs for new material handling equipment in Alternative 2, but not any of the other alternatives, the description of Alternative 2 should explain the reason, such as this equipment is required only if the warehouse function were to relocate to a different facility, due to the different configuration of that facility.

A6.7.4. Are combinations of systems or projects considered among the alternatives? Given two or more viable alternatives, would an alternative based on a mixture of two or more alternatives that combine the best features of each be reasonable? For example, in a management information system analysis, one alternative might be a manual system and another might be an automated system. If feasible, a third might be a combination of a manual and an automated system.

A6.7.5. Are all significant interfaces with existing systems or projects adequately considered in developing and describing the alternatives? Proper treatment of alternatives requires careful examination of how the proposed alternatives affect and are affected by related systems or projects. The need for this examination is crucial in areas such as transportation and management information systems.

A6.8. Cost Analysis: This section of the comparative analysis describes the cost estimating methodologies used in the analysis and presents the costs and revenues, as applicable, for each alternative. **What to look for:**

A6.8.1. Are all the costs and revenues labeled with their type of dollars, as well as with their associated FY (e.g., FY18 then-year dollars, FY12 constant dollars)? Check that all totals or other calculations are completed with the same type of dollars.

A6.8.2. Are cost models identified? A cost model implements the methodology used to construct the cost estimate. These models may be complex and computer assisted or may consist of a few relatively simple equations readily computed by hand. The study should identify and describe all cost models used so the reviewer or decision maker can determine the validity of the model used and how the cost estimates were derived. If the documentation does not permit the reviewer to do this, then more information is required.

A6.8.3. Are the cost estimating relationships valid? Does the cost estimating methodology make sense?

A6.8.3.1. Cost estimating relationships may be unsophisticated cost factors, simple extrapolation of recent experience, or complex equations with many variables. In all cases, the purpose of a cost estimating relationship is to translate a characteristic or a specification of a physical resource (e.g., aircraft weight) or conceptual resource (e.g., lines of code) into a cost.

A6.8.3.2. Cost estimating relationships should be based on current data, or distorted estimates may result. For example, the purchase price per pound for engines has increased over the years due to changes in metal alloy technology (advanced alloys are lighter, but cost more per pound to produce), and the maintenance cost per flying hour for aircraft has increased significantly over the past years as more sophisticated aircraft have been introduced into the force structure.

A6.8.4. Are all relevant costs and revenues that are incremental to the decision included in constructing the cost estimate? Deciding which costs are relevant requires analysis and judgment. Preparing a universal list of always-relevant costs is not possible. Ideally, the analysis should indicate why certain costs were considered relevant and why others were omitted. Are revenue estimates based on realistic assumptions and computed in the same type dollar as the costs in the same alternative?

A6.8.5. Is the time phasing of all cash flows realistic?

A6.8.6. Are any cost avoidance items included in the cost analysis? For example, productivity improvements sometimes lower costs (and result in savings when compared to other alternatives), but sometimes only result in cost avoidances. If an alternative is estimated to save 100 hours per year, but no manpower positions will be eliminated, then manpower costs will not be reduced. In this situation, productivity savings should be captured as cost avoidances in the Benefits Analysis section, not as savings in the Cost Analysis section.

A6.8.7. Are sunk costs and inherited assets properly treated?

A6.8.7.1. Inherited assets are those resources such as installations, equipment, and trained personnel inherited from efforts that are being phased out. Sunk costs are costs already expended or irrevocably committed. The costs pertinent to decision making are those yet to be incurred. These previously incurred or committed costs should be excluded from comparative analyses.

A6.8.7.2. Including the costs of inherited assets and other sunk costs can produce distorted cost estimates and financial metrics with consequent effect on the conclusions. On the other hand, if inherited assets have alternative uses, any relevant costs and benefits should be included in the analysis.

A6.8.8. Are construction costs included? The costs for additional installations or facilities are sometimes overlooked, yet these costs can be significant. Costs of facility rehabilitation should also be included.

A6.8.9. Are replacement, consumption, and maintenance costs included? Cost estimates for major equipment items should include not only the acquisition of the operational equipment, but also costs for the additional items required for initial inventory and operations and maintenance for the life of the system (e.g., replacement parts, overhauls).

A6.8.10. Are all training costs included? The resource implications of training personnel can be significant. Initial training costs represent the resources for training personnel necessary for introduction of the alternative. The availability of fully trained personnel and the number of personnel requiring complete or transitional training is the initial resource required. Annual training costs represent the resource implications for maintaining currency/certifications and training replacements. These replacements are required because of usual attrition.

A6.8.11. Are all directly related support costs incremental to the decision included in the cost estimate? Cost estimates of systems or organizations should include the marginal cost of those other units or elements required in direct support.

A6.8.12. Are investment costs and recurring costs properly categorized?

A6.8.13. Are the cost data accurate?

A6.8.13.1. Cost data can be from many different sources and the reviewer cannot check all cost data for accuracy. However, the reviewer should consider whether the sources of data are authoritative and spot check for accuracy. Cost data furnished by manufacturers should be viewed critically. These cost data may be understated, particularly for new or advanced projects. Advanced system costs stated as an exact figure rather than presented as a range with estimated lower and upper values are particularly suspect.

A6.8.13.2. Great accuracy in cost estimates is often not feasible. In fact, in dealing with costs of future acquisition, having a range of possible costs (i.e., upper and lower values) is usually more realistic than a single point cost estimate that implies no uncertainty. The analysis should use the most likely cost in the estimate, but vary costs with uncertainty in a sensitivity analysis.

A6.8.14. Are price escalation and inflation appropriately addressed and properly applied? AFMAN 65-502 provides information on how to appropriately make these adjustments.

A6.8.15. Are costs presented in terms of present value? As explained in paragraph 4.5.6.4.1., were midyear discount factors used (vice End-of-Year factors)? The costs of proposed alternatives will differ both in total dollars and in the percentage distribution of the total over the years included in the period of analysis. The present value, or discounting method, is the means by which dollars in any year of the analysis can be converted to dollars of the present so they can be compared. Using midyear discount factors produces consistency in identifying the resource implications of proposed investments. Any use of End-of-Year or other discount factors should be explained in the Assumptions section. The report may also present costs in other types of dollars, but present value dollars is required.

A6.8.15.1. If the analyst prepared the comparative analysis using an Air Force approved comparative analysis software application, then it is safe to assume all the discounting calculations were done correctly. If not, spot-check the calculations, including calculations of the discount factors from the discount rates (or double-check ALL calculations if there is reason to believe there may be calculation errors).

A6.8.15.2. If part of the analysis report identifies funding required by FY in order to facilitate budget preparation, those dollars should be presented in then-year dollars for that section of the analysis and analysis report.

A6.8.16. Are cost aspects of all alternatives treated equally? Inconsistency in handling the costs of competing alternatives prevents an objective evaluation and can lead to incorrect conclusions. Realize, though, that using the same cost estimating technique for calculating a particular cost element for all alternatives is not always possible. The issue is whether the final dollar estimate accurately reflects the actual resource requirements for the alternative and that the differences in estimating techniques do not distort the cost results. Are wash/common costs included in the cost estimate of any of the alternatives? If so, they should be included in the cost estimate for all alternatives.

A6.8.17. If costs are incurred in foreign currency, have they been converted at the known or estimated exchange rate of the base year of the analysis, NOT the Foreign Currency Fluctuation Account budget rate? Verify that an explanation of the exchange rate being used is provided, as well as its source. The assumptions section is a typical location for this explanation.

A6.9. Benefits Analysis: This section of the comparative analysis identifies, measures, and evaluates the non-monetary benefits of the proposed alternatives. What to look for:

A6.9.1. Are any monetary (i.e., budget) benefits included in the Benefits Analysis?

A6.9.2. Only non-monetary (non-budget) benefits should be included in this section. Therefore, cost avoidance items can be included, but no savings. Budgetary effects should be included in the Cost Analysis.

A6.9.2.1. Examine any items identified as cost avoidance to ensure they are not actually savings.

A6.9.3. Are the benefits clearly defined and mutually exclusive? Ensure there is no overlap in benefits (i.e., double counting of benefits). For example, if upgrading an aircraft's propulsion system, two possible benefits that sound different, but likely overlap would be "Range of Aircraft" and "Air Refueling Tanker Demand."

A6.9.4. Are the benefits all equal in importance? If not, was a weighting system used to adjust the level of impact each benefit has on the analysis? If so, does the weighting scheme seem logical and consistent?

A6.9.5. Are the benefit measuring techniques identified and explained? The study should clearly identify the standards or measures used for evaluating the quantity of benefits provided by the alternatives under study. The alternatives cannot be properly evaluated, particularly when their costs are similar, without proper evaluation of the benefits received.

A6.9.5.1. Are some aspects of benefits received not measurable? The treatment of immeasurable benefits in the total measurement of benefit should be treated thoughtfully.

A6.9.5.2. Measures of benefit obtained by quantifying study aspects such as morale or leadership can be misleading. At times, the only practical solution may be a qualitative discussion of these factors.

A6.9.6. Is the evaluation of benefits based on straight extrapolation? Occasionally a study may evaluate benefits by straight (linear) extrapolation from the measurement of benefits of a small unit. For example, a hypothetical study may show that Airmen are twice as happy when the dining hall serves three entrees rather than one. An extrapolation stating that 21 entrees will make Airmen 10 times happier (i.e., two additional entrees increase happiness by X, so 20 additional entrees will increase happiness by $10X$) may not be justified without supporting evidence. The potential error in straight line extrapolation is that it disregards the concept of diminishing marginal utility (i.e., diminishing returns).

A6.9.7. Is the impact of other operations ignored? In measuring the benefits of a system or organization, consider the effects on other operations. For example, peak use of power, or vehicles, or people may have detrimental effects on related projects or activities. The "ripple effect" should be considered.

A6.9.8. Do the benefits of future systems take into account the timing of benefits? The benefits of a proposed future system often depend on when it will be available for operational use and the total operational life span (economic life) of the system. In examining the effect of the time dimension on benefits, pay particular attention to the time between the present and the initial operational availability of the complete system.

A6.9.9. Is there a reason to believe there is significant execution or schedule risk associated with the alternatives? If so, risk can be handled either in the Benefits Analysis or the Uncertainty Analysis sections of the comparative analysis. If it is not in the Benefits Analysis, make sure an independent risk assessment is included in the Uncertainty Analysis.

A6.9.9.1. The more easily risk can be quantified and measured, the easier it is to handle in the Benefits Analysis. If the risks are difficult to quantify and measure, it might be more appropriate to include the risk assessment in the Uncertainty Analysis.

A6.9.9.2. If the amount of risk is not quantified, is a convincing explanation provided on why the risk was different across the alternatives and what characteristics drove the risk or distinguished the alternatives?

A6.9.10. Has the analysis included any benefits that were realized in the past? Like sunk costs, unless benefits will be received in the future as a result of implementing an alternative, they should not be recognized as benefits.

A6.10. Uncertainty Analysis, including Sensitivity Analysis and Risk: An Uncertainty Analysis includes a Sensitivity Analysis and may include a Risk Analysis. Sensitivity Analysis tests the effect that uncertain assumptions have on the results of the alternatives relative to each other. A Risk Analysis evaluates risk to program execution (cost, schedule, performance) and risk to the Air Force for each alternative. What to look for:

A6.10.1. Is a Sensitivity Analysis performed on all assumptions whose value is uncertain and significantly affects analysis results? The study should clearly explain how sensitive analysis results (costs and benefits) are to changes in assumption values.

A6.10.1.1. Verify that cost elements that constitute a high percentage of total life cycle costs were considered for a Sensitivity Analysis. Similarly, verify that benefits constituting a large relative weight were considered for a Sensitivity Analysis.

A6.10.1.2. If the present values of the two lowest-cost alternatives are very close, a Sensitivity Analysis should be done on the most uncertain assumption(s) of the alternatives, and if it shows a change in the cost ranking of alternatives, this should be pointed out in the Summary and Comparison of Alternatives section.

A6.10.2. Are the processes followed in conducting all sensitivity analyses explained? Additionally, are the results of each sensitivity analysis explained? Reader of the comparative analysis should not have to rely solely on graphs and charts. An explanation of the graphs and charts highlighting the important findings should be included.

A6.10.3. For each sensitivity analysis performed, did the sensitivity analysis consider the effects of varying variable values across the entire range of reasonable values for the period of analysis? For example, if the period of analysis is two years and current interest rates are 5 percent, a reasonable range for a sensitivity analysis might be 3-7 percent. However, if the period of analysis is 20 years, a reasonable range might be 1-10 percent.

A6.10.3.1. If sensitivity analyses show a change in the cost ranking of alternatives, is this finding pointed out in the Summary and Comparison of Alternatives section?

A6.10.3.2. Are the crossover points for each assumption identified?

A6.10.4. The period of analysis is often not considered to be a subject for sensitivity analysis, but if one or more alternatives have occasional “balloon” costs (e.g., overhaul of heavy equipment, replacement of air conditioners, water heaters, washers/dryers, and other durable goods), it probably should be. For example, would 10 years of operations as opposed to 5 make a significant difference in the relative costs of the alternatives?

A6.10.5. For qualitative assumptions, were sensitivity analyses considered? A useful technique is to make other plausible major assumptions (e.g., the use of a Fixed Price contract versus a Cost Plus contract). If these invalidate the study's results, then the analysis should discuss the assumption values that drive the results and try to assess the likelihood of the different values.

A6.10.6. The number of sensitivity analyses required and feasible is a matter of judgment. There are limits to the time and manpower available for a given study. At the minimum, though, a sensitivity analysis should be performed on assumptions with uncertainty and a large effect on analysis results. Variables comprising a large percentage of costs should also be considered for sensitivity analysis. The reviewer should have a confident understanding of the circumstances under which analysis results would change.

A6.10.7. Does the level of risk associated with any alternative have a reasonable likelihood of being a key consideration for the decision-maker? Or, is a risk analysis required by the type of analysis or the decision-maker? If so, ensure a risk analysis is performed. If not, a risk assessment is not required.

A6.10.8. If a risk analysis is included, does it assess the following issues (if appropriate):

A6.10.8.1. Risk that the benefits expected from an alternative may not be achieved. If there is uncertainty associated with the assumptions in the benefits analysis, a risk analysis can examine the probability and impact of not achieving the benefit.

A6.10.8.2. The degree of execution risk (i.e., cost, schedule, or performance) associated with the alternatives.

A6.10.9. Ensure the cost of any risk mitigation measures assumed when assessing the risk of an alternative are included in the cost analysis.

A6.10.10. Make sure the risks are adequately explained and are included in the Summary and Comparison of Alternatives section.

A6.10.11. If risk is not quantified, make sure a convincing explanation is provided on why the risk is different across the alternatives and what characteristics drive the risk or distinguished the alternatives.

A6.10.12. Ensure risk elements rated as zero risk are included in the overall assessment of risk unless they are common among all alternatives. Leaving those elements out biases the risk assessment.

A6.11. Summary and Comparison of Alternatives: This is where the analyst summarizes the results of the Cost Analysis, Benefit Analysis, and Uncertainty Analysis for each alternative, compares the strengths and weaknesses of each alternative with respect to the other alternatives, and explains the implications of the results. What to look for:

A6.11.1. Are the present value of costs and revenues summarized, compared, and discussed across alternatives? (Ensure cost avoidance is not included in the discussion of costs).

A6.11.2. Are the benefits, both quantitative and qualitative, compared across alternatives?

A6.11.3. Are the results of the Uncertainty Analysis summarized and the assumptions with crossover points identified?

A6.11.4. Are summary tables accompanied by a narrative explanation of the summarized cost and benefit data and uncertainty assessment included?

A6.11.5. Are analyses expressed in qualitative terms summarized?

A6.11.6. Are the criteria for comparison identified? The criteria (i.e., or characteristics of cost, schedule, and performance) are the bases for the conclusions. The criteria should be stated specifically and clearly.

A6.11.7. Are the criteria too general? Very general criteria should be suspect. For example, a study may state a criterion as being "the system with maximum military worth" or the "best system." These generalizations can be interpreted differently by different people and, therefore, are not meaningful. Good criteria leave less room for individual interpretation (e.g., “the minimum cost of maintaining a specified level of transport capability over a specified time span.").

A6.11.8. Is the interpretation of results (conclusions) logically derived from the material in the study?

A6.11.8.1. Do the conclusions show bias? Studies sometimes unwittingly show bias because of parochial or institutional interests. One test for bias is to judge whether the same conclusions would be reached by another study agency based on the material in the study.

A6.11.8.2. Are the conclusions based on outside considerations? If so, document those considerations in the analysis.

A6.11.8.2.1. Occasionally, conclusions must be drawn in the face of great uncertainty. A study may find several alternatives exhibiting similar costs and benefits, but the results are very sensitive to the values assigned to the inputs. In this situation, some studies arrive at conclusions based on considerations other than those studied. In other words, the study agency is stating, after the analysis was performed, that applying the criteria did not lead to a preference, but rather to indifference among the alternatives. In that case, the issue was decided based on other unstudied criteria. In situations of this kind, those criteria should be stated, and sensitivity to the unstudied criteria must be examined.

A6.11.8.2.2. Some studies draw conclusions based on previous studies and materials that are not fully documented within the study (mention in a bibliography is not enough). If input from another study is essential, it should be documented and explained. This requires at least a statement of the validity, scope of application, and uncertainty related to the particular input.

A6.11.9. Have all the significant consequences been considered in arriving at the conclusions and interpretations?

A6.11.9.1. Sometimes a study fails to consider all the pertinent consequences in developing the conclusions of the study or arriving at the decisions to be made. These consequences are often referred to as "spillovers." For example, if a study recommended adoption of an engine requiring a new type of fuel, the supply system to include supply, storage, and transportation operations would be affected.

A6.11.9.2. Spillover effects are not always negative. For example, adopting dehydrated rations to achieve greater shelf life may also reduce construction and transportation costs because of the smaller unit volume and weight of dehydrated food.

A6.11.10. Are the interpretations and conclusions in this section consistent with the interpretations in the Executive Summary? Sometimes, changes made in one of these do not catch up to the other sections before the documentation is finalized.

A6.11.11. Are the conclusions intuitively satisfying? When the conclusions of the study are not intuitively satisfying, one should try to isolate the cause. If the study fails to show by data, models, and other means that the intuition is wrong, further examination is required to determine if some subtle considerations have been neglected because of over simplification or other reasons.

A6.11.12. Are the criteria consistent with higher echelon objectives? No matter what the concern of a study, the subject falls into a larger framework. Are the criteria used in the study consistent with higher-level objectives? This requires management judgment and the necessity to examine the larger context of the problem. If the study criteria are not consistent with objectives at the higher level, then the analysis may be addressing the wrong problem (sub-optimization).

A6.11.13. If a recommendation is included in the analysis, does the recommendation logically follow from the conclusions? Is the rationale used to determine the recommendation included? Consider the feasibility of the recommended alternative in light of political, cultural, policy, and other considerations not included in the analysis.

A6.12. Documentation and Data Evaluation: This is everything that serves as the basis for the analysis. Each comparative analysis should be a stand-alone document, so it should include copies of source data and all calculations used to turn source data into comparative analysis inputs. A reviewer should be able to understand the comparative analysis without having to look at anything else. They should be able to replicate the comparative analysis using the source data and documentation. If the reviewer does not feel the documentation provides enough information to do so, the documentation may be insufficient. What to look for:

A6.12.1. Is the analysis adequately documented? One characteristic of good documentation is that it provides enough information about the data sources and methodology used so a reader not familiar with the study could arrive at essentially the same result. Without documentation, an analysis appeals for acceptance solely on faith in the authority of the issuing agency.

A6.12.2. Are all data sources provided? Are the data sources authoritative?

A6.12.3. Are the facts correct? It is usually not possible to verify all the facts from a variety of sources used in the study. However, facts upon which conclusions are based should be specifically evaluated.

A6.12.4. Are the facts stated with proper qualifications? In addition to checking the validity of the facts, completeness should also be evaluated. Some material may be correct in isolation, but may take on a different meaning when other facts are added. For example, a bulldozer may generally be able to move "x" cubic yards of earth per day. However, this rate may not be valid for earth removal in rocky or frozen terrain. Likewise, a builder might be able to construct buildings at a certain pace, but if work cannot be performed in the rain, then the rate of construction may not be valid if the project is scheduled for rainy season.

A6.12.5. Are the performance characteristics valid?

A6.12.5.1. Performance characteristics are often the key element in determining the benefits of a system or piece of equipment.

A6.12.5.2. In evaluating the validity of performance characteristics, the source of the data should be examined.

A6.12.5.2.1. Performance characteristics based on manufacturer's claims are often optimistic.

A6.12.5.2.2. Performance characteristics derived from tests at research installations also require examination. Test performance characteristics are usually derived under controlled conditions. Performance characteristics derived from field tests should be examined. Such tests can, at times, produce misleading results due to artificialities caused by abnormally stringent operating and safety regulations and choice of test areas.

A6.12.6. Are the data from supporting simulation models valid? Does the analysis use the results from simulation models in an appropriate manner?

A6.12.6.1. In determining the validity of simulation results, the reviewer should judge how well the model portrays the essential relationships. The review should also evaluate the validity of the judgments and assumptions used in conducting the analysis. Major judgments and assumptions used in the model should be fully identified.

A6.12.6.2. Studies sometimes use the results of simulation models as facts. In evaluating whether the analysis uses simulation results appropriately, the reviewer should consider the nature of simulation. Basically, a simulation involves an abstraction from the real world. Models are structured according to mechanistic rules or judgments or both, and these are made by people. Additionally, many assumptions are made when constructing the model. Therefore, simulation results should not be treated as fact. However, they can be used to provide insight into problem behavior, and sensitivity analysis can be used on the simulation model assumptions to determine the volatility of the model's results, or on the model's output if it is fairly stable and predictable.

A6.12.7. Are any of the data derived from questionnaires? The data obtained from questionnaires should be examined to determine the validity of the questions, adequacy of the number of people surveyed, and the relevant qualifications of the people surveyed.

A6.12.8. This is the end of the reviewer's guide. If reviewer need more assistance in reviewing a comparative analysis, there is also a Comparative Analysis Preparer's Guide in **Attachment 5** of this manual.

Attachment 7

FORMULAS FOR FACTORS AND FINANCIAL INDICATORS

A7.1. Midyear discount factor.

Table A7.1. Midyear discount factor.

$$F_t = \frac{1}{(1+r)^{(t-.5)}}$$

Where:
F_t is the discount factor for dollar flows in year t,
r is the annual discount rate written as a decimal, and
t is the sequence number of the year in question, beginning at program inception.
t = 1 indicates the first year in the period of analysis.

The formula produces a unique factor for each year in an analysis. The discount rates come from OMB Circular A94, Appendix C. SAF/FMCE provides annual updates to the discount rates to be used for economic analysis. The rates can be found on the SAF/FMC SharePoint® page, to which a link is provided on the SAF/FMCE page of the Air Force Portal.

A7.2. End-of-year discount factor.

Table A7.2. End-of-year discount factor.

$$F_t = \frac{1}{(1+r)^{t}}$$

Where:
F_t is the discount factor for dollars flows in year t,
r is the annual discount rate written as a decimal fraction, and
t is the sequence number of the year in question, beginning at program inception. t = 1 indicates the first year in the period of analysis.

A7.3. Present Value (PV): Present Value is the value of a future amount or series of future amounts, discounted to reflect the time value of money. The future amounts are discounted to a date chosen by the analyst (e.g., first year of investment). Present value comparisons are used in economics to meaningfully compare different cash flows. Present Value is the primary cost measurement for decision-making and will be included in all formalized cost comparisons.

Table A7.3. Present Value (PV).

$$PV_{t=1} = \sum_{t=1}^{N} [FV_t * F_t]$$

Where:
PV is the present value of a future cash flow,
FV_t is the future value of a cash payment or cost,
F_t is the appropriate mid-year or end of year discount factor,
t is the sequence number of the year in question, beginning at program inception, and
N is the period of analysis or number of years over which all cash flows occur.

A7.4. Uniform Annual Cost (UAC): Uniform Annual Cost is 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 in which costs were incurred. The following is a notional example showing the Uniform Annual Cost calculations for two alternative methods for meeting an objective. The first alternative has an economic life of 5 years and the second alternative has an economic life of 10 years. The example uses a 2.7% midyear discount rate:

Figure A7.1. Uniform Annual Cost Calculation Example.

	Alternative A			Alternative B		
Year	Discount Factor	Cost	Present Value	Discount Factor	Cost	Present Value
1	0.9868	$1,000	$986.8	0.9868	$1,700	$1,677.5
2	0.9608	$100	$96.1	0.9608	$100	$96.1
3	0.9356	$100	$93.6	0.9356	$100	$93.6
4	0.9110	$100	$91.1	0.9110	$100	$91.1
5	0.8870	$100	$88.7	0.8870	$100	$88.7
6				0.8637	$100	$86.4
7				0.8410	$100	$84.1
8				0.8189	$100	$81.9
9				0.7974	$100	$79.7
10				0.7764	$100	$77.6
TOTAL	4.6811	$1,400	$1,356.2	8.7785	$2,600	$2,456.7
UNIFORM ANNUAL COST			**$289.7**			**$279.9**

A7.4.1. UAC Calculation. This table above shows that Alternative A has a lower total cost than Alternative B, but their economic lives of the alternatives are different. The benefit of Alternative B is being received for 10 years and only the benefit of Alternative A is being received for 5 years. When the difference in economic lives of the alternatives are normalized using the UAC Approach, Alternative B has a lower Uniform Annual Cost.

Table A7.4. UAC Calculation.

$$Alternative\ A\ UAC = \frac{\$1{,}356.2}{4.6811} = \$289.7$$

$$Alternative\ B\ UAC = \frac{\$2{,}456.7}{8.7785} = \$279.9$$

A7.4.2. Uniform Annual Cost is used as an alternative to the Terminal Value Method of reporting costs for the alternatives. The Uniform Annual Cost measure has the benefit of not requiring the estimate of a terminal value. Senior leaders will differ as to which method they prefer.

A7.5. Savings/Investment Ratio (SIR): The SIR equals the present value of the savings generated from an investment divided by the present value of the implementing investment amount. The SIR should include all savings across the program life.

Table A7.5. Savings/Investment Ratio (SIR).

$$\frac{Savings}{Implementing\ Investment}$$

A7.6. Return on Investment (ROI): The present value of the total return generated by an investment (minus the implementing investment amount) divided by the present value of the implementing investment amount.

Table A7.6. Return on Investment (ROI).

$$ROI = \frac{Savings - Implementing\ Investment}{Implementing\ Investment}$$

A7.6.1. Return on Investment is required in Clinger-Cohen Act Economic Analyses.

A7.6.2. The Return on Investment is very similar to the Savings to Investment ratio. They are related by the following formula.

Table A7.7. Savings to Investment ratio.

$$\text{ROI} = Savings\ to\ Investment\ Ratio - 1$$

A7.6.3. Return on Investment is useful for projects that are expected to achieve efficiencies that would realize savings or a profit. Return on Investment allows for a comparison of financial return as a percent of the implementing investment. A drawback of Return on Investment is that it does not provide the magnitude of the financial benefit/cost in absolute terms (present value calculations provide that information). Many government projects are selected for the non-monetary benefits they yield. As a result, return on investment may be zero or negative for many government projects.

A7.7. Cost/Benefit Ratio (CBR): The present value cost of an alternative divided by the benefit measure of that alternative. The result will be the average cost per unit of benefit. This metric is applicable with benefits measured quantitatively (e.g., direct quantitative measure or weighted benefit score)

A7.7.1. This technique should be used with caution. Decisions generally should not be made on average costs and benefits, but instead should be based on marginal costs and benefits. As an example, assume the benefit being measured is hangar size as measured in square meters, assuming all square meters of area produce the same marginal benefit. Nominal life cycle costs and the benefits are provided in the **Figure A7.2**

Figure A7.2. Notional Example Cost Benefit Ratio.

PV19 $	Status Quo	Add/Alter
Square Meters (Benefit Measure)	4,000	5,000
Cost	$10,500,000	$15,000,000
Cost/Benefit Ratio	$2,625	$3,000

A7.7.2. The cost per benefit ratio in **Figure A7.2** implies that the status quo is a better choice than the Add/Alter alternative because the average cost per square meter is lower. However, the decision should not be based on which alternative has the lower average cost per square meter. Instead, the decision should be based on whether the decision-maker believes the additional 1,000 square meters is worth $4.5M. That is the marginal cost paid for the marginal benefit received. Even though the cost per benefit is higher for the additional 1,000 square meters, that may still be an acceptable price for the decision-maker.

A7.7.3. An additional concern with cost benefit ratios is that with some types of analyses, the decision-maker does not directly incur the cost for the benefit received. For example, funding for major MILCON projects does not come out of a local organization's budget. The fact that the cost is not directly incurred at the local level, may impact how benefits are valued relative to cost.

A7.8. Payback Year:

A7.8.1. To calculate the Payback Year, add the expected savings for each period (i.e., the numbers in the Annual Totals column) until the cumulative total equals or exceeds the investment total. That will be the year in which payback is achieved. In the example in **Figure A7.3** below, investments are reflected as negative cash flows in the Annual Totals column. All of the cash flows are the incremental changes that result from the decision to invest. By the end of the investment year (year 0) there are cash outflows of $100,000. By the end of year 1, there is a mix of cash outflows and savings that net to $50,000. By the end of year 2 and for subsequent years, the incremental cash flow has turned positive in that the savings now exceed the incremental cost for that year. Looking at the Cumulative Totals column, the cumulative cash flow switches from negative to positive sometime in year 5, so the Payback Period is between 4 and 5 years. To calculate the Payback Period, the analyst needs to have an idea of the schedule of cash inflows in the Payback Year. In this case, cash inflows will be $53,000 and there will be $50,000 remaining until payback is reached. It is common to assume that the cash inflows occur evenly throughout the year. As a result, the portion of year before payback

is reached is: $\frac{\$50,000}{\$53,000} = 0.94$. As a result, it takes 4.94 years, or about 4 years and 11 months to reach payback.

A7.8.2. By convention, payback year analysis ordinarily uses un-discounted dollars.

Figure A7.3. Payback Year Example (TY19$).

Year	Annual Totals	Cumulative Totals	Description
Year 0	-$100,000	-$100,000	Initial Investment
Year 1	-$50,000	-$150,000	Additional Investment
Year 2	$28,000	-$122,000	Return
Year 3	$32,000	-$90,000	Return
Year 4	$40,000	-$50,000	Return
Year 5	$53,000	$3,000	Year of Payback

A7.8.3. Payback is useful for projects that are expected to achieve efficiencies. Payback tends to be biased toward projects with earlier savings. This could be good given that savings later in the life of a project are commonly less certain. The drawback is for those cases where savings expected later in a project are anticipated to be much larger than the other alternatives.

Attachment 8

SAMPLE FORMATS FOR SUMMARY OF COSTS

A8.1. Figures A8.1 and A8.2 are two sample formats for displaying summarized cost data. Their use is not mandatory, and can be changed to fit the needs of the analysis. Items such as Uniform Annual Cost, Savings/Investment Ratio, Payback Year, etc. may not be applicable to the analysis. Notional numbers were included in the figures.

Figure A8.1. Format A - Summary Of Costs For Comparative Analysis.

Format A - Alternative 2: Upgrade					
1. Submitting Organization	XYZ Air Force Base				
2. Type of Submission	Capital Investment Program				
3. Project Title	XX Capability				
4. Description of Project	To provide XX capability.				
5. Title of Alternative	Upgrade				
6a. Project Life (Years)	10				
6b. Period of Analysis (TVM)	9				
7. Program/Project Costs	(NOTE: discount factors are rounded)				
a. Project Year	b. Non-Recurring	c. Recurring Operations	d. Annual Cost	e. Discount Factor	f. Discounted Annual Cost
2015	$ 600,000	$ 900,000	$ 1,500,000	0.9997	$ 1,499,498
2016	$ -	$ 978,000	$ 978,000	0.9990	$ 977,018
2017	$ -	$ 997,560	$ 997,560	0.9983	$ 995,891
2018	$ -	$ 1,017,511	$ 1,017,511	0.9977	$ 1,015,129
2019	$ -	$ 1,037,861	$ 1,037,861	0.9970	$ 1,034,738
2020	$ -	$ 1,058,619	$ 1,058,619	0.9963	$ 1,054,726
2021	$ -	$ 1,079,791	$ 1,079,791	0.9957	$ 1,075,100
2022	$ -	$ 1,101,387	$ 1,101,387	0.9950	$ 1,095,868
2023	$ -	$ 1,123,415	$ 1,123,415	0.9943	$ 1,117,037
2024	$ -	$ 1,145,883	$ 1,145,883	0.9937	$ 1,138,615
8. TOTAL	**$ 600,000**	**$ 10,440,027**	**$ 11,040,027**	**9.9666**	**$ 11,003,620**
9. Total Discounted Project Cost: Line 8, Column F					$ 11,003,620
10. **UNIFORM ANNUAL COST:** Line 9 / Line 8, Column E					$ 1,104,051
11. Discounted Terminal Value					$ 59,659
12. Discounted Value of Costs Beyond Terminal Value Period of Analysis					$ 1,138,615
13. TVM PROJECT COST (discounted): Line 9 - (Line 11 + Line 12)					**$ 9,805,346**
14. Source/Derivation of Cost Estimates: Included in Appendix 1					
15. Principal Action Officer	Alan Analyst - Financial Analyst /xxx-xxx-xxxx /Alan.D.Analyst@us.af.mil				

Notes:
- TVM = Terminal Value Method
- When comparing alternatives using the Uniform Annual Cost method include all costs for the entire economic life of the alternative.
- When comparing alternatives using the Terminal Value Method, subtract discounted costs beyond the Terminal Value Method period of analysis (usually the number of years of the alternative with the shortest economic life) and subtract out the discounted residual value for the alternative with the longer economic life. The discounted costs beyond the Terminal Value Method period of analysis are highlighted orange for illustrative purposes.

A8.2. FORMAT A COMMENTS:

Table A8.1. Format A Comments.

Line 5: Indicates the alternative being considered for attainment of the project objective. Generally a Format A is submitted for every feasible alternative which has been costed in the comparative analysis. Format A, and the other formats in this instruction, may be modified to fit the special features of a particular analysis.

Line 6a: Indicates the economic life of the project for which the alternative is being proposed. This period may be either equal or unequal to the physical or technological lives of the investment. If the requirement for the project is longer than the economic life of any particular investment, future investment may have to be included in the analysis.

Line 6b: Indicates the period of analysis for the study. The period of analysis is used for the Terminal Value Method. The Terminal Value Method is explained in **Chapter 4** of this manual

Column 7a: Indicates the years into the future that the project or program will exist.

Column 7b: Nonrecurring investment costs, corresponding to the Column 7a project year during which they will be incurred. These costs should include all costs not categorized as annually recurring, periodically recurring or operational costs. These costs may include but are not limited to: initial investment, future overhaul of equipment, future renovation of facilities, installation and start-up costs, equipment relocation, and freight charges. In Column 7b, Research and Development (R&D) costs are separated from other investment costs. If there are no R&D costs, the format may be modified to include only one column under Column 7b for investments.

Column 7c: Recurring costs that correspond to the Column 7a project year during which they will be incurred.

Column 7d: Includes the total incurred costs, obtained by summing Columns 7b and 7c, in relation to the project year indicated in Column 7a.

Column 7e: Discount factors, which should be mid-year, can be generated by computer spreadsheets using a formula (see **Attachment 7** of this instruction).

Column 7f: Discounted annual cost is obtained by multiplying Column 7d, Annual Costs, times Column 7e, Discount Factor. The product is the present value of the annual costs.

Line 8: The totals row includes the totals of Columns 7b through 7f. Column 7e total should include only those factors corresponding to years in which recurring costs occur. Column 7f total is the total project cost (discounted) and is also entered on Line 9, Total Discounted Project Cost.

Line 9: From Line 8, Column f.

Line 10: Uniform Annual Cost, sometimes called "equivalent annual cost," is calculated by dividing the total discounted project cost (Line 9) by the sum of the discount factors of the years in which recurring costs occur (ordinarily from Line 8, Column 7e, Discount Factor).

Line 11: The discounted terminal value is determined by multiplying the anticipated terminal value by the discount factor corresponding to the year in which terminal value will be realized. If terminal value is not applicable in a project or is zero, "NA" or 0 should be entered here.

Line 12: The discounted value of the costs beyond the terminal value period of analysis are subtracted from the cost of the alternative to normalize the costs to the period of analysis

Line 13: The Terminal Value Method project cost is Line 9 minus Line 11 and Line 12.

Figure A8.2. Format A-1--Summary of Differential Costs for Economic Analysis.

Format A-1						
1. Submitting Organization		XYZ Air Force Base				
2. Type of Submission		Capital Investment Program				
3. Project Title		XX Capability				
4. Description of Project		To provide XX capability.				
5. Title of Alternative						6a. Econ. Life
5a.	Baseline					9
5b.	Upgrade					10
6b. Period of Analysis (TVM)		9				
7. Program/Project Costs		(NOTE: discount factors are rounded)				
a: Project Year	b: Recurring Costs i. Baseline	b: Recurring Costs ii. Alternative 2 Upgrade	c: Differential Costs	d: Discount Factor	e: Discounted Differential Costs	
2015	$ 1,050,000	$ 900,000	$ 150,000	0.9997	$ 149,950	
2016	$ 1,071,000	$ 978,000	$ 93,000	0.9990	$ 92,907	
2017	$ 1,092,420	$ 997,560	$ 94,860	0.9983	$ 94,701	
2018	$ 1,114,268	$ 1,017,511	$ 96,757	0.9977	$ 96,531	
2019	$ 1,136,554	$ 1,037,861	$ 98,692	0.9970	$ 98,395	
2020	$ 1,159,285	$ 1,058,619	$ 100,666	0.9963	$ 100,296	
2021	$ 1,182,471	$ 1,079,791	$ 102,680	0.9957	$ 102,233	
2022	$ 1,206,120	$ 1,101,387	$ 104,733	0.9950	$ 104,208	
2023	$ 1,230,242	$ 1,123,415	$ 106,828	0.9943	$ 106,221	
8. TOTAL:	**$10,242,360**	**$ 9,294,144**	**$ 948,216**	**8.9729**	**$ 945,443**	
9. Present value of new investment					$ 599,799	
10. Less: Present value of investment required by the Baseline						
11. Plus: Present value of existing assets used on project that had another planned use						
12. Less: Present value of existing assets to be used elsewhere						
13. Less: Present value of terminal value of new investment					$ 59,659	
14. TOTAL PRESENT VALUE OF NET INVESTMENT					**$ 540,140**	
15. Present value of savings from operations (7e)					$ 945,443	
16. Plus: Present value of the cost of refurbishment or modification avoided						
17. TOTAL PRESENT VALUE OF SAVINGS (line 15 plus line 16):					**$ 945,443**	
18.	a. Savings/investment ratio (line 17 / line 14):				1.75	
	b. Amortization Period (Year in which payback will occur)				6	
19. Source/derivation of cost estimates: Sources are listed in the EA						
20. Principal Action Officer		Alan Analyst - Financial Analyst /xxx-xxx-xxxx				

A8.3. FORMAT A-1 COMMENTS:

Table A8.2. Format A-1 Comments.

Lines 6a & 6b: While the alternatives can have different economic lives, the costs are accounted for only up to the period of analysis and any terminal value types of expenses to normalize the alternatives for comparison purposes.
Column 7a: Years in which any costs will be incurred.

Column 7b: Operating costs of baseline system, corresponding to years in which incurred and the Operating costs of the proposed system corresponding to years in which incurred.

Column 7c: Savings attributable to differential operating costs (Column 7b.i minus 7b.ii).

Column 7d: Discount factors corresponding to the years in Column 7a.

Column 7e: Year-by-year present value of operating savings (Column 7c times Column 7d).

Line 8, Totals: Totals for Columns 7b through 7e.

Lines 9: Present value of investments for the proposed alternative. These are assets not on hand, new assets for which funding must be obtained.

Line 10: Present value of baseline investments for assets not on hand new assets for which funding must be obtained. Subtracted from this present value will be the terminal value of the asset at the end of the period of analysis.

Line 11: Present value of assets on hand that will be used on the proposed alternative and are not currently used on the present alternative (i.e., equipment removed from storage or taken from another organizational element). These are assets that are in existing Air Force inventories and were planned to be used elsewhere. Subtracted from this present value will be the terminal value of the asset at the end of the period of analysis.

Line 12: Present value of assets that are used on the present alternative but will not be used if the proposed alternative is adopted; the assets will be sold, made available for use by other organizations, or used on another project. If the assets cannot be sold or will not be used on another project, then do not include them. Subtracted from this present value will be the terminal value of the asset at the end of the period of analysis.

Line 13: Present value of eventual salvage income from asset investments listed in Line 9.

Line 14: Line 9 minus line 10 plus Line 11 minus Line 12 minus Line 13.

Line 15: Present value of operations savings; sum of row 8 column 7e.

Line 16: Present value of a current asset overhaul or modification that will not be required if the proposed alternative is adopted; savings due to elimination of need of overhaul of current

assets.

Line 17: Line 15 plus Line 16.

Line 18a: Line 17 divided by Line 14.

Line 18b: Follow instructions in Attachment 7 to calculate the payback year.

Attachment 9

PRELIMINARY COMPARATIVE ANALYSIS

A9.1. Preliminary comparative analyses are internal planning tools. A preliminary comparative analysis is a first, less detailed effort of performing a comparative analysis. Typically, the Air Force performs preliminary comparative analyses early in project consideration: (1) when it is more practical to do an abbreviated analysis and (2) to provide for a better understanding of which alternatives of a specific project merit further development/consideration. A preliminary comparative analysis could also be used when resources are limited and there are many potential projects that would benefit from an analytical approach. There are some situations where a preliminary analysis is required. See AFI 65-501.

A9.1.1. The findings of a preliminary comparative analysis do not preclude a different set of findings or recommendation in a full comparative analysis.

A9.1.2. When a preliminary analysis has been done, care should be taken to ensure the decision-maker is not anchored to those results when subsequent information in the full comparative analysis leads to different results.

A9.2. In no case may a preliminary comparative analysis be substituted for: A full comparative analysis when a full comparative analysis is required by AFI 65-501.

A9.3. The format below provides: An idea of the contents appropriate for a preliminary comparative analysis, which is generally a document of no more than a few pages.

A9.3.1. **Background.** Provide a brief, relevant and clear context surrounding the project.

A9.3.2. **Objective.** State the generic need in an unbiased, non-limiting manner, quantified to the extent possible, e.g., provide adequate housing for 300 unaccompanied enlisted personnel. If "adequate" can be translated into square footage or other parameters, this quantification should be done.

A9.3.3. **Facts/Assumptions/Ground Rules.** Identify only the most significant limitations, constraints, assumptions, legal or regulatory considerations, e.g., all dormitories are currently averaging 95 percent occupancy; no present base organizations are planned to be inactivated or relocated.

A9.3.4. **Alternatives.** Identify, as a minimum, all alternatives that sound reasonable. Categorize the alternatives into two groups: feasible alternatives to be analyzed (e.g., status quo, renovation, new construction, basic allowance for housing (BAH)), or infeasible alternatives to be eliminated (e.g., leasing). Analyze all alternatives that are both reasonable and feasible. Include reasons for eliminating infeasible alternatives.

A9.3.5. **Costs.** Identify the major categories of costs and include preliminary estimates by major category. "Wash" or common costs may be excluded. Ignore minor categories of cost or incidental costs. Summarize the differences in costs among alternatives as a rough order of magnitude. Discounting would only be necessary in a preliminary comparative analysis if cash flows vary significantly in timing. Work to develop cost estimates with the appropriate local functional expert (e.g., facility maintenance and new facility construction costs from civil engineering, number of dorm occupants by pay grade from base billeting office). Documentation of costs should be at an appropriate level to track both the source of the data and the methodology behind the estimate. Calculations should be checked for accuracy.

A9.3.6. **Benefits.** Identify the more important benefits associated with each of the alternatives being analyzed (e.g., renovation corrects all deficiencies, or opting for off-base housing results in demolishing old poor quality dorms.

A9.3.7. **Uncertainty (Sensitivity/Risk) Assessment.** Identify the key variables which, if varied within a reasonable range of analysis, could possibly change the results of the analysis. Also, identify any significant risks to project execution or benefit realization for each alternative.

A9.3.8. **Summary and Comparison of Alternatives.** Briefly summarize the cost, benefit and uncertainty analysis and interpret the results. Emphasize that the conclusions are based on preliminary analysis only and could possibly change based on results of a complete, formal comparative analysis.

Attachment 10

ANNUAL ECONOMIC ANALYSIS REPORT (RCS: HAF-FMC[A] 9501) FORMAT

A10.1. Command/field operating agency financial analysis offices forward this report to: SAF/FMCE by 1 December annually, reporting on economic analysis activity of the recently completed FY. **Report the number of comparative analyses and waiver requests signed/certified at MAJCOM/FOA/DRU level during this period, regardless whether SAF/FMCE has seen them.**

A10.2. This report is designated emergency code C-2. Continue reporting during emergency conditions, normal precedence. Submit data requirements in this category as prescribed or as soon as possible after submission of priority reports. Discontinue reporting during MINIMIZE. A blank spreadsheet version of this report can be obtained from SAF/FMCE.

Attachment 11

REAL PROPERTY CONSTRUCTION AND REPAIR ECONOMIC ANALYSES

A11.1. Introduction. This Attachment provides guidance on the preparation of construction and repair comparative analyses required as part of the project justification process for Facility Improvement, Replacement, and New Construction projects. Based on the guidance governing the requirement analyses, a comparative analysis for real property construction and repair is called an economic analysis. A thorough and well documented economic analysis is a critical factor in project approval and subsequent Congressional appropriation. The purpose of this manual is to assist in conducting and documenting the results of applying the economic analysis approach to real property decisions. In this area, the analyses that result are called economic analyses.

A11.1.1. **Types of Facilities Covered.** The information contained in this section is relevant to construction and repair projects.

A11.1.2. Relevant projects include, but not limited to: administrative facilities, transient quarters, dormitories, maintenance facilities, warehouses, child care facilities, Military Family Housing and mission support facilities.

A11.2. Initiating and Updating an Economic Analysis

A11.2.1. An economic analysis is initiated as early as practical during the project planning process. An early start assures the analysis is in place for decision making and allows sufficient time to collect all the necessary data to conduct a more accurate life cycle cost analysis and a more informed benefit and uncertainty analysis in order to provide better information and lay the foundation for superior program support documentation.

A11.2.2. Do a preliminary economic analysis after an Installation Facilities Board has established a requirement for a project, but before the Installation Facilities Board has chosen an alternative. Develop the preliminary analysis as the civil engineering staff develops the Department of Defense Form 1391.

A11.2.3. Complete a full economic analysis or a waiver to an economic analysis for each facility project likely to be funded in the budget year. Complete the analysis prior to the documentation deadline contained within the respective facility project business rules (e.g., MILCON; Unspecified Minor MILCON; Facilities Sustainment, Restoration, and Modernization). The preliminary economic analysis is often the basis for this full economic analysis unless conditions surrounding the project have changed substantially.

A11.2.3.1. For MILCON projects, a completed economic analysis or approved waiver must be evident in each project's development and analysis before the Air Force Corporate Structure decides to include the project in the Air Force's Program Objective Memorandum submission. **(T-1).**

A11.2.3.2. For Unspecified Minor MILCON, Unspecified Minor Construction, or repair projects, an approved economic analysis or waiver must be part of each project's development and analysis at cost thresholds in AFI 65-501, and must be included as attachments in higher headquarters approval request packages. **(T-1).**

A11.2.4. An economic analysis is updated when significant developments occur that would invalidate or alter its conclusions. The following situations require an update to the economic analysis if there is decision space remaining to impact execution of the project:

A11.2.4.1. When there is a change in project scope.

A11.2.4.2. If there are major changes in the initial study assumptions.

A11.2.4.3. When new alternatives are identified that appear to satisfy the stated requirement.

A11.2.4.4. If changes in costs or benefits would be likely to change a decision made using the analysis.

A11.3. Analysis Coordination. According to AFI 65-501, the primary responsibility for performing the economic analysis lies with the FM staff at the affected organizational level. Collateral responsibility lies with the Civil Engineering staff and the project user. Completing the economic analysis requires close coordination between Civil Engineering, FM, and the end user of the facility. **Figure A11.1** presents the responsibility matrix. Some of the tasks have multiple OPRs and Offices of Collateral Responsibility (OCRs). In these cases, the asterisks indicate the division of responsibilities within the task. The responsibilities in the matrix are for both economic analyses and waivers to the economic analysis requirement. See **Attachment 3** of this manual for the certification process for construction and repair economic analyses and for the approval process for economic analysis waivers.

Figure A11.1. Real Property Economic Analysis Responsibility Matrix.

TASK	FINANCIAL MANAGEMENT*	ENGINEER**	USER***
Identify Need			OPR
Determine if Analysis Required	OPR	OCR	OPR
Initiate Analysis			OPR
Develop Objective	OCR	OCR	OPR
Develop Scope	OCR	OPR	OPR
Develop Groundrules and Assumptions	OPR	OPR	OPR
Develop Alternatives	OCR	OPR	OPR
Identify and Collect Required Data	OPR	OPR	OCR
Data Analysis	OPR		
Recommend/Select Alternative	OCR	OCR	OPR
Documentation	OPR	OPR	OCR
Certification	OPR	OCR	OCR

Note: Where multiple OCRs and OPRs are listed for a task:
* Financial Management is responsible for cost and economic aspects (compliance, data, etc.)
** Civil Engineering is responsible for engineering aspects (alternatives, data, etc.)
*** The user is responsible for non-real property aspects (alternatives, data, etc.)

A11.4. Analysis Foundational Elements

A11.4.1. **Defining the Project, Formulating Assumptions, and Identifying Alternatives.** A clear, concise statement of the project objective is necessary in order to identify potential alternatives for the project. This section will assist the analyst in accurately identifying the problem, defining the project objective, formulating assumptions, and identifying alternatives to meet the need.

A11.4.2. **Collecting and Reviewing Background Information.** The analyst collects and reviews all written documentation available that could affect any project alternatives. This review will include: the most current Department of Defense Form 1391, the construction cost estimate for the proposed project, previous economic analyses, the Base Comprehensive Plan, and the Planning Charrette Report. Next, interviews are conducted with personnel involved in the project planning process and with the current facility users. The current facility users are a good source for identifying deficiencies in the existing facility. All information is collected in writing, including the source of the data, and the name, organization, title, and phone number of each point of contact. The signed source documents are presented in Appendix B of the economic analysis.

Figure A11.2. Sample Questions for Interviews and Background Data Collection.

What is the problem or requirement?

What is the total requirement both in size (i.e., number of square feet) and capacity (i.e., number of people, equipment outfitting, function)?

If one exists, what is the size and capacity of the existing facility?

If one exists, what is the age of the existing facility?

What is the condition of the existing facility and primary components?

What is the renovation history of the facility?

Do the alternatives include any buildings on the National Register of Historic Places or other historically sensitive programs?

Do the alternatives require asbestos, radon, or lead-based paint remediation?

Does the existing facility meet health, fire, safety, and security requirements?

Are sustainment costs for the existing facility excessive?

Is the existing facility (or facilities) efficiently utilized?

Does the existing facility meet the functional needs of the users?

Does the existing facility meet the requirements laid out in the Architectural Barriers Act (ABA) for handicapped accessibility?

A11.4.2.1. The issues raised in the sample questions have to be identified in order to determine scope of the proposed project. For example, a facility that is on or under consideration for addition to the National Register of Historic Places may not be eligible for demolition and could generate unique architectural/engineering compliance requirements for renovation. As another example, asbestos, radon, or lead-based paint in the existing facility can lead to costly abatement procedures which may impact the project schedule. These costs may be incurred if the facility is renovated or demolished, depending on the scope and type of remediation required.

A11.4.2.2. When reviewing the current facility situation, it is important to consider the user. Does the existing facility meet the needs of the user? Are the current working conditions affecting morale? Is an organization disjointed and spread over several facilities? Would the organization work more efficiently if it were consolidated into one facility? Could labor time be saved or duplicate functions be eliminated as a result of a consolidation? It is important to address these and other types of user concerns when trying to define the requirement.

A11.4.2.3. The following are possible facility deficiencies and other concerns that may need to be addressed for the proposed construction or repair project.

Figure A11.3. Possible Facility Deficiencies.

Facility Structure Inadequate	Health/Fire/Safety/Environment	Other
· Space shortage.	· Health violation.	· Mission expansion or change.
· Space inadequacy.	· Fire safety violation.	· National Register of Historic Places.
· Inefficient layout/utilization.	· Safety violation.	· Facility user concerns.
· Structural deficiency.	· ADA violation.	
· Utilities deficiency.	· Asbestos present.	
· Inefficient energy use.	· Lead-based paint present.	
· Security deficiency.	· Radon present.	
· Excessive O&M costs.	· Environmental clean-up required.	

A11.4.3. **Defining the Project Objective.** From the information collected, a clear, concise statement of the project objective should be developed.

A11.4.3.1. When writing the project objective, it is important that the statement not be biased toward any alternative. Also, the project objective should be quantified to the extent possible.

A11.4.3.2. Once the project objective is clearly defined, the analysis team will identify alternatives that satisfy the requirement. **Figure A11.4** presents examples of project objectives for several facility types. **(T-2).**

Figure A11.4. Sample Analysis Objectives for Selected Construction and Repair Projects.

PROJECT	OBJECTIVE
Visiting Officer Quarters:	To provide suitable quarters for 100 officers and distinguished visitors on TDY to Bolling AFB.
Dorm:	To provide suitable housing for the 120 enlisted military personnel due to arrive in FY25 to support the new air wing.
Warehouse:	To provide 40,000 square feet of covered secure storage for war readiness materials, alternate mission equipment, communications scheme assets, and other base supplies and materials used to support the wing mission.
Squadron Operations Facility:	To provide 960 square feet to accommodate the new mission requirements of the 605th Airlift Support Group and the addition of the 605th Maintenance and Aerial Port Squadrons.
Parking Garage:	To provide 295 additional parking spaces to support daily faculty/staff requirements and special events.
Administrative Facility:	To consolidate the base procurement activities in order to facilitate employee interaction, eliminate duplicate functions, increase security, and improve the morale and productivity of the employees.

A11.4.4. **Formulating Assumptions.** Economic analyses are based on facts and data pertaining to the project in question. However, an economic analysis deals with costs and benefits occurring in the future. Since the future is unpredictable, assumptions and sensitivity analyses are prepared to account for uncertainties. To avoid invalidation or bias of the analysis, assumptions based on realistic assessments or anticipated conditions should be made by qualified individuals. There are several common assumptions made when preparing an economic analysis for a construction or repair project:

A11.4.4.1. Economic Life of the Project. The economic life for construction and repair projects is different for each facility type. Additionally, the economic life of a renovated facility is normally less than a newly constructed facility.

A11.4.4.1.1. Residual Value. Residual Value is the remaining (depreciated) value of the facility at a point in time. Residual value is normally calculated using straight-line depreciation of the start value over the project's economic life. State which method is used to determine the assumed residual value.

A11.4.4.1.2. Inflation and Escalation. The source and date of all inflation and escalation indices used must be documented in the assumption section. **(T-2).** Inflation measures a sustained rise in the general price level. When historical data is used to estimate future costs, the historical costs must be escalated to the year in which funds would be appropriated for the project using a specific price index. **(T-2).** When converting those costs to a constant year dollar (or base year dollar), use the inflation index published by SAF/FMC. **(T-1).** Consult the Resource Management Cost Division (formerly FM Center of Expertise) or SAF/FMCE for assistance on escalation indices and inflation indices.

A11.4.4.1.3. Discount Rate. The discount rate is used to account for the time value of money when comparing the cost and benefits of alternatives over several years and is documented as an assumption. Economic analyses performed to support Air Force construction and repair programs should be discounted at the interest rate published in the most recent President's Budget. The President's Budget is published in January or February of each year and includes both the constant and current-dollar discount rates to be used in economic analyses. The annual discount rates are posted on the SAF/FMCE SharePoint® page, to which a link is provided on the SAF/FMCE page of the Air Force Portal. These discount rates reflect the latest values contained in the OMB Circular A-94 Appendix C.

A11.4.4.1.4. Additional assumptions will likely be required when project data is unavailable, when future costs are uncertain, or when a project involves unique circumstances.

A11.5. Identifying Alternatives. For potential construction and repair projects, there are typically six possible alternatives available to meet the objective:

Figure A11.5. Typical Construction and Repair Project Alternatives.

- Status Quo
- Improvement
- New Construction or Replacement
- Government Leasing
- Community Partnerships
- Non-Construction Solution

A11.5.1. Typical Alternatives

A11.5.1.1. The first three typical alternatives (Status Quo, Improvement and New Construction/Replacement) are always reasonable alternatives for real property construction and repair decisions. As a result, they must be included in all real property construction analyses and waivers. **(T-1).** They may be deemed infeasible when appropriate, but must at least be addressed. The last three typical alternatives (Leasing, Community Partnerships and Non-Construction Solutions) may or may not be reasonable alternatives given the project under consideration.

A11.5.1.2. The Status Quo alternative is considered the baseline for the economic analysis. The Status Quo can be one or a combination of scenarios. Four common examples are:

A11.5.1.2.1. The continued use and operation of existing facilities in their current condition.

A11.5.1.2.2. The continued payment of Basic Allowance for Housing to personnel living off base in private residential housing when there is insufficient dormitory space on base.

A11.5.1.2.3. The continued payment of lodging per diem to personnel on temporary duty when there are insufficient transient quarters on base.

A11.5.1.2.4. The continued use of temporary leased space in a privately owned facility off base.

A11.5.1.3. The Improvement alternative involves renovating an existing facility to eliminate deficiencies and/or reduce future maintenance and repair costs, altering the facility to improve its operating efficiency, or constructing an addition to the facility to increase space. Various levels of improvements can be addressed as alternatives, from minimal correction of life-safety deficiencies to comprehensive "gut and rebuild" efforts. The actual work to be performed is explicitly documented in the analysis.

A11.5.1.4. The New Construction or Replacement alternative consists of the construction of a new facility in order to eliminate an existing shortage or deficiency, to meet a shortage or deficiency created by a new mission or mission change, or to replace a substandard facility. If new construction involves replacing an existing facility, then the disposal of the existing facility is addressed.

A11.5.1.5. A Government Leasing alternative involves direct, long-term leasing by the Air Force of a suitable, privately owned facility off base. General Services Administration handles long-term leases for general-purpose facilities. If leasing is used to replace an existing facility, then the disposal of the existing facility is addressed.

A11.5.1.6. The Community Partnerships alternative can use partnerships with local public and private sector organizations to provide facilities for the Air Force.

A11.5.1.7. Non-construction alternatives consider that there may be ways of resolving the need without construction. It is important to remember that improved facilities are just one way of meeting a need. Other alternatives may include making operations more efficient so that a new facility is not required. For instance, a shortage of warehouse space may be compensated for by acquiring new handling and stacking equipment that allows more efficient use of vertical space (i.e., cubed footage) or instituting just-in-time parts provision procedures. Another solution may involve consolidating related functions to make better use of existing or new space. These innovative approaches to meeting space requirements can result in significant cost savings, and may offer the added benefit of improving operational efficiency and/or productivity. **It is important that the user take an active role in alternative development so that these non-facility solutions can be properly represented**.

A11.5.2. In the case of a transient or dormitory quarters requirement, a direct compensation alternative may also need to be considered.

A11.5.2.1. Direct compensation is an alternative when:

A11.5.2.1.1. There is suitable housing off base for non-mission essential personnel within the allowable Basic Allowance for Housing rates.

A11.5.2.1.2. There is suitable lodging available off base for temporary duty personnel within the allowable per diem.

A11.5.2.1.3. In other situations where compensation can potentially be made to members in lieu of providing a facility on base.

A11.5.2.2. A market analysis of the local hotel or housing market is normally conducted to assess the viability of a Direct Compensation alternative.

A11.5.3. The above-mentioned alternatives are the ones most frequently addressed in construction and repair economic analyses. However, an analyst should always aggressively pursue all reasonable alternatives, since the final decision can be no better than the available choices. Throughout the economic analysis process, the analyst will continually consider accepting new alternatives and discarding old ones.

A11.5.4. Occasionally, after a complete review of the facts and circumstances pertaining to the proposed project, the analyst may conclude that there is only one feasible alternative. In this case, a waiver from the requirement for an economic analysis is required. This waiver must follow the process described in this manual and in AFI 65-501. **(T-1).** Cost is not a basis for infeasibility. If cost is the only aspect of an infeasibility determination, that alternative must remain and an economic analysis must be developed. **(T-2).**

A11.5.5. **Disposing of Existing Facilities.** If the alternative involves replacing the current facility either by means of new construction, private sector development, or a long-term lease, the issue of what to do with the existing facility must be addressed. **(T-2).** There are three common disposal practices:

A11.5.5.1. Converting the facility to another use. This is normally only an option if an existing need could be met by the conversion. Conversion and operating costs are assumed to be borne by the new occupant and are not included in the economic analysis.

A11.5.5.2. Demolishing the facility. This option is considered whenever the existing facility is substandard, its site is required for a new facility, or if there is no other potential use for it. Facilities are a resource, however, so before demolition is selected, a review of all possible current or future uses needs to be conducted. The cost of demolition is included in the analysis.

A11.5.5.3. Placing the facility in caretaker status. This option involves closing up the facility and preserving it for potential future use by providing periodic maintenance to preserve its structural integrity; "mothballing" and "pickling" are colloquial terms for caretaker status. The sustainment costs associated with caretaker status are included in the analysis.

A11.6. Conducting the Cost Analysis. This section discusses the cost analysis required in the economic analysis. The costs and savings associated with each alternative under consideration must be quantified and included in the analysis calculations. **(T-2).**

A11.6.1. All incremental costs expected to be incurred over the economic life assumed for each alternative, except sunk costs, are included in the life cycle cost analysis. Examples of sunk costs could include: project planning, preliminary design, and preparation of the economic analysis itself depending on the phase at which the analysis is being completed. Design costs are considered sunk if they are obligated or spent prior to selection of an alternative. The amount of design costs that are considered sunk will vary based on the project. Wash costs are optional to include.

A11.6.2. **Construction and Other One-Time Costs.** Most one-time costs occur early in a project's life cycle although they can occur at any point, e.g., disposal costs. Construction costs are usually the most significant example of one-time costs. However, all other one-time costs are also considered.

A11.6.2.1. Construction/Improvement Costs. Construction/Improvement costs include design fees for the primary facility or building addition, demolition, site preparation, utilities, roads and pavements, contingencies, and Supervision, Inspection, and Overhead. Since the largest percentage of the project cost is determined by the scope of the Improvement or New Construction project, it is imperative that all primary and support costs are considered in the economic analysis. Equally important is the need for accurate and complete cost estimating capabilities. Parametric cost estimating systems, such as the Parametric Cost Engineering System (PACES), allow the analyst to readily compile costs for multiple project construction or renovation alternatives. It is important for users of a parametric cost model to understand how changes to model inputs will impact estimated cost.

A11.6.2.2. Construction/Improvement costs are included on the Department of Defense Form 1391 and attachments. The Department of Defense Form 1391 and attachments for an economic analysis include:

A11.6.2.2.1. The project title, project number, and alternative name.

A11.6.2.2.2. The scope of the estimate in square feet or square meters (noting which unit is used).

A11.6.2.2.3. A brief description of the costing methodology or estimating system used.

A11.6.2.2.4. Dated sources for variables, such as area cost factors and escalation factors.

A11.6.2.2.5. The base year of the project cost.

A11.6.2.2.6. Authority signature for the estimate.

A11.6.3. The estimate shows all interim calculations so that the values can be tracked from the source data to the total project cost appearing on the Department of Defense Form 1391 and in the Life Cycle Cost Report. Clear documentation speeds review of the analysis. In addition, a clearly documented Department of Defense Form 1391 can be easily updated when the source data changes or when the project is changed for a different program year.

A11.6.4. When compiling project costs, special attention is also given to ensure that all costs associated with a renovation alternative, such as asbestos abatement, lead-based paint remediation, environmental compliance, etc., have been considered.

A11.6.5. Other One-Time Costs. Accurate assessment and inclusion of other one-time costs is imperative to ensure a complete analysis. Examples (many of which can be found in Housing AFIs 32-6001, *Family Housing Management,* 32-6005, *Unaccompanied Housing Management*, 32-6004, *Furnishings Management Program*) of one-time costs include:

A11.6.5.1. Moving and storage of furnishings and equipment when users are relocated.

A11.6.5.2. Disposal and replacement of furnishings and equipment.

A11.6.5.3. Lease payments made for temporary space.

A11.6.5.4. Temporary contracting out of the requirement.

A11.6.5.5. Tenant build-out requirements involving renovations to the temporary space in order to make the facility meet the users' needs.

A11.6.6. All attempts should be made to time facility replacement or improvement construction activities to correspond with the expected requirement. However, even with the best scheduling attempts, temporary accommodations may be required. Occasionally, contracting out the requirement may be feasible and economical. In other cases, users may require temporary accommodations. For renovation alternatives, this may involve moving the users into temporary leased space while the existing facility is being improved and, following completion of the project, moving into the completed facility. Lease rates are discussed below. Moving and storage costs (drayage) can be obtained from the base transportation office. The Interstate Commerce Commission can also provide approximate moving costs based on weight, as well as requirements for cartons and custom-built crates. In addition, some tenant build-out, such as partitions, power, and telecommunications, may be required to meet the users' requirements.

A11.6.7. The improvement or replacement of a dormitory can result in some unique one-time costs, such as:

A11.6.7.1. Reconnection fees associated with telephone and cable television service.

A11.6.7.2. Moving and storage of personal belongings for dormitory residents.

A11.6.7.3. Basic Allowance for Housing payments made to personnel in temporary housing off base.

A11.6.8. As with other construction and repair projects, all attempts should be made to schedule or phase dormitory improvements or replacements so as to minimize these one-time costs.

A11.6.9. **Recurring Costs.** Recurring costs are the repeated costs required to operate and maintain a facility. They are generally calculated on an annual or periodic basis.

A11.6.9.1. Examples of recurring costs include:

A11.6.9.1.1. Maintenance and repair of the facility.

A11.6.9.1.2. Utilities, such as electricity, natural gas, steam, water, and sewer.

A11.6.9.1.3. Personnel costs, such as building management, lease management, custodial service, and security service.

A11.6.9.1.4. Lease costs

A11.6.9.1.5. Miscellaneous costs, such as grounds maintenance, landscaping, and snow removal.

A11.6.9.2. Maintenance and Repair Costs. Maintenance and repair costs include both annual maintenance and repair and periodic maintenance and repair. Annual maintenance and repair expenses include preventive maintenance, unscheduled plumbing and electrical repairs, and minor structural repairs that are required to ensure a safe and efficient work or living environment. Periodic maintenance and repair expenses include major repairs to building components, such as roof systems, electrical systems, heating ventilation and air conditioning, plumbing fixtures, and interior finishes. These costs can be estimated based on the expected life of the building system.

A11.6.9.2.1. Annual maintenance and repair costs

A11.6.9.2.1.1. When an existing facility is associated with the Status Quo alternative, historical annual maintenance and repair costs typically are used to project future annual maintenance and repair costs in the economic analysis. The analyst should collect and review at least three years of data in order to develop a valid estimate.

A11.6.9.2.1.2. An industry reference that provides maintenance and repair cost per square foot for a given facility type can also be utilized.

A11.6.9.2.1.3. Renovation and replacement alternatives typically have lower annual maintenance and repair costs than the Status Quo alternative. Therefore, the historical maintenance and repair cost data are normally adjusted downward by an assumed percentage (commonly based on engineering judgment) for the improvement and replacement alternatives. These assumptions must be clearly stated in the analysis. **(T-2).** In the absence of information specific to the current project, the Building Age Multiplier factors presented in **Figure A11.6** may be used to adjust annual maintenance and repair costs over the life of the improved or new facility. If an assumption is made that there is no increased annual maintenance cost associated with building age, then that assumption should be explicitly stated and justified.

Figure A11.6. Building Age Multiplier Factors.

Year	Percent of Status Quo Cost
Status Quo	100%
1-5	25%
6-10	50%
11-15	75%
>15	100%

Source: NAVFAC Pub 442 Economic Analysis Handbook

A11.6.9.2.2. Periodic maintenance and repair costs:

A11.6.9.2.2.1. Periodic maintenance and repair schedules are based on the expected life of the equipment or fixtures. Civil Engineering can provide the date the item was last replaced so that the analyst can project future schedules and costs under the Status Quo alternative. Renovation and new construction alternatives generally begin with all new equipment; hence, replacement schedules are based on the construction date. It is important to remember that scheduled intervals will often vary based on local conditions. For example, the salt air in marine environments corrodes and shortens the expected lives of exterior mechanical units, roof membranes and drainage systems, window frames, exterior doors, etc. **Figure A11.7** displays the generally accepted useful lives of various equipment and fixtures.

Figure A11.7. Life Cycles of Selected Building Systems.

System	Expected Useful Life
Roof Systems	20 years
Plumbing	30 years
Sprinklers (Fire Protection)	30 years
Electrical	20 years
HVAC	20 years
Elevators	20 years
Alarms/Intercom	20 years
Interior Finishes	10 years
Pavements and Walkways	15 years

Source: "Suggested Average Useful Life of Building Components," *MEANS*

A11.6.9.2.2.2. Periodic maintenance and repair costs can be estimated from local prices or by using the cost of any recent replacement of similar items, including appropriate labor fees. If such cost data is unavailable, commercial sources, such as R.S. Means, Whitestone or Dodge Cost Data can be used and documented. Another possible source would be comparable maintenance and repair costs from another installation for a similar facility.

A11.6.9.3. Utility Costs. Utility costs include the expenses associated with the provision of utility services, such as: Electricity, Natural gas or Oil, Steam, Water, Sewage, and Telecommunications.

A11.6.9.3.1. **Figure A11.8** presents an example of the technique used to estimate annual electricity costs for all alternatives based on an area (square footage) basis; other energy-consuming utility costs can be similarly calculated. The analyst uses annual utility usage and facility size for similar facility types to estimate utility costs for the proposed facility. The most accurate estimates of utility costs are available when bases can meter utility usage at the facility level. Utility bills or Defense Utility Energy Reporting System reports provide total utility consumption figures for the facility. The Defense Utility Energy Reporting system can also provide the necessary area figures. Civil Engineering is the best source for this data. If possible, usage rates from three previous years are averaged after adjusting them to the base year of the economic analysis. IHS Energy escalation Indices are used to escalate energy costs to the base year. This data is available from SAF/FMC.

A11.6.9.3.2. Non-energy-consuming utilities such as sewage, and telecommunications can also be calculated based on a three-year average. Since improvement or replacement usually will not influence these usage rates, status quo values can be used for all alternatives where the same users will move back into the facility. The analyst should escalate non-energy costs to the base year using an appropriate escalation rate.

Figure A11.8. Calculation of Annual Electricity Costs on an Area Basis.

Status Quo Cost: Using Three Year Average			
Year	Annual Cost (TY)	Escalation Index	Annual Cost (TY17$)
2015	$ 70,550	1.034	$ 72,949
2016	$ 67,023	1.047	$ 70,173
2017	$ 70,374	1.000	$ 70,374
Total Cost (FY17$)			$ 213,496
		divided by	3 (Years)
Avg Cost (FY17$)			**$ 71,165**

Using three year average to calculate a cost per square foot

Status Quo Cost per Square Foot Calculation:				
Avg Cost		Total Area (Square Feet)		Cost/SF (TY17$)
71,165	Divided by	83,000	Equals	0.85741

Applying three year average to Renovation and Replacement.

Renovation Cost								
Status Quo Cost per Square Foot		25% Estimated Savings		Cost per Square Foot		Net Square Feet		Total Cost (TY17$)
0.85741	times	0.75	equals	0.64306	times	83,000	equals	$53,374

Replacement Cost								
Status Quo Cost per Square Foot		30% Estimated Savings		Cost per Square Foot		Net Square Feet		Total Cost (TY17$)
0.85741	times	0.7	equals	0.60019	times	82,000	equals	$49,215

A11.6.9.4. Personnel Costs. Personnel costs include the costs of staffing building services, such as building management, lease management, and security.

A11.6.9.4.1. Personnel costs are calculated as the product of the number of personnel and their appropriately burdened salary.

A11.6.9.4.2. As noted in **paragraph A11.6.1**., the analyst should only include incremental costs (additional costs that will result from an alternative being selected). The following examples apply the incremental cost concept to personnel costs. If the Air Force had to create a manpower position in order to support the facility, then the Air Force will incur additional personnel cost as a result of the facility and the cost should be included in the analysis. Conversely, if the building will require more time within normal duty hours from an individual already employed by the Air Force, then the Air Force did not incur additional personnel cost unless overtime pay is required. In this second example, the increased hours should be assessed in the benefits section.

A11.6.9.4.3. Different alternatives or alternative facility designs can result in different personnel costs. For example, a facility with a small number of exterior entrances may require fewer security personnel than a design with numerous entry points or multiple, unconsolidated facilities.

A11.6.9.4.4. For transient quarters, personnel costs also include maid service and the front desk operation. Consult the AFI 65-503, *US Air Force Cost and Planning Factors* for the most recent tables of Military and Civilian Compensation. If more specific data than AFI65-503 is available, use that information.

A11.6.9.5. Contract Operations and Maintenance Costs. Contract costs include the costs for contracts needed to keep the facility in working order. Contract costs can vary based on building design. For example, a dorm with exterior walkways may require fewer custodial personnel than a dorm with interior corridors.

A11.6.9.5.1. Many building services could be estimated either under personnel costs, if the services are provided by base personnel, or under contract costs, if the services are provided by a contractor.

A11.6.9.5.2. For administrative facilities, the median cost per square foot for building services can be obtained from the Building Owners and Manager's Experience Exchange Report (BOMA International, Washington, DC, (202) 408-2662).

A11.6.9.6. Lease Costs. Lease costs are associated with using off-base facilities on either a temporary or long-term basis. If there is an existing Air Force lease of similar space off base, then that lease rate per square foot can be used to estimate future lease costs for either temporary space or a long-term requirement under a Government Lease Alternative. If there is not an existing Air Force lease, then the General Services Administration lease rates for the appropriate geographic area are used. The base office responsible for real property management can normally provide the General Services Administration space rates. For most facility types, Air Force leases are negotiated and managed by the General Services Administration. General Services Administration rates are provided by functional space type (e.g., office, conference, storage, laboratory, and industrial). General Services Administration lease rates are typically gross leases--that is, the lease rate includes reimbursements for services like maintenance and utilities. Gross leases are also known as “full service” leases. The Air Force has authority to negotiate and manage leases directly for land and unique, special-purpose facilities.

A11.6.9.7. Direct Compensation

A11.6.9.7.1. For a dormitory facility, the primary cost element associated with a Direct Compensation alternative is Basic Allowance for Housing payments. Basic Allowance for Housing payments are based on grade and geographic location. Basic Allowance for Housing data can be obtained from the Defense Travel Management Office **https://www.defensetravel.dod.mil/site/bah.cfm**.

A11.6.9.7.2. For a transient quarters facility, the primary cost element associated with a Direct Compensation alternative is lodging per diem payments. The Defense Travel Management Office can provide lodging per diem rates for the geographic area **https://www.defensetravel.dod.mil/site/perdiemCalc.cfm**. Where there are no existing transient quarters, the billeting office can also provide the number of "Certificates of Non-Availability" that have been issued over the last 3 years.

A11.6.9.8. Basic Allowance for Housing or per diem payments may also be incurred when users need to find temporary accommodations off base during a renovation or construction project for dormitory or transient quarters. These costs would be incurred in accordance with the construction schedule.

A11.6.9.9. **Figure A11.9** summarizes the suggested data sources for obtaining the data required to conduct a construction or repair economic analysis.

Figure A11.9. Summary of Data Sources for Construction and Repair Economic Analyses.

Data Type	Primary Source	Other Sources
Construction Costs	PACES	Means, Air Force Historical Cost, DoD Facilities Pricing Guide UFC 3-701-01
Annual Maintenance & Repair Costs	IWIMS/ACES/TRIRIGA BCE	DEMRC: Form 1133 BCE: RCS HAF LEE (SA) 7101, Whitestone
Periodic Maintenance & Repair Costs	IWIMS/ACES/TRIRIGA BCE	DEMRC: Individual facilityjackets, Means or Dodge, Whitestone
Utility Costs	DUERS, IWIMS/ACES/TRIRIGA	BCE: RCS HAF LEE (SA) 7101, MAJCOM consumption report
Miscellaneous Operations and Maintenance Costs	Base Contracting, Facilities Management Office, Base Transportation	Means, Dodge, Whitestone
Lease Costs	Base Real Property Office	Off-base real estate broker, GSA
Basic Allowance for Housing	Financial Management Office	Housing Office, For Rates: https://www.defensetravel.dod.mil/site/bah.cfm
Per Diem	Base Billeting Office	For Rates: https://www.defensetravel.dod.mil/site/bah.cfm
Discount Rates, Price Escalation Indices and Inflation Indices	Air Force Portal	

A11.6.10. **Impact of Project Schedule on Cost.**

A11.6.10.1. The project schedule provides information about project phasing and facility occupancy under each alternative. Many costs associated with the existing situation continue to be incurred during the construction period. In general, reduced costs, such as lower utility costs, cannot be realized until the new facility is occupied and the old facility has been disposed.

A11.6.10.2. Where the project schedule allows for phased occupancy, costs such as annual maintenance and repair and utilities are pro-rated. The occupancy or "move-in" date may vary for some alternatives due to different time factors associated with the construction period, approvals, and the solicitation process.

A11.6.11. **Other Cost Considerations**

A11.6.11.1. The concept of present value is fundamental to the economic analysis. Present value calculations allow comparison of different dollar amounts received or expended during different time periods. In addition to presenting the costs in either then-year or constant-year dollars, the costs for each alternative must be presented in present value terms. **(T-2).**

A11.6.11.1.1. Discounting is the technique used to determine the present value of future cash flows. Discounting is further explained in **Chapter 4** of this manual. The Air Force normally uses a mid-year discounting convention. The mid-year discounting calculation is illustrated in **Attachment 7** of this manual.

A11.6.11.2. Uniform Annual Cost**.** Uniform Annual Cost is a technique used to account for alternatives having different economic lives. It is required for real property construction and repair economic analyses **(T-2).**

A11.6.11.2.1. Uniform Annual Cost uses a life cycle cost to measure the cost of each alternative. In addition, construction and repair economic analyses are required to report the life cycle cost of each alternative using the Uniform Annual Cost Method, and the Terminal Value Method as described in **Chapter 4** of this AFMAN.

A11.6.11.2.2. The Uniform Annual Cost Method is further illustrated in **Attachment 7**. Reporting costs in terms of the Uniform Annual Cost Method and the Terminal Value Method provides the Air Force with methods of comparing the costs of alternatives with different economic lives.

A11.7. Conducting the Benefits Analysis. A benefits analysis takes into account the non-monetary aspects of each alternative in an economic analysis. A benefits analysis is required in all economic analyses.

A11.7.1. There are a variety of ways benefits can be evaluated including narrative description, ordinal measurement and quantitative measures. **Chapter 5** of this manual provides details on conducting benefit analyses.

A11.7.2. The financial management analyst is responsible for conducting the benefits analysis. However, input should be provided by a variety of installation functions including, but not limited to, the primary user or beneficiary of services from the facility, civil engineering, services, security police, transportation, and other appropriate agencies. One effective approach is to convene a "roundtable" discussion with all participating organizations to determine benefit categories and elements and to evaluate the benefits by alternatives.

A11.7.3. The financial management analyst should prepare a source document for the benefits analysis showing participants, assumptions, rationale for benefit selection, and sources. This document must be included in the economic analysis. **(T-2).**

A11.7.4. Examples of typical benefits are presented in **Figure A11.10** Note that the list in **Figure A11.10** is by no means exhaustive, but it does include many of the benefits which are normally considered when evaluating construction and repair projects.

Figure A11.10. Benefits for Consideration in Construction and Repair Projects.

SAMPLE BENEFIT CONSIDERATIONS

Accessibility - The extent to which a service or facility is accessible to the users. This can include location, transportation, and parking issues.

Availability of Base Services/Activities - The location of the proposed project relative to the other services and activities on base.

Environmental Impact - The evaluation of the potential environmental impact of each of the alternatives under consideration to meet the objective.

Facility Adequacy - This criterion measures the extent to which a facility or service meets the needs of its user. Issues include: "Is there sufficient space/capacity?", "Is the layout compatible with the user?", "Are the utilities reliable?"

Health/Safety - This criterion allows the analyst to assess the health and safety environments that would be provided under each alternative.

Historic Preservation - This factor needs to be addressed if the existing facility or a facility considered in one of the alternatives is of historic value and is likely to be altered or demolished.

Land Use Compatibility - The analyst should assess the suitability of the site selection or location of each of the alternatives relative to the adjacent facilities and the base comprehensive plan.

Maintenance - Newly constructed or improved facilities are easier to maintain and service. Many of these potential cost savings can be quantified and included in the life cycle cost analysis. Those benefits which cannot be quantified should be addressed here.

Mission/Operational Impact - Some alternatives will have a positive impact on the mission or operations of the affected organization. A new or improved facility may increase the productivity or efficiency of its workers. (Note: If these increases result in a reduction of positions, the savings associated with these positions should be included in the life cycle cost analysis, not the benefit analysis, since they will have an impact on the budget.)

Morale - Morale is important both to performance and retention of Air Force personnel.

Off-base Effects - This criterion can be used if an alternative under consideration for the base would result in either an increase or decrease in dollars spent in the local community.

Security - Security refers to the ability of a facility to protect the resources it houses. Security requirements differ depending on the function performed and are often specified in Air Force regulations. If the security needs can be quantified across alternatives, then these costs should be included in the life cycle cost analysis.

A11.8. Uncertainty Analysis (Sensitivity and Risk Analysis).

A11.8.1. A sensitivity analysis is required in all economic analyses **(T-1).** Sensitivity analysis identifies key assumptions and variables within an economic analysis and determines how changes affect the results of the alternatives relative to each other. 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 that stem from uncertainty) affect the economic analysis conclusion and interpretation of results.

A11.8.2. Sensitivity Analyses should be performed on assumptions that drive cost and any assumptions that have the possibility of significantly changing the relative value of the alternatives. **Chapter 6** of this nanual provides additional information on how to conduct a sensitivity analysis.

A11.8.3. Risk Analysis – A risk analysis is an evaluation of unfavorable events or outcomes and assesses uncertainty in a manner different from sensitivity analysis.

A11.8.4. A risk analysis is not required in real property construction and repair economic analyses, but should be included when directed by the decision-maker or when the level of risk associated with any alternative has a reasonable likelihood of being a key consideration for the decision maker. **Chapter 6** of this manual provides additional information on how to conduct a risk analysis.

A11.9. Summary and Comparison of Alternatives. This section is the key to a meaningful economic analysis. The analyst summarizes the analysis, compares the alternatives and provide some interpretation of the results for the decision maker.

A11.9.1. Summarizing Alternatives

A11.9.1.1. Provide summary tables for the cost analysis, benefit analysis, and uncertainty analysis for areas where the analyses have been expressed in quantitative terms.

A11.9.1.2. The cost summary should include a table(s) with the present value of the alternatives, new funding required by alternative, and any other financial measures used to evaluate the alternatives.

A11.9.1.3. Benefits - The benefit summary should include a summary table if the benefits were measured using: physical counts, an index/ratio, or a rating scale. If benefits were evaluated using narrative descriptions, then those descriptions should be summarized in this section.

A11.9.1.4. Uncertainty - A description of the sensitivity analyses should be included in this section. This also is the appropriate section to summarize results for the risk assessment. If risk was measured quantitatively, a table should be included.

A11.9.2. Comparing Alternatives

A11.9.2.1. The present value of costs and the Uniform Annual Costs must be compared across alternatives and any resulting cost differences addressed. **(T-2).**

A11.9.2.2. As a minimum, the benefits must be narratively compared across alternatives. **(T-2).** In certain analyses, comparison of benefit scores is also appropriate.

A11.9.2.3. The overall relative strengths and weaknesses of each alternative are required to be discussed narratively in this section.

A11.9.3. The interpretation of the results should flow logically and be consistent from the rest of the analysis.

A11.9.3.1. For example, an economic analysis for transient quarters could demonstrate that continuing to pay per diem to transient personnel is the least cost alternative.

A11.9.3.2. However, if off-base lodging is remote and a significant number of the transients are distinguished visitors, the benefits analysis may demonstrate that construction of new quarters satisfies the objective far more effectively.

A11.10. Documenting the Results of the Economic Analysis. An economic analysis must be documented in an economic analysis report to allow complete replication by reviewers. **(T-2).** This section provides guidance on how to document an economic analysis. **Figure A11.11** lists the required elements.

Figure A11.11. Documentation Elements.

DOCUMENTATION ELEMENTS

- **Certificate of Satisfactory Economic Analysis**
- **Executive Summary Report**
- **Table of Contents**
- **Background/Objective/Scope**
- **Facts/Ground Rules/Assumptions**
- **Alternatives**
- **Source and Derivation of Costs.**
- **Source and Derivation of Benefits**
- **Uncertainty (Risk and Sensitivity Analyses)**
- **Summary and Comparison of Alternatives**
- **Appendix A – 1391s**
- **Appendix B – Source Documents**
- **Appendix C – Interim Calculations**

A11.10.1. **Certificate of Satisfactory Economic Analysis – For the Certificate of Satisfactory Economic Analysis, follow the procedure and format provided in Attachment 3 of this manual.**

A11.10.2. **Executive Summary – For the Executive Summary, follow the format in Section A11.11** of this manual.

A11.10.3. **Table of Contents – A Table of Contents outlining the organization of the economic analysis is placed after the Executive Summary.**

A11.10.4. **Background/Objective/Scope – The objective and an abbreviated version of the background will be included in the executive summary to orient the reader to the analysis. (T-2).** A more thorough background will be included in the body of the economic analysis document in addition to the objective and a description of the scope of the analysis. **(T-2).**

A11.10.5. **Facts/Assumptions/Ground Rules – All economic analyses must include a list of the assumptions made. (T-2).** These assumptions must be clearly stated so evaluators can understand the level of uncertainty and risk inherent in the economic analysis results. **(T-2).** It is also important to include the source for each assumption.

A11.10.6. **Alternatives - Detailed descriptions of each of the reasonable alternatives addressed in the economic analysis are also included in the economic analysis executive summary report.** **Figure A11.12** presents a checklist by alternative of the information that is included in the project description. Justification for alternatives that were considered but dismissed as infeasible are also presented in this section.

Figure A11.12. Description of Alternatives Construction and Repair Economic Analyses.

STATUS QUO
Square footage of existing facility
Age of facility
Capacity of facility
Current condition
Date of last renovation
Location

RENOVATION
Number of square feet to renovate
Capacity of renovated facility
Renovation schedule
Extent of renovations
Location

NEW CONSTRUCTION
Square footage of new facility
Capacity of new facility
Location
Construction schedule
Disposal of existing facility

GOVERNMENT LEASE
Number of square feet to lease
Capacity of lease space
Lease term
Location
Disposal of existing facility

PSD
Number of square feet Capacity
Location
Construction schedule
Disposal of existing facility
Legislative authority

A11.10.7. **Source and Derivation of Costs**

A11.10.7.1. The methodology used for the interim calculations can be presented narratively, or in tables or charts. Tables and charts can facilitate the review of the economic analysis for evaluators. It is very important to include the source and any interim calculations conducted for all estimates and data used in the economic analysis. Therefore, this section will refer the reader to the appropriate signed source documents in Appendix B and interim calculations in Appendix C of the economic analysis.

A11.10.7.2. Any assumptions that were used in the derivation of the cost estimate are also reiterated here. For example, the derivation of annual maintenance and repair costs might read like this: **"Annual maintenance and repair costs for the existing facility were based on historical data provided by the Planning Department of the Civil Engineering Squadron (Appendix B). The data were adjusted to TY22 dollars (Appendix C). Annual maintenance and repair costs for the renovation alternative were assumed to be 10 percent less than the Status Quo alternative. Annual maintenance and repair costs for the new construction alternative were assumed to be 15 percent less than the Status Quo alternative. These assumptions were based on interviews with Civil Engineering personnel and are documented in the Civil Engineering Source Document dated 29 April 20XX. (Appendix B)."**

A11.10.8. **Source and Derivation of Benefits:** This section explains the methodology used to develop the benefit analysis. The discussion on benefits analysis includes:

A11.10.8.1. A description of each benefit element.

A11.10.8.2. A discussion of the method used to obtain data and analyze the benefits (e.g., interviews, survey) to include the names and organizations of those who provided benefit information. If the benefits were scored, include a discussion of how the weights and values were calculated.

A11.10.8.3. Results of the benefit analysis by alternative to include rankings for non-narrative analyses.

A11.10.8.4. When feasible, include a table summarizing the benefits by alternative.

A11.10.9. **Uncertainty (Sensitivity Analysis and Risk Analysis) – The Sensitivity Analysis results will be included in the economic analysis. (T-1).** If the results of any sensitivity analysis indicates a change in the alternative rankings, then this fact will be discussed. The results of any risk assessment will also be included.

A11.10.10. **Comparison of Alternatives and Interpretation of Results – In this section, the analyst will provide a comparison of the alternatives and interpret the results. (T-2).** The executive summary will contain an abbreviated form of this section as a conclusion. **(T-2).**

A11.10.11. **Appendices – The economic analysis appendices include the following:**

A11.10.11.1. Appendix A includes the Department of Defense Form 1391 for each alternative.

A11.10.11.2. Appendix B includes the Source Documents used to build the analysis. All of the signed source documents and supporting data are presented, including the name and phone number of points of contact.

A11.10.11.3. Appendix C includes the interim calculations for the analysis. All of the worksheets used in calculating utility, maintenance, moving, temporary leases, personnel costs, BAH for military personnel, per diem for traveling personnel, and other estimates, as well as inflation and escalation adjustments are presented in this appendix.

A11.11. A sample Executive Summary for a MILCON Economic Analysis is provided below. Even though the content of this sample applies strictly to MILCON, the format can be applied to other comparative analyses. Note that only the Executive Summary is provided below, not the entire analysis report. More details on the cost analysis, benefit analysis, and uncertainty analysis would be included in the body of the document.

A11.11.1. The Executive Summary includes a description of all reasonable alternatives. Including a description of reasonable alternatives that are infeasible will inform subsequent readers of why an alternative was excluded from further consideration.

A11.11.2. The cost table includes: new funding required, life cycle costs, and Uniform Annual Costs. The life cycle costs are only those costs relevant for comparative analyses. For example, they do not include sunk costs and may not include wash costs.

A11.12. A weighted benefit summary was included in the Executive Summary to: Reflect that a weighted benefit technique was used as part of the comparative analysis. Following the sample Executive Summary, a second example of a benefit analysis summary was provided that could be used in an Executive Summary. The second example of a benefit analysis summary is for when a narrative benefit technique is used in the comparative analysis. Please note that the Executive Summary only contains a summary of the benefit analysis. A more thorough description of the benefit analysis should be included in the main body of the document.

A11.13. The sample Executive Summary includes a recommendation.

Figure A11.13. The sample Executive Summary includes a recommendation.

EXECUTIVE SUMMARY

Installation/MAJCOM: Sample Air Force Base (AFB), Any State/Air Mobility Command (AMC)

Project Title: 237th Aeromedical Evacuation Squadron Facility

Project Number: 1024223

Project Objective: Provide facility at Sample Air Force Base (SAFB) that meets the needs of the 237th Aeromedical Evacuation Squadron

Background

The 237th AES conducts aeromedical evacuation missions spanning the continental United States, Europe, the Pacific and the Middle East. A Strategic Basing Decision was approved by the Secretary of the Air Force (SecAF) in May 20XX to relocate the 237th AES from Old Air Force Base to Sample Air Force Base. This relocation aligns the 237th AES with the Air Mobility Wing at SAFB.

The 237th AES is manned by flight medical personnel, plus medical, logistics, and radio/communications technicians. This incoming unit will need secure space for unit operations and climate-controlled storage to relocate its 57 officers, 110 enlisted, one civilian, and all associated mobility support equipment.

Alternatives Considered

Alternative 1: Status Quo (Infeasible) **–** The 237th AES is a new mission at SAFB and no facility exists to accommodate the squadron without modifications. Therefore, this alternative is considered infeasible and was not analyzed further.

Alternative 2: Renovation – Under this alternative, Building 241 on SAFB would be used to house the incoming 237th AES. The building would require a major renovation to accommodate the 237th AES. The renovation would replace the old, leaking roof with a new standing seam metal roof, replace the original interior doors, install new floor coverings, repaint the exterior of the facility, replace the ceiling throughout the facility, replace all electrical wirings, install energy efficient lighting and controls, replace raised flooring, remove curb slope entrance at the second floor restrooms, replace all original windows with those approved for antiterrorism/force protection, install fire detection and suppression systems as required. Building 83 would be used for equipment storage. The renovation project is estimated to begin in June of 2019 and is estimated to be completed by September of 2020.

Alternative 3: New Construction - Under this alternative, a new purpose-built facility would be constructed with 29,999 SF to accommodate the 237th AES and B83 would be used for equipment storage. Under this alternative, the project is estimated to begin in March of 2022 and would be completed by January of 2023. Since there is no currently existing facility, disposal costs will not be incurred.

Summary of Analysis Results

Summary of Costs - A cost summary is provided in the table below. Renovate has a significantly lower investment cost and a lower life cycle cost. Consistent with the lower investment and life cycle cost, the Uniform Annual Cost for renovation is also lower than the Uniform Annual Cost for new construction.

Table A11.1. Cost Summary.

Alternative	Feasible	New Funding Required (TY20)	Total Life Cycle Costs* (PV)	Uniform Annual Cost (PV)
Status Quo	No	-	-	-
Renovate	Yes	$ 11,432,348	$ 16,857,274	$ 472,748
New Construction	Yes	$ 23,276,829	$ 24,718,967	$ 700,583

*Total Life Cycle Costs were calculated using the Terminal Value Method.

Summary of Benefits: Benefits were addressed using the weighted benefit score technique. Three benefit elements were used in the analysis: mission, timeliness, and security. While the new construction alternative was superior with respect to mission and security, the renovate alternative was superior for timeliness. Timeliness is significant because of the mission degradation/inefficiencies with keeping the 237th AES at Old AFB. The weighted benefit scores are as follows:

Table A11.2. Benefits Summary.

		Alternative 2: Renovate		Alternative 3: New Construction	
Benefit Elements	**Weight Points**	**Percent***	**Benefit Score**	**Percent***	**Benefit Score**
Mission	10	75%	7.5	100%	10
Timeliness	4	90%	3.6	30%	1.2
Security	3	80%	2.4	95%	2.85
	Total Score		**13.5**		**14.05**

* The percent represents the extent to which the alternative met the objective (between 0% and 100%).

Mission evaluates the impact of the facility structure on the mission. The renovations to Building 241 would be sufficient to support the 237th AES mission, however; the renovation would not provide as much benefit as a purpose built facility. This is reflected in the Renovate score being 7.5 and the New Construction Score being 10. New construction would be purpose built for the 237th AES mission. As an example, a new facility would include dedicated training rooms designed for nurses and medical technicians to exercise emergency medical scenarios on advanced technology mannequins. These rooms would provide training to more than 150 aircrew personnel annually. In addition, the new facility would include storage space designed for the medical equipment the required for the mission.

Timeliness evaluates the impact of the scheduled completion of the facility on unit operations. The renovation alternative will be available for occupancy by September 2020 whereas the new construction alternative will not be available for occupancy until January of 2023. This timeliness advantage of renovation is significant because it allows the 237th to be more efficiently and effectively integrated into the Contingency Response Wing mission that it is supporting. This advantage is reflected in a renovation score of 3.6 compared with the lower new construction score of 1.2.

Security evaluates the physical security associated with the alternative facilities. Both renovation and new construction will have a reasonably high degree of security because they are both within the fence line of Sample AFB. The new construction alternative will include more standoff distance for parking and additional barrier protection around the facility. As a result, the new construction alternative offers a slightly more secure facility which is reflected in the slightly higher score of 2.85 when compared with the Renovate score of 2.4.

Uncertainty (Sensitivity/Risk) Analysis

A risk assessment was not performed. There is no expectation that the level of risk for either the new construction or renovation alternative will be a significant consideration for the decision maker. Sensitivity analyses were performed on key assumptions of the analysis. The sensitivity analyses indicate that there is a low probability for the cost results to be overturned. This is partly because of the significant cost difference between renovate and new construction, but also because they have many similar cost elements (e.g., construction labor). There are some unique costs (e.g., asbestos and lead paint removal for the renovation), but those unique costs appear unlikely to cause a change in the relative ranking of the alternatives.

Summary and Comparison of Alternatives

Alternative 2: Renovate has the lowest present value, requires less new funding and has the lowest Uniform Annual Cost. Alternative 3: New Construction has superior benefits for Mission and Security. Renovate has superior benefits for Timeliness. In terms of benefits, within the 237th AES (and the Contingency Response Wing more broadly), the advantage in Timeliness for Alternative 2 is outweighed by benefits for New Construction in Mission and Security. As such, the 237th and the Contingency Response Wing preferred the benefits from Alternative 3 (New Construction).

If the additional benefits received from new construction for mission and security outweigh the additional cost of new construction and the loss of benefit in timeliness, then the decision-maker should select new construction. Conversely, if the cost advantage and additional benefits from timeliness held by renovation outweigh the new construction benefit advantage in mission and security, then the decision-maker should select renovation.

Example Summary of Benefits for the Narrative Benefit Technique

The following example of a benefit analysis summary is for when the narrative benefit technique is used in the comparative analysis. If a narrative benefit technique was used, the following example could be inserted into the Executive Summary above. The benefit analysis in the body of the document should provide additional details of the benefits by alternative so the decision-maker has a clear understanding of the relative differences between the alternatives. Communicating those differences is a critical piece to informing the decision.

Summary of Benefits: Benefits were addressed narratively in the analysis and were not prioritized (weighted). Three benefit elements were used in the analysis: mission, timeliness, and security. While the new construction alternative was superior with respect to mission and security, the renovate alternative was superior for timeliness. Timeliness is significant because of the mission degradation/inefficiencies with keeping the 237th AES at Old AFB.

Mission evaluates the impact of the facility structure on the mission. The renovations to Building 241 would be sufficient to support the 237th AES mission, however; the renovation would not provide as much benefit as a purpose built facility. New construction would be purpose built for the 237th AES mission. As an example, a new facility would include dedicated training rooms designed for nurses and medical technicians to exercise emergency medical scenarios on advanced technology mannequins. These rooms would provide training to more than 150 aircrew personnel annually. In addition, the new facility would include storage space designed for the medical equipment the required for the mission.

Timeliness evaluates the impact of the scheduled completion of the facility on unit operations. The renovation alternative will be available for occupancy by September 2020 whereas the new construction alternative will not be available for occupancy until January of 2023. This timeliness advantage of renovation is significant because it allows the 237th to be more efficiently and effectively integrated into the Contingency Response Wing mission that it is supporting.

Security evaluates the physical security associated with the alternative facilities. Both renovation and new construction will have a reasonably high degree of security because they are both within the fence line of Sample AFB. The new construction alternative will include more standoff distance for parking and additional barrier protection around the facility. As a result, the new construction alternative offers a more secure facility.

Attachment 12

ECONOMIC IMPACT ANALYSIS

A12.1. Introduction. By its very presence in local communities, both in the continental US and around the world, each Air Force installation increases economic output of its host community thru local spending on goods and services. In addition, individuals who work on an installation spend their own money in the local community on things like rent, food and entertainment. These expenditures have an impact on the local economy that can be quantified using an Economic Impact Analysis (EIA). In turn, the EIA can be an important tool for installation leadership in interactions with civic leaders.

A12.2. Background. An EIA is an estimate of an installation's economic impact on its host community. This chapter provides a methodology, guidance and instructions for estimating an installation's economic impact in terms of dollars and jobs.

A12.2.1. The requirement to complete an EIA by Air Force installations, units, or MAJCOMs is determined by the MAJCOM Headquarters or installation commander. For installations that do produce an EIA, the guidance in this chapter is provided to ensure a valid methodology is used and to aid in consistency and comparability across installations.

A12.2.2. SAF/FMC developed an Excel® estimating template to assist producers of EIA and to facilitate consistency of EIA across the Air Force. This Excel® template/spreadsheet is available on the SAF/FMCE SharePoint® page, to which a link is provided on the SAF/FMCE page of the Air Force Portal. The Installation and Mission Support Center Resource Management Cost Division may also be a useful reference.

A12.2.3. While it is possible to calculate economic impact without multipliers, the Air Force primary approach uses multipliers. An allowable alternate approach is to calculate the economic impact without using multipliers. The analysis should state whether or not multipliers have been included. If an installation does include economic multipliers, the analyst should use the economic multipliers from the Bureau of Economic Analysis. Multipliers for many installations are provided in the Excel® template.

A12.2.3.1. The Bureau of Economic Analysis multipliers are developed using the Regional Input-Output Modeling System (RIMS II) and the resulting multipliers are called final-demand multipliers. Only changes in purchases made by final users are used with final-demand multipliers. A final-demand change refers to goods and services sold to final users. Final users are people and organizations that purchase a finished or final product. For example, a bakery that buys ingredients (e.g., flour, sugar, eggs) to make bread and pastries is not considered a final user; the customers who buy the final product (i.e., the bread and pastries) are the final users. In most cases for Air Force EIA, dollars associated with final users are limited to Appropriated Fund and Working Capital Fund expenditures and payroll.

A12.2.3.1.1. Accounting for Government Expenditures and Payroll – The Bureau of Economic Analysis does not include a government multiplier that is suitable to use in an EIA. Instead, analysts will have to break out expenditures by type (e.g., construction, utilities, payroll). This approach will then require the application of multipliers by expenditure type as described in **section A12.4** of this manual.

A12.2.3.1.2. Examples of final user expenditures are: (1) construction funded by appropriated funds, (2) utilities funded by appropriated funds, (3) supplies funded by appropriated funds, (4) any other good or service funded by appropriated funds, and (5) purchases funded by a Working Capital Fund.

A12.2.3.1.3. Examples of final user payroll are: (1) military pay, (2) civilian pay, (3) Non-Appropriated Fund employee payroll funded by appropriated funds, (4) Army & Air Force Exchange Service and Defense Commissary Agency (DeCA) employee payroll funded by appropriated funds, (5) other employee payroll funded by appropriated funds and (6) employee payroll funded by a Working Capital Fund.

A12.2.3.2. Some expenditures are purposefully not included when calculating the economic impact of an installation on the local area. That is because they do not represent a final-demand change caused by the Air Force installation.

A12.2.3.2.1. Expenditures that are not final user should not be included in expenditure amounts to which the multipliers will be applied. These intermediate expenditures are accounted for by the multiplier itself. They are similar to purchases made by a military person or government civilian at a local community department store, grocery store, etc. Likewise, a housing privatization expenditure is similar to the cost of construction for a newly constructed house off-installation that is being rented to a military member. In this case, the economic impact is accounted for under the Basic Allowance for Housing (BAH) payment, not the privatized construction cost.

A12.2.3.2.2. Examples of expenditures that are not final user include: (1) Non-Appropriated Fund employee payroll not funded by appropriated funds, (2) Non-Appropriated Fund activity expenditures not funded by appropriated funds, (3) housing privatization expenditures not funded by appropriated funds, (4) payroll and expenditures of a business that physically resides on an installation, such as a bank, credit union or tenant restaurant.

A12.3. Data Collection. The SAF/FMC EIA tool requires a variety of data elements (described below). The data elements are organized into tables to help analysts organize the data. Each table element is intended to be self-explanatory. Annualize all expenditures for payroll, contracts, construction and other procurements that are spent over more than one FY. If actual expenditures are not available, distribute the contract amount for a project or service evenly over the number of years of the contract. Input the annualized number, not the full contract value. Include tenant organizations to the extent that they impact the local economy. Who and what amount to include will not be an exact science. That being said, it is key to document which organizations are included in the analysis. The paragraphs under **paragraph A12.3** (this section) refer to tables in the Excel® template as a way to organize data collection. **Figure A12.1** summarizes the data collection requirements.

A12.3.1. Personnel.

A12.3.1.1. **Input Table 1 – Number of Personnel.** The number of personnel table in the Excel® template will show the number of personnel employed locally by the installation or activity, regardless of where the servicing personnel or payroll offices are located.

A12.3.1.1.1. Military Personnel – Data Source: Servicing Personnel office.

A12.3.1.1.2. Trainees/Cadets – Data Source: Servicing registrar or equivalent.

A12.3.1.1.3. Retirees – Data Source: Department of Defense Office of the Actuary. (It is an open question as to what portion of the retirees are in the local area as a result of the installation. For clarity, any retiree impact, if included, should be reported separately from the installation economic impact).

A12.3.1.1.4. Civilian Employees – Data Source: Servicing Personnel office.

A12.3.1.1.5. Foreign National Direct Hires (FNDH) – Data Source: Servicing Personnel office.

A12.3.1.1.6. Non-Appropriated Fund Employees funded by appropriated funds – Data Source: Servicing Non-Appropriated Fund Human Resources Office.

A12.3.1.1.7. Army & Air Force Exchange Service and Defense Commissary Agency employees funded by appropriated funds – Data Source: Respective installation manager.

A12.3.1.1.8. Department of Defense Education Activity employees – Data Source: Local Department of Defense Education Activity.

A12.3.1.1.9. Tenant employees funded by appropriated funds – Data Source: Individual tenant unit(s) or installation Memorandum of Agreement (MOA) manager.

A12.3.1.1.10. Contract Civilians (not elsewhere included) – Data Source: servicing contracting office. Report the number of Full-Time Equivalent (FTE) contract civilians assigned. Numbers may also be obtained from the functional organization requiring the contract.

Figure A12.1. List of Expenses to Include in the Economic Impact Analysis.

Expense Category	Data Source	Notes	Ref Paragraph
Payroll			A12.3.1.2.
Active Duty Personnel	Servicing FSO	Do not include retirement or other accruals	A12.3.1.3.1.1.
Air Force Reserve Personnel	Servicing FSO		A12.3.1.3.1.2.
Air National Guard Personnel	Servicing FSO		A12.3.1.3.1.2.
Trainees/Cadets	Training Institution		A12.3.1.3.1.3.
General Schedule Civilian Employees	Servicing FSO		A12.3.1.3.2.1.
AcqDemo Civilian Employees	Servicing FSO		A12.3.1.3.2.1.
Federal Wage System Civilian Employees	Servicing FSO		A12.3.1.3.2.1.
NAF-Related Employees Funded by APF	Servicing NAF HRO		A12.3.1.3.2.3.
AAFES Employees Funded by APF	Installation Manager		A12.3.1.3.2.4.
DeCA Employees Funded by APF	Installation Manager		A12.3.1.3.2.4.
DoDEA Employees	Local DoDEA Activity		A12.3.1.3.2.5.
Tenant Employees Funded by APF	Servicing FSO or Individual Tenant Units		A12.3.1.3.2.6.
Other Civilian Employees Funded by APF or WCF	Servicing FSO		A12.3.1.3.2.
Foreign National Direct Hire Employees	Servicing FSO		A12.3.1.3.2.2.
Other Foreign National Employees	Servicing FSO		A12.3.1.3.2.2.
Contract Civilians Not Included Elsewhere	Servicing Contracting Office	Do not include contract civilians who are already accounted for under contract expenses.	A12.3.1.3.2.7.
Expenditures By Industry for Items and Services Produced in the Local Area			A12.3.2.1.
Construction Expenditures (MILCON, NAF, WCF, etc.)	Civil Engineer function	Only include construction paid with APF, WCF, or NAF	A12.3.2.1.1.
O&M Expenditures for Locally Produced items and services (Non-Construction)	Installation Budget Office	e.g., Utilities, warehousing, printing, telecom, waste management, Advisory and Assistance Services, etc.	A12.3.2.1.2.3.1.
AAFES Expenditures for Locally Produced items and services (Non-Construction)	Installation Manager		A12.3.2.1.2.3.2.
DeCA Expenditures for Locally Produced items and services (Non-Construction)	Installation Manager		A12.3.2.1.2.3.2.
Medical Expenditures for Locally Produced items and services (Non-Construction)	Local Medical Organization Resource Advisor	Include TRICARE spending if possible	A12.3.2.1.2.3.3.
NAF Expenditures for Locally Produced items and services (Non-Construction)	Local NAF Resource Management Office		A12.3.2.1.2.3.4.
WCF Expenditures for Locally Produced items and services (Non-Construction)	Installation Budget Office		A12.3.2.1.2.3.5.
Education Expenditures for Locally Produced items and services (Non-Construction)	Local DoDEA Activity		A12.3.2.1.2.3.6.1.
Education Impact Aid	Local School District or US Department of Education Impact Aid Office	https://www2.ed.gov/about/offices/list/oese/impactaid/index.html	A12.3.2.1.2.3.6.2.
Education Tuition Assistance	Installation Education Office		A12.3.2.1.2.3.6.3.
Expenditures By Industry for Items and Services Purchased Locally, but Produced Outside the Local Area			A12.3.2.2.
Include goods and services purchased locally but not included in paragraph 8.3.2.1.	Installation Budget Office	The Excel® template will only include the local (retail) impact for these expenses	A12.3.2.2.1. / A12.3.2.2.2.
Exclude goods and services not purchased locally		e.g., Air Force Stock Fund and e-commerce via the Government Purchase Card	A12.3.2.2.2.
TDY/Travel			A12.3.2.3.
Include local spending by individuals TDY to the installation or in Temporary Lodging during a Permanent Change of Station	Installation Lodging Office		A12.3.2.3.1.

A12.3.1.2. **Input Table 2 – Annual Payroll by Classification.** This table in the Excel® template will show the installation payroll expenses impacting the local area. The many people who work on Air Force installations (military personnel, civilian personnel and host-nation civilian employees) increase the economic output of the local community by spending some portion of their pay on such items as rent, restaurants, entertainment and daily necessities.

A12.3.1.2.1. Payroll is defined as gross income including basic pay, benefits and allowances. Do not include retirement funds accrued or employer contributions that are not immediately available to the employee.

A12.3.1.2.2. When appropriate, or when specific cost information is not available, use cost factor tables from AFI 65-503. The current cost factor tables are available on the SAF/FMCE SharePoint® page, to which a link is provided on the SAF/FMCE page of the Air Force Portal. Table references that follow refer to AFI 65-503.

A12.3.1.3. The community on an Air Force installation consists of many different kinds of employees funded by appropriate funds. The intention is to count all these personnel in the EIA. Personnel categories to include:

A12.3.1.3.1. Military Pay.

A12.3.1.3.1.1. Regular Air Force.

A12.3.1.3.1.1.1. Data Source: Servicing Financial Services Office. An alternate method is to multiply the total quantity of assigned personnel with the applicable standard composite rate(s), Table A19.1 or A19.2.

A12.3.1.3.1.1.2. Include only the following data elements of the Standard Composite Factors: Basic Pay, Basic Allowance for Housing, Incentive Special Pay and Miscellaneous. Do not include any accruals (retirement or other), Permanent Change of Station or acceleration factors.

A12.3.1.3.1.2. Air Force Reserve/Air National Guard.

A12.3.1.3.1.2.1. Include non-extended active duty Air Force Reserve/Air National Guard. This includes those personnel who serve one weekend per month and a two-week active duty tour per year.

A12.3.1.3.1.2.2. Data Source: Servicing Financial Services Office. An alternate method is to multiply the total quantity of assigned personnel with the applicable standard composite rate(s), Table A22.1 or A23.1. Include only the following data elements of the Standard Composite Factors: Basic Pay, Basic Allowance for Housing, Incentive Special Pay and Miscellaneous. Do not include any accruals (retirement or other), Permanent Change of Station or acceleration factors.

A12.3.1.3.1.3. Trainees/cadets.

A12.3.1.3.1.3.1. Data Source: Training institution or **Table** A19.1 or A19.2. Use an average daily student load if appropriate.

A12.3.1.3.1.3.2. The head-count and composite rate method is an alternative source for trainee payroll data.

A12.3.1.3.1.4. Military Retirees. It is an open question as to what portion of the retirees are in the local area as a result of the installation.

A12.3.1.3.1.4.1. Data Source: Department of Defense Office of the Actuary.

A12.3.1.3.1.4.2. For clarity, any retiree impact, if included, should be reported separately from the installation economic impact.

A12.3.1.3.2. Civilian employees funded by appropriated funds or a Working Capital Fund.

A12.3.1.3.2.1. General Schedule, DoD Civilian Acquisition Workforce Personnel Demonstration Project and Federal Wage System employees.

A12.3.1.3.2.1.1. Data Source: Servicing Financial Services Office. If this data is not readily available, an approximation is [C / (1 + F)] * N. Where C is the applicable standard composite rate from Table **A27.1** or **A28.1**, F is the retirement and benefits factor from Table A30.1, and N is the number of Full-Time Equivalent (FTE) personnel. This equation estimates the total payroll, net of retirement accrual and other employer-sponsored contributions.

A12.3.1.3.2.2. Foreign National Direct Hire (FNDH), Foreign National Indirect Hire (FNIH), other foreign national employees.

A12.3.1.3.2.2.1. Data Source: Servicing Financial Services Office. Or use the alternative method described in **paragraph A12.3.1.3.2.1.1**

A12.3.1.3.2.3. Non-Appropriated Fund-related employees funded by appropriated funds.

A12.3.1.3.2.3.1. Include employees funded by Non-Appropriated Funds when the employee or function is funded by appropriated funds via a Memorandum of Agreement.

A12.3.1.3.2.3.2. Data Source: servicing Non-Appropriated Fund Human Resources Office.

A12.3.1.3.2.4. Army & Air Force Exchange Service and Defense Commissary Agency employees funded by appropriated funds.

A12.3.1.3.2.4.1. Data Source: Respective installation manager.

A12.3.1.3.2.5. Department of Defense Education Activity employees.

A12.3.1.3.2.5.1. Data Source: Local Department of Defense Education Activity.

A12.3.1.3.2.6. Tenant employees funded by appropriated funds.

A12.3.1.3.2.6.1. Data Source: Servicing Financial Services Office or the individual tenant unit(s), or use applicable cost factors from AFI 65-503.

A12.3.1.3.2.7. Contract Civilians (not elsewhere included).

A12.3.1.3.2.7.1. Data Source: Servicing contracting office. Numbers may also be obtained from the functional organization requiring the contract. If this data is not readily available, an approximation can be made by dividing the total labor cost by cost per man-year or total labor hours divided by hours per man-year.

A12.3.1.3.2.7.2. Caution! Do not double-count payroll in the "Contract Civilians" line and in Table 3. If the payroll of contract civilians is part of a contract amount reported in Table 3, do not enter the payroll amount in Table 2.

A12.3.2. **Input Table 3 – Expenditures by classification.** Table 3 in the Excel® template will show the installation expenses for Construction, Services, and Procurement of Materials, Equipment and Supplies. This is spending in the local community by installation units, organizations and activities. An Air Force installation increases economic output of its host community through spending on locally-purchased materials, supplies, equipment and contracts. Installations also spend locally for services and construction contracts as well as utilities and many other items, large and small. In addition to spending by official Air Force units, recreational and other supporting organizations also make purchases off-installation, as do tenant vendors, banks and many other unofficial activities on the installation.

A12.3.2.1. **Locally produced goods and services – This category includes goods and services that are not only purchased from local suppliers, but also produced locally.**

A12.3.2.1.1. Construction expenditures. Include the following construction-related expenditures as appropriate (suggested source: Civil Engineer function staff):

A12.3.2.1.1.1. MILCON Program.

A12.3.2.1.1.2. Military Family Housing Construction.

A12.3.2.1.1.3. Military Family Housing Operations and Maintenance (O&M).

A12.3.2.1.1.4. Construction-related Operations & Maintenance. Include only those costs associated with contract construction (i.e., minor construction, architectural and design fees, and real-property maintenance contracts).

A12.3.2.1.1.5. Non-Appropriated Fund Construction.

A12.3.2.1.1.6. Working Capital Fund Construction.

A12.3.2.1.2. Locally produced non-construction expenditures.

A12.3.2.1.2.1. Include all expenditures for goods and services that were produced in the local area.

A12.3.2.1.2.2. Examples include: utilities (e.g., Cost Element Code 2332xxx for commercial utilities, Legacy: Element of Expense 480xx), warehousing and storage, printing, telecommunications, internet, real estate services (leasing, etc.), Advisory and Assistance Services, Administrative and Support Services, waste management, educational services, lodging services and hospital services.

A12.3.2.1.2.3. Suggested Sources:

A12.3.2.1.2.3.1. Operations & Maintenance. Installation budget office.

A12.3.2.1.2.3.2. Army & Air Force Exchange Service and Defense Commissary Agency. Use appropriated fund expenditures only. Information may be obtained directly from the installation manager. If unable to determine how much appropriated fund spending is local, the analyst may make a reasoned estimate.

A12.3.2.1.2.3.3. Medical. Ensure that any local procurement spending of Air Force funds in the medical appropriation are included. The local medical facility may also help determine the amount of local TRICARE spending in the local economy.

A12.3.2.1.2.3.4. Non-Appropriated Funds. Information on local procurements may be obtained directly from the local Non-Appropriated Funds resource management office. If unable to determine how much of Non-Appropriated Funds spending is local, the analyst may make a reasoned estimate.

A12.3.2.1.2.3.5. Working Capital Fund. Installation budget office.

A12.3.2.1.2.3.6. Education.

A12.3.2.1.2.3.6.1. Department of Defense Education Activity. Information may be obtained directly from the local the Department of Defense Education Activity. If unable to determine how much of Department of Defense Education Activity spending is local, the analyst may make a reasoned estimate.

A12.3.2.1.2.3.6.2. Impact Aid. The Federal Government provides financial assistance to local school districts to assist with the provision of educational services to children of Federal employees (in accordance with Title VIII of the Elementary and Secondary Education Act of 1965 (20 U.S.C. § 7701 et. seq.)). An allocation should be used if there is more than one military installation in the economic area (e.g., based on military and civilian personnel assigned to the installation). Information may be obtained from the local school district or United States Department of Education, Impact Aid Programs, **http://www2.ed.gov/about/offices/list/oese/impactaid/index.html** or **ImpactAid@ed.gov**. Contact telephone number is: 202-260-3858.

A12.3.2.1.2.3.6.3. Tuition Assistance. Information may be obtained directly from the installation Education Office.

A12.3.2.2. **Local purchases of goods produced outside the local area.**

A12.3.2.2.1. Include local expenditures that are not captured in A12.3.2.1 above.

A12.3.2.2.2. One suggested method of data collection (for Air Force appropriated fund activities on an installation) is to perform a Commanders' Resource Integration System (CRIS) and/or Defense Enterprise Accounting and Management System (DEAMS) retrieval of all expenditures (Accrued Expenditures Paid) incurred in the relevant FY by Cost Elements (Legacy: Element of Expense and Investment Code). Exclude expenditures that were not spent locally, like the Air Force Stock Fund and e-commerce via the Government Purchase Card (GPC) program. Based on location and circumstances, useful information may be available in contracting and civil engineering databases. If appropriate, the analyst may assume expenditures were made locally and include them in the estimate. This is a difficult category of local spending to estimate and the analyst must exercise the best reasoned judgment.

A12.3.2.3. Temporary Duty/Travel.

A12.3.2.3.1. Include the amount of local spending by individuals Temporary Duty (TDY) to the installation (suggested source: Installation Lodging office).

A12.3.2.3.2. Lodging cost: Number of Temporary Duty and Temporary Lodging bed nights multiplied by the lodging rate. Account for any changes in lodging rates that occur during the year. Account for bed nights in installation lodging separately from those in local community lodging due to the differences in lodging rates.

A12.3.2.3.3. Meals and Incidental Expenses (M&IE): A suggested method is to obtain the number of TDY bed nights and perform the following calculation: B * (M * 0.75). Where B is the number of Temporary Duty bed nights in local community lodging, M is the Meals and Incidental Expenses rate, and 0.75 assumes that travelers spend 75% of their Meals and Incidental Expenses allowances in the local community.

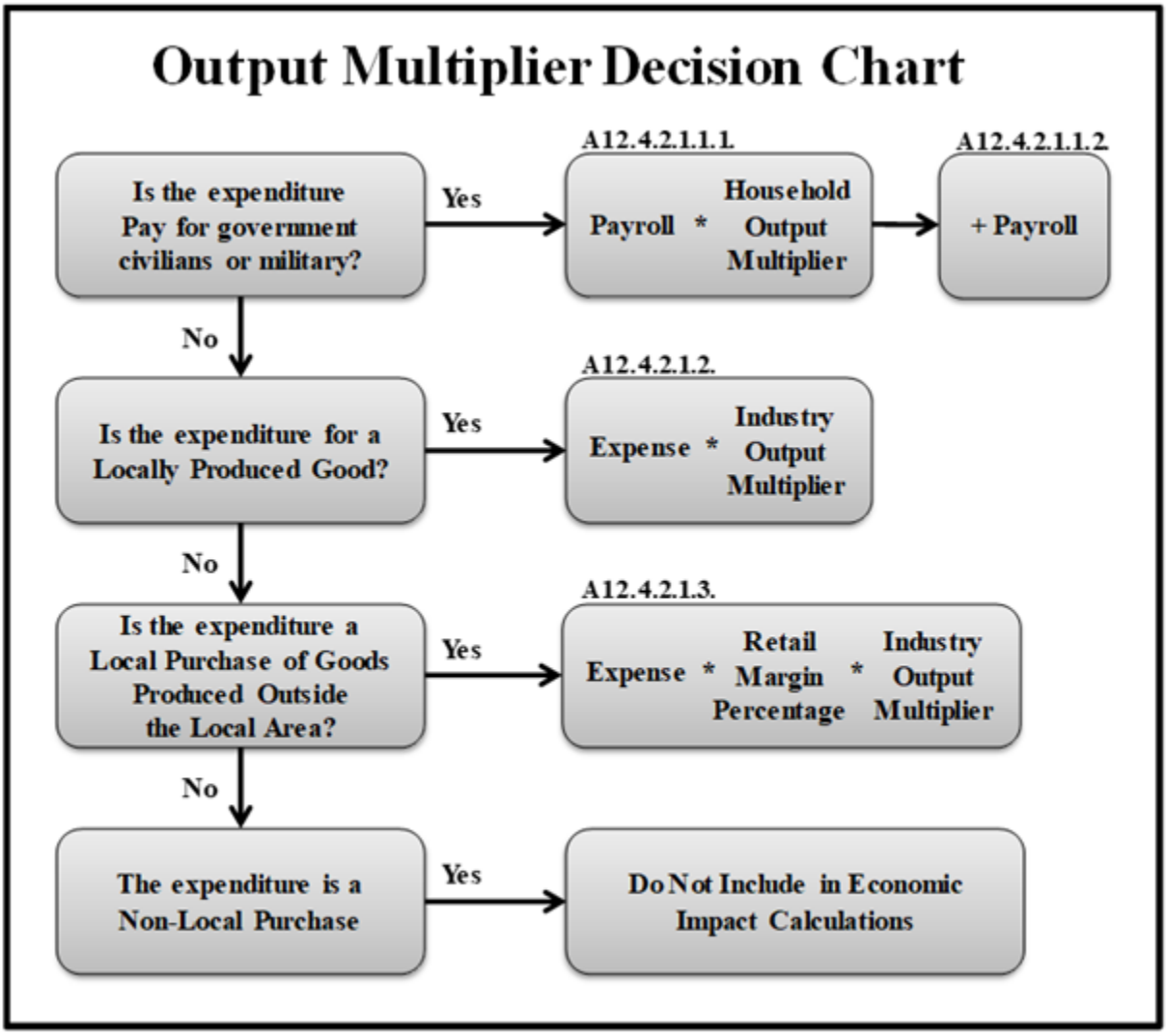
A12.4. Estimate of Economic Impact.

A12.4.1. There are many measures of economic impact (e.g., output, earnings, employment, value added). This instruction will provide two measures using the data collected. The first measure will be "output plus payroll." The "output plus payroll" measure represents the total dollar change in output that occurs for each additional dollar expended by the Air Force plus payroll expenditures. The second measure is employment. The employment measure represents the total change in number of jobs that occurs in all industries for each additional million dollars expended by the Air Force (expenditures should be normalized to the year of data upon which the multiplier is based). The below calculations are performed within the Excel® template.

A12.4.2. Economic Impact on Output Plus Payroll and Employment.

A12.4.2.1. Economic Impact on Output Plus Payroll.

Figure A12.2. Output plus Payroll Multiplier Decision Chart.



A12.4.2.1.1. Annual Payroll Expenditures.

A12.4.2.1.1.1. Multiply the payroll expenditures by the household output multiplier to obtain the increase in economic output produced by the local community that is created from household expenditures.

A12.4.2.1.1.2. To calculate total impact from payroll, add the original payroll expenditures to the number calculated in **paragraph A12.4.2.1.1.1** This step is taken because the multipliers do not count household payroll as "output" to the economy. As a result, the original payroll expenditures are included for the "output plus payroll" measure.

A12.4.2.1.2. Locally produced goods and services.

A12.4.2.1.2.1. Segregate the expenditures by industry.

A12.4.2.1.2.2. Multiply the locally produced expenditures by the respective industry economic output multiplier.

A12.4.2.1.3. Local purchases that were produced outside the local area.

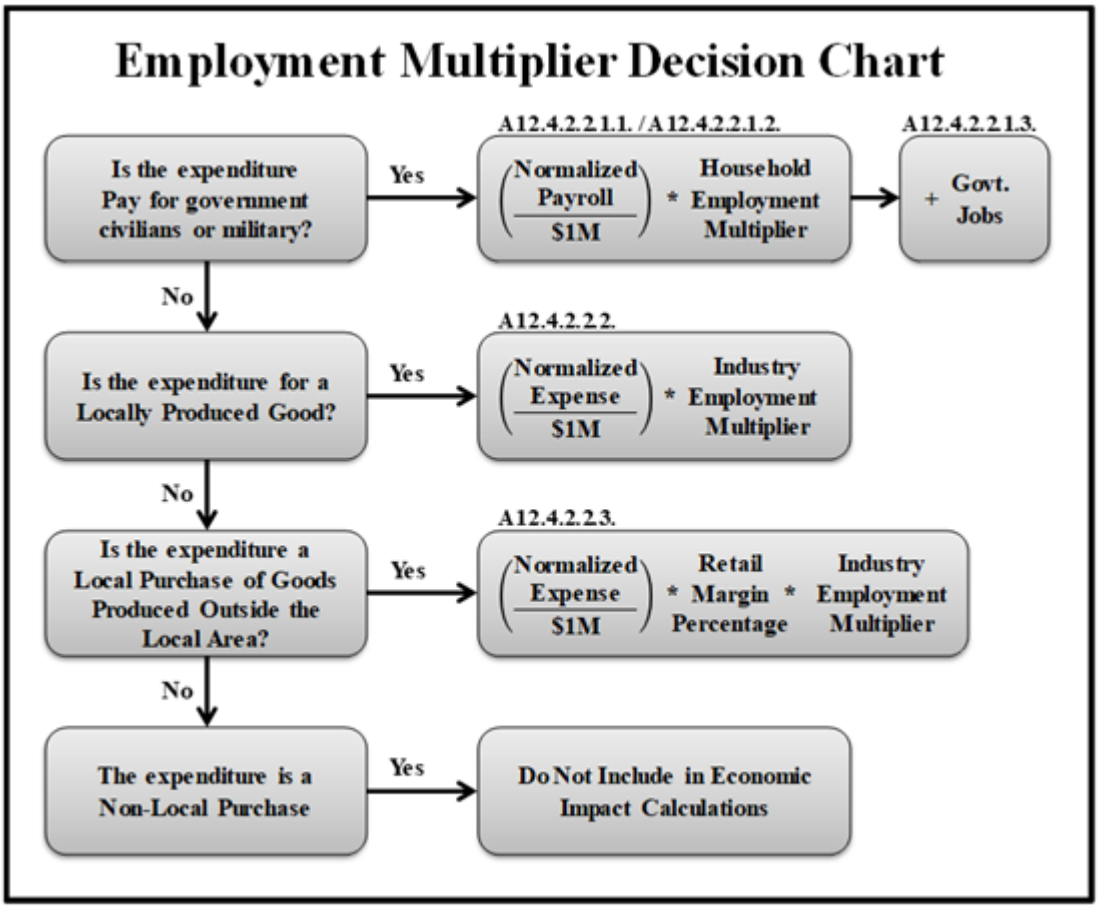
A12.4.2.1.3.1. The only portion of these expenditures that actually impacts the local area is the retail margin (the portion of the price that can be attributed to the local retailer). To obtain the retail margin, multiply these expenditures by the most appropriate retail margin percentage.

A12.4.2.1.3.2. Multiply that product by the multiplier for retail goods.

A12.4.2.1.3.3. Selected retail margins are available in the retail margin table of the Excel® template. If a retail margin is not available, use the "Other retail" margin from the Excel® template.

A12.4.2.2. Economic Impact on Employment.

Figure A12.3. Employment Multiplier Decision Chart.



Note: See **paragraph 12.3.1.3.** and sub-paragraphs for what to include in Payroll

A12.4.2.2.1. Annual Payroll Expenditures.

A12.4.2.2.1.1. Use the SAF/FMC inflation index to normalize the payroll expenses to the base year of the multipliers. Divide the normalized payroll expenditures by $1M.

A12.4.2.2.1.2. Multiply the payroll expenditures by the household employment multiplier.

A12.4.2.2.1.3. The employment impact from the calculations in sections **A12.4.2.2.1.1** and **A12.4.2.2.1.2** represent the number of jobs created in the local community as a result of government personnel spending their salaries in the local community. To calculate total employment impact from payroll, add the original number of government jobs represented by payroll to the number calculated using **paragraphs A12.4.2.2.1.1** and **A12.4.2.2.1.2**

A12.4.2.2.2. Locally produced goods and services.

A12.4.2.2.2.1. Segregate the expenditures by industry.

A12.4.2.2.2.2. Use the SAF/FMC inflation index to normalize expenditures for locally produced goods and services to the base year of the multipliers. Divide the normalized expenditures by $1M.

A12.4.2.2.2.3. Multiply the locally produced expenditures from **paragraph A12.4.2.2.2.2** by the respective industry economic employment multiplier.

A12.4.2.2.3. Local purchases that were produced outside the local area.

A12.4.2.2.3.1. For these purchases, the only portion of the expenditure that actually impacts the local area is the retail margin (the portion of the price that can be attributed to the local retailer).

A12.4.2.2.3.2. Use the SAF/FMC inflation index to normalize expenditures for local purchases produced outside the local area to the base year of the multipliers. Divide the normalized expenditures by $1M.

A12.4.2.2.3.3. Multiply the expenditures from **paragraph A12.4.2.2.3.2** by the most appropriate retail margin percentage.

A12.4.2.2.3.4. Multiply the product of **paragraph A12.4.2.2.3.3** by the employment multiplier for retail goods.

A12.4.2.2.3.5. Selected retail margins are available in the Excel® template. If a retail margin is not available, use the "Other retail" margin from the Excel® template.

A12.5. Alternative Methodologies. If an installation desires to use a different methodology for their EIA, a request must be submitted through the MAJCOM to SAF/FMCE **(T-1).** Requests should include an explanation of the proposed method and the reason the Air Force method is not appropriate or executable.

Attachment 13

CLINGER-COHEN ACT ECONOMIC ANALYSES

A13.1. Issues Unique To Clinger-Cohen Act Comparative Analyses.

A13.1.1. The Clinger-Cohen Act requires "…criteria related to the calculation of a Return on Investment" when considering whether to undertake an investment in information systems. DoDI 5000.75 provides guidance on how to satisfy the Return on Investment requirement for Defense Business Systems acquisition programs. DoDI 5000.02 provides guidance on how to satisfy the Element 6 Return on Investment requirement for all other defense programs. DoDI 5000.74 - Defense Acquisition of Services provides Clinger-Cohen Act guidance for the acquisition of contracted services.

A13.1.2. Based on this DoD guidance, the Return on Investment requirement in the Clinger-Cohen Act will be met either through an Economic Analysis or through a Life Cycle Cost Estimate. **(T-0).** This Attachment provides information that is used to determine which type of analysis is required and when in the acquisition life cycle the analysis is required. It also provides information specific to preparing Clinger-Cohen Act economic analyses.

A13.2. Type Of Analysis Required.

A13.2.1. The Clinger-Cohen Act requires a Return on Investment calculation for automated information systems. These systems can either be wholly automated information systems such as a business system or they can be part of another weapon system or product such as software inside an aircraft. See DoDI 5000.02 Table 1 Note 4 for the definition of automated information systems. The Automated Information System category designation is determined by the Component Acquisition Executive, as delegated by the Secretary of Defense or Secretary of the Military Department, DoDI 5000.02.

A13.2.2. To satisfy Clinger-Cohen Act requirement, the Department of Defense requires an Economic Analysis or a Life Cycle Cost Estimate depending on the type of system being procured. The following rules apply. The rules are summarized in **Figure A12.1**

A13.2.2.1. Acquisition Master List or Other Acquisition Designation. Programs/systems on the Acquisition Master List or with Other Acquisition Designation, (i.e., Middle-Tier Acquisitions from FY17 NDAA Section 804) that acquire information technology require Clinger-Cohen Act certification. If a program/system is not on the Acquisition Master List or does not have an acquisition definition, then Clinger-Cohen Act requirements are performed at the discretion of the Secretary of the Air Force- Chief Information Officer/A6.

A13.2.2.2. Acquisition Phase

A13.2.2.2.1. In general, an economic analysis or life cycle cost estimate is required for Clinger-Cohen Act purposes during the development and production or deployment acquisition phases.

A13.2.2.2.2. A program/system at any phase after the full deployment decision (or equivalent) in its acquisition lifecycle is not required to update its economic analysis or life cycle cost estimate for Clinger-Cohen Act purposes.

A13.2.2.2.3. For Defense Business Systems, a system at any point after the acquisition authority to proceed decision point (or equivalent) is not required to update its economic analysis for Clinger-Cohen Act purposes.

A13.2.2.2.4. Modification programs to the parent program require an independent economic analysis or Life Cycle Cost Estimate (LCCE) for Clinger-Cohen Act purposes if that modification is treated as an acquisition program in its own right regardless of the acquisition phase of the parent program.

A13.2.2.3. When the system program is on the acquisition master list or other acquisition designation and at an acquisition phase which requires an economic analysis or life cycle cost estimate for Clinger-Cohen Act purposes, the next key discriminators for determining the type of analysis required are (1) whether the program/system is, or just includes, an Automated Information System; (2) whether the program/system is a Defense Business System; (3) whether the program/system is classified as a National Security System; and (4) whether the program system is an information technology service. The type of analysis required in each situation is described below:

A13.2.2.3.1. If the system under consideration is not an Automated Information System under DoD Instruction 5000.02 Table 1 Note 4, then:

A13.2.2.3.1.1. A Life Cycle Cost Estimate is required for Clinger-Cohen Act purposes unless the program is an Information Technology Services Contract.

A13.2.2.3.1.2. If a program is an Information Technology Service Contract, then an Economic Analysis with a Return on Investment is required for Clinger-Cohen Act purposes. Information Technology Services are defined in DoDI 5000.74.

A13.2.2.3.1.3. **Note:** The current definition in Table 1 Note 4 excludes "computer resources, both hardware and software, that are an integral part of a weapon or weapon system" from the definition of Automated Information Systems. However, the analyst should always validate their official automated information system categorization.

A13.2.2.3.2. If the system under consideration is a Defense Business System, then perform an Economic Analysis with a Return on Investment when the system is in the "Business System Functional Requirements and Acquisition Planning Phase" (approaching it's "Acquisition" Authority to Proceed) or equivalent phase. Defense Business Systems are defined in DoDI 5000.75. By definition, the category of Defense Business System does not include National Security Systems.

A13.2.2.3.3. If the program/system under consideration is an Automated Information System, but not a National Security System and not a Defense Business System, then perform an Economic Analysis with a Return on Investment.

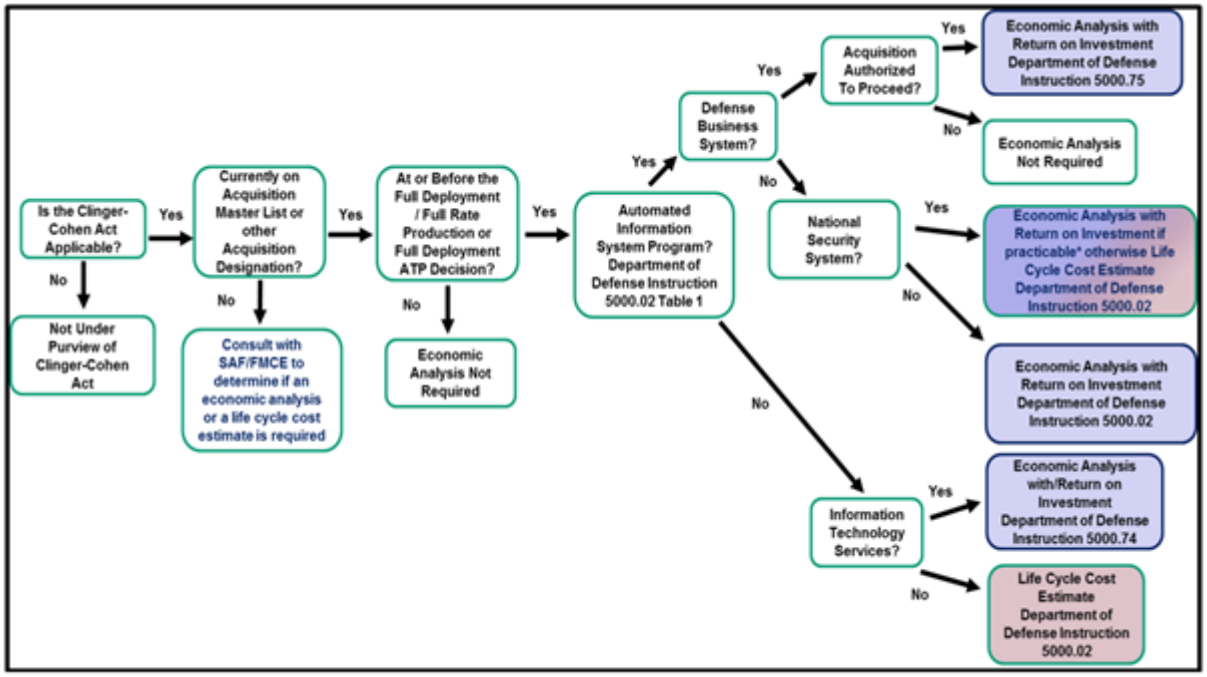
A13.2.2.3.4. If the program/system under consideration is an Automated Information System and also a National Security System, then the return on investment required for Clinger-Cohen Act purposes will be met using an economic analysis with return on investment if practicable; otherwise, a life cycle cost estimate is required. This is the one categorization where an economic analysis is required, but a life cycle cost estimate may be substituted if the economic analysis is not practicable to complete.

A13.2.2.3.4.1. In determining whether an economic analysis would be practicable, the analyst should consider whether it is possible to accomplish the return on investment, which is essentially a quantitative calculation, and also whether the return on investment would provide information that could be relevant to the decision.

A13.2.2.3.4.2. The initial determination of whether an economic analysis is practicable is made by the program office. **(T-2).** The final determination is made by the highest level of Financial Management concurrence required for the analysis (Economic Analysis or Life Cycle Cost Estimate). This will be either the Product Center Cost Chief, the Sustainment Center Cost Chief, the MAJCOM Cost Chief, or SAF/FMC and is determined by acquisition category level (see the coordination process in **paragraph A13.4** of this Attachment). **(T-2).** The program office may consult with the appropriate center level Cost Chief or SAF/FMC in advance when making an initial determination on whether an Economic Analysis is practicable.

A13.2.2.3.4.3. For acquisition programs, lack of time is rarely an acceptable reason for determining that accomplishing an Economic Analysis is not possible.

Figure A13.1. Clinger-Cohen Act Economic Analysis and Life Cycle Cost Estimate Requirements.



* Practicable is further discussed in **paragraphs A13.2.2.3.4.1. – A13.2.2.3.4.3.**

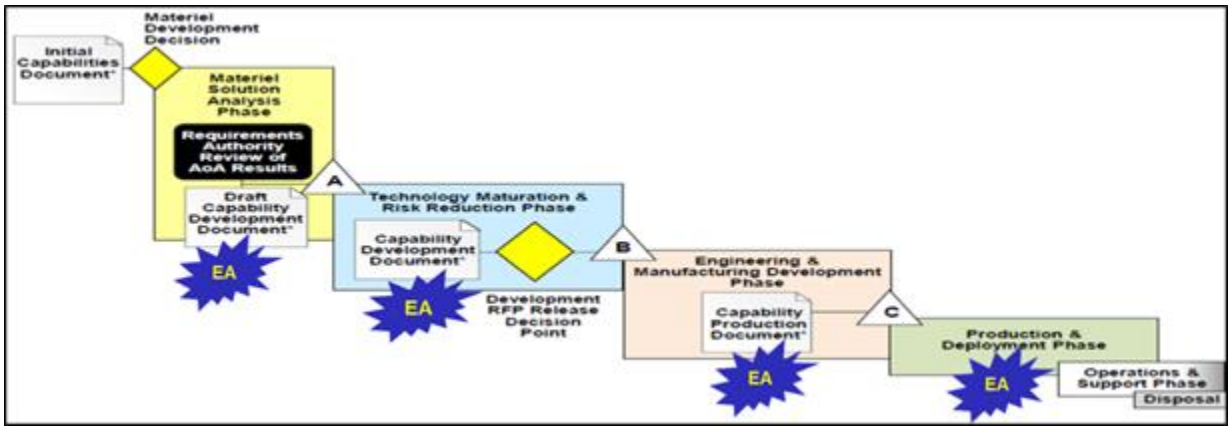
A13.3. Timing of The Requirement For An Economic Analysis Or Life Cycle Cost Estimate.

A13.3.1. For Defense Business Systems, the Economic Analysis is required for the Acquisition Authority To Proceed decision point (or equivalent). **Figure A13.2** shows the timing of the Defense Business System Economic Analysis in the context of the Defense Business System Acquisition Cycle described in DoDI 5000.75.

Figure A13.2. Timing of Economic Analysis Requirement For Defense Business Systems.

A13.3.2. For non-Defense Business Systems Automated Information Systems requiring an Economic Analysis, the Economic Analysis is required for Milestone A, B, C and Full Rate Production/Full Deployment decisions (or equivalent). For Milestone A, an Analysis of Alternatives can satisfy the requirement for the initial Economic Analysis as long as the Analysis of Alternatives includes a rigorous consideration of costs and benefits associated with alternative means of accomplishing the objective and a return on investment. **Figure A13.3** illustrates the timing of the non-Defense Business Systems Economic Analysis in the context of the Acquisition Cycle described in DoDI 5000.02.

Figure A13.3. Timing of Economic Analysis Requirement For Non-Defense Business Systems.



A13.3.3. An Economic Analysis with an appropriate Return on Investment calculation from a previous milestone decision may be sufficient for subsequent milestones if the Life Cycle Cost Estimate has not changed by more than 15%, and the results of the Economic Analysis would not be overturned by a change in cost or benefits.

A13.4. Coordination Process.

A13.4.1. If an Economic Analysis is required for Clinger-Cohen Act compliance, the Economic Analysis will be developed by the Program Office and submitted to the appropriate Cost Chief for concurrence and further reviews as required in **paragraph A13.4.1.1** and **paragraph A13.4.1.2** (**T-2).** The coordination process is also summarized in **Figure A13.4**

A13.4.1.1. For Defense Business Systems that are Category I, non-Defense Business Systems that are ACAT I, and for select programs, as identified by the Secretary of Air Force and/or Milestone Decision Authority, the Economic Analysis and associated documentation (including coordination by the appropriate Cost Chief's office) will be submitted to Secretary of the Air Force/Financial Management Cost for review. **(T-1).**

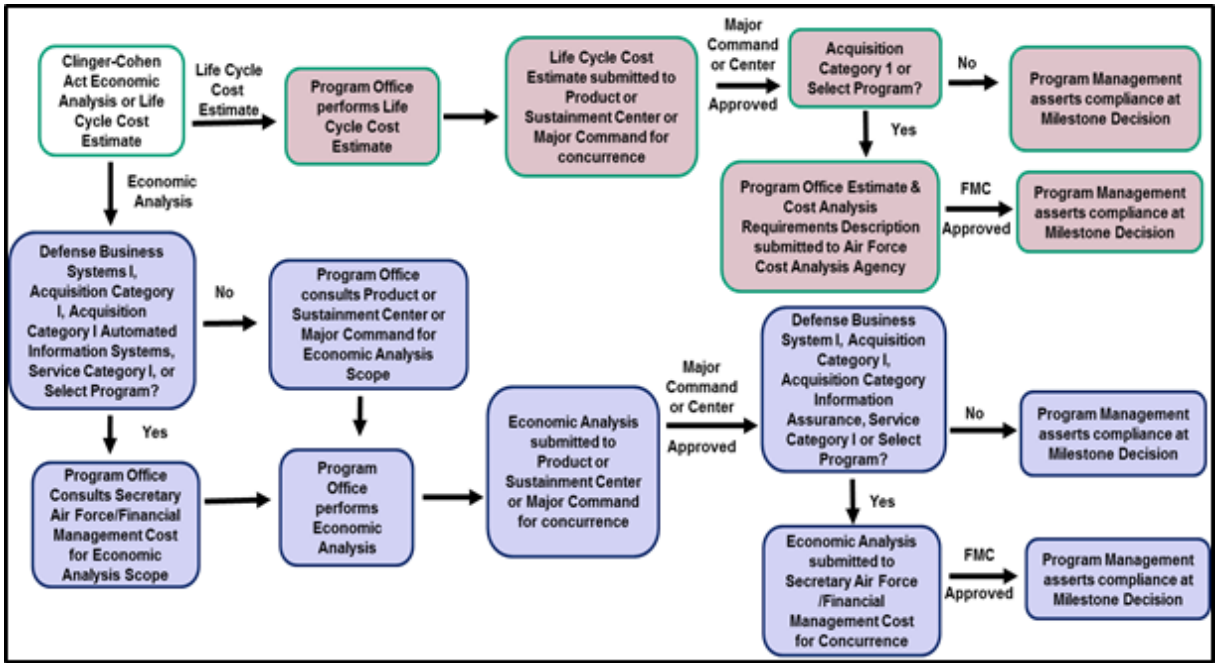
A13.4.1.1.1. Programs on the Acquisition Master List or other Acquisition designation will be approved by the appropriate Center Cost Chief prior to being submitted to Secretary of the Air Force/Financial Management Cost. **(T-1).**

A13.4.1.1.2. Projects not on the Acquisition Master List or other Acquisition designation will be approved by the appropriate MAJCOM Cost Chief prior to being submitted to SAF/FMC. **(T-2).** For Non-Acquisition designated Clinger-Cohen Projects with an investment (non-recurring) cost of under five million dollars the MAJCOM Commander may delegate review/approval to the Wing-level Commander who may further delegate approval to the Wing-level Comptroller for where the project originated.

A13.4.1.1.3. The reviewing offices within the Secretary of the Air Force/Financial Management Cost are SAF/FMC and AFCAA/FMCI. Once approved, Secretary of the Air Force/Financial Management Cost & Economics will distribute approval coordination to the appropriate MAJCOM Cost Office or Center Cost Office. Secretary of the Air Force/Financial Management Cost & Economics coordination will serve as evidence of Clinger-Cohen Act compliance of the return on investment requirement for category I Defense Business Systems, non-Defense Business Systems that are ACAT I, and select programs.

A13.4.1.2. For non-select Defense Business Systems that are category II and III, the highest level of concurrence required is the Product Center Cost Chief, Sustainment Center Cost Chief, or MAJCOM Cost Chief. **(T-2).** Similarly, for ACAT II and III systems that are non-select and non-Defense Business Systems, the highest level of concurrence required is the Product Center Cost Chief, Sustainment Center Cost Chief or MAJCOM Cost Chief. **(T-2).** These cost offices' coordination will serve as evidence of Clinger-Cohen Act compliance for category II and III non-select programs.

Figure A13.4. Clinger-Cohen Act Element 6 Process Flow And Coordination Requirements.



A13.5. Alternatives.

A13.5.1. When developing an Economic Analysis, the analyst should consider all reasonable alternatives for meeting the objective of the project. In some cases, Congressional legislation may exclude the status quo (current state) as an alternative. If so, the analyst should list the status quo and explain why it is not a feasible alternative for further consideration. It is only in this situation that an economic analysis with only one costed course of action is acceptable. If the status quo is not excluded, then the Clinger-Cohen Act Economic Analysis will include at least two possible alternatives (one alternative in addition to the status quo). **(T-2).** The second alternative will be the planned system investment. **(T-2).**

A13.5.1.1. Alternative 1 (Current State) – The course of action if the investment under consideration is not made. Essentially, it is the current or "as-is" process prior to investment.

A13.5.1.1.1. Software maintenance to keep software up-to-date should be included in the Status Quo recurring cost.

A13.5.1.1.2. Software maintenance as defined by Defense Federal Acquisition Regulation System Subpart 208.7401 is defined as the right to receive and use upgraded versions of software, updates and revisions.

A13.5.1.2. Alternative 2 (Investment) – The course of action if the investment under consideration is made.

A13.5.1.3. It is important to note that the requirements/technology maturation process may reveal multiple reasonable material solutions that would satisfy the objective. With more than one reasonable material solution, there may be more than two alternatives in the economic analysis.

A13.6. The Return On Investment Calculation

A13.6.1. A Return on Investment, as commonly defined, is intended to measure financial gain (after investment cost) as a percent of the investment cost. For the Air Force, this financial gain commonly translates into budget savings. Using this definition, the Return on Investment calculation requires estimating a status quo alternative from which the budget savings can be calculated.

Table A13.1. Return On Investment Calculation.

$$Return\ On\ Investment = \frac{Savings\ from\ Investment - Investment}{Investment}$$

Figure A13.5. Return on Investment.

Example: A software program is updated to achieve manpower efficiencies and eliminate manual data inputs. The investment cost is estimated at $10 million. The program office estimates direct budgetary manpower savings of $12 million and a further $8 million in manpower cost avoidance*. The return on investment calculation for the program would be:

$$Return\ on\ Investment = \frac{Savings - Investment}{Investment} = \frac{\$12{,}000{,}000 - \$10{,}000{,}000}{\$10{,}000{,}000} = 20\%$$

* **Note:** The Cost avoidance is not used in the calculation.

A13.6.2. For programs where the status quo has been excluded as a feasible alternative, the analyst may substitute "criteria related to a Return on Investment" instead of the formal Return on Investment calculation described above. The analyst should include the costs of the investment alternative(s) as the investment and a description of the (non-monetary) benefits from the investment alternatives as the return.

A13.6.3. Many programs are undertaken to correct a deficiency unrelated to budget savings. As a result, the Return on Investment may not be a meaningful measure of which alternative best meets the needs of the Air Force. In such a case, while the analyst is still required to include the Return on Investment by law, the benefit analysis should carry a greater significance than the Return on Investment in the Economic Analysis.

Figure A13.6. Return on Investment Alternative.

Example: A program is legislatively directed to make an investment. The investment cost is estimated at $10 million. Since the status quo of continuing without the investment is not a feasible alternative, the return on investment for the program will not be a calculation. Instead, the program will list the cost and provide a narrative description of the anticipated benefits that will result from the investment.

A13.7. Additional Considerations.

A13.7.1. If cost risk is included in the estimate for the "investment" alternative, cost risk should also be assessed for the status quo alternative.

A13.7.2. Both alternatives should be evaluated at similar confidence levels.

Attachment 14

OTHER SPECIALIZED ANALYSES

A14.1. Lease-Purchase Decisions

A14.1.1. OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, distinguishes two types of decisions regarding lease-purchase:

A14.1.1.1. The decision to acquire the services of an asset. This involves cost-benefit analysis to show that acquiring the asset is the best economic alternative.

A14.1.1.2. Once the decision to acquire the services of an asset is made, the related decision to lease or purchase the asset. In this lease-purchase type of analysis, benefits are often essentially the same. In many Air Force analyses, mission need has already determined the requirement. In this situation, only a lease-purchase analysis would be required (i.e., an economic analysis with two alternatives, lease and purchase).

A14.1.2. When estimating for major facilities, the Air Force normally does not have authority to solicit bids both for a lease or service contract alternative and for a purchase alternative. Under these circumstances, one estimation method is:

A14.1.2.1. Estimate a life-cycle flow of funds for the purchase alternative.

A14.1.2.2. Compare the present value (i.e., discounted dollars) of contractor bids for the lease or service contract with the present value of the purchase alternative. IMPORTANT: Work with contracting offices to develop such bids since it must be made clear that the government's request for information may not lead to an offer.

A14.1.3. All economic analyses involving lease-purchase analysis follow special guidance outlined below.

A14.1.3.1. Leases are often "level term." Their cost is set per month or year over a number of months or years. The lease terms are stated in nominal (i.e., inflated) dollars. For this reason, economic analyses involving lease-purchase analysis are often accomplished in nominal dollars. Discount these nominal dollars using the nominal discount rate provided in OMB Circular A-94, Appendix C, for the term of the lease. The rates are updated annually when the President presents the Budget, and can be found on the SAF/FMC SharePoint® page, to which a link is provided on the SAF/FMCE page of the Air Force Portal, or on the OMB website.

A14.1.3.2. If lease costs are stated in constant dollars, use constant dollars in the comparative analysis and discount at the real rate.

A14.1.3.3. When the term of a lease or service contract differs from the economic life of the asset under the purchase option, estimate asset value at the end of the lease term and include it in the purchase alternative as a benefit (negative cost) in the final period of the analysis.

A14.1.3.4. Add to the cost estimate for the lease the cost to the Treasury of any special tax benefits available to the lessor associated with a lease.

A14.1.3.4.1. For example, 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.

A14.1.3.4.2. Consider current tax laws applicable to a lessor to determine whether or not an adjustment is appropriate in a particular comparative analysis. Because tax laws change, consult with legal and contracting staff.

A14.1.3.4.3. 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 (i.e., straight-line depreciation).

A14.2. Energy Projects.

A14.2.1. Since energy price changes in energy sectors are apt to differ from price changes in other sectors, use Department of Energy (DoE) indices, published annually (NISTIR 85-3273-xx).

A14.2.2. Use the following guidelines for Energy Resilience and Conservation Investment Program (ECIP) comparative analyses of retrofits to existing energy systems:

A14.2.2.1. Base all analyses on an economic life of 25 years or the life of the retrofit or of the facility, whichever is less.

A14.2.2.2. Use the Department of Energy published escalation rates for energy.

A14.2.2.3. Energy Resilience and Conservation Investment Program projects will use the published discount rates in the annual supplement to National Institute of Science and Technology (NIST) handbook 135, NISTIR 85-3273-xx, *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis* (check with the civil engineering office). **(T-2).**

A14.2.3. Analyze lease-purchase decisions and private sector financed leases or service contracts involving energy projects using the following guidance:

A14.2.3.1. Use the Energy Resilience and Conservation Investment Program approved discount rate for lease-purchase comparative analyses.

A14.2.3.2. Escalate the government MILCON Program alternative estimate using DoE rates for comparison with private sector financed (e.g., lease, service contract) alternatives. Take the lessor or contractor bid at face value (i.e., not escalated, since this constitutes the actual commercial bid).

A14.2.3.3. Energy Resilience and Conservation Investment Program projects should in most cases have a Simple Payback of 10 years or less with a minimum Savings Investment Ratio (SIR) of 1.25 to meet Department of Defense criteria. (Estimated Simple Payback time is the number of years required for the cumulative value of energy cost savings less future non-fuel costs to equal the investment costs of the building system without consideration of future price changes or discount rates. For example, invest $100,000 at an annual savings of $20,000. Simple Payback is investment divided by savings, so the Simple Payback would be 5 years. Simple Payback does not take into account the time value of money.)

A14.2.4. Analyze energy plant conversion projects using the following guidelines:

A14.2.4.1. Discount projects using a renewable energy source at the rate for Energy Resilience and Conservation Investment Programs.

A14.2.4.2. Discount projects using fossil (nonrenewable) fuel at the rate published by the OMB.

A14.2.4.3. Use DoE energy indexes.

A14.2.5. Additional analytical tools can be found at the Federal Energy Management Program's website: (**https://www.energy.gov/eere/femp/femp-solution-center-tool-box**) **Note:** Comparative analyses which are not specifically energy projects are not required to use Department of Energy indexes.

A14.3. Warranty Cost-Benefit Analysis.

A14.3.1. Follow this guidance when performing a cost-benefit analysis (CBA) to determine whether using a warranty is beneficial to the government. (**T-1**). 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.

A14.3.2. Plan sufficient lead time to complete the detailed work required in a warranty CBA. Start early if it will support contract negotiations. Interim CBA findings are very valuable in establishing government negotiating positions; the CBA identifies expected major cost drivers and potential failure nodes.

A14.3.2.1. The analyst 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.

A14.3.2.2. The 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 (Program Office (PO) director, project manager, etc.) should ensure the CBA is initiated as soon as system technical design is well enough established to allow LCC estimation.

A14.3.2.3. OCRs are significant stakeholders and any other organizations with information necessary to develop the life-cycle cost model. OCRs usually include civil engineering and logistics staffs.

A14.3.3. A computer model is available to do the CBA. Contact HQ Air Force Material Command Financial Management (AFMC/FM) for information. Consider information in the Warranty Activity Report, if available, when doing the CBA.

A14.3.4. Estimate LCC for the system or component without warranty coverage. Then estimate LCC under full or partial warranty coverage.

A14.3.4.1. 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.

A14.3.4.2. Estimate the expected costs over time for each failure node, based on expected failures and anticipated cost per failure.

A14.3.4.2.1. 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).

A14.3.4.2.2. Estimate the mean time between failures (mean operating cycles between failures, etc.) and variables which are related to failure.

A14.3.4.2.3. Build estimates of the cost of a failure at each node from historical data or projections, as applicable.

A14.3.4.2.4. Sum up monetary LCCs as the total of the costs of each failure node.

A14.3.5. 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.

A14.3.5.1. Estimate the costs and benefits of each warranty clause or provision.

A14.3.5.1.1. Consider benefits to the government of warranty implementation plans and procedures.

A14.3.5.1.2. Consider administrative costs of the warranty and potential claims that the warranty is likely to cover. When possible, identify administrative costs with specific warranty provisions, to increase the precision of the warranty assessment.

A14.3.5.2. 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.

A14.4. Military Construction Design

A14.4.1. **Purpose.** This guidance establishes criteria and standards for performing comparative analyses and life cycle cost studies used in support of design decisions for MILCON program projects, i.e., to support the selection from various alternatives of components/systems being considered as elements in facilities design. These criteria and standards apply to all design decisions regardless of when they are made in the planning, programming, design or procurement process. This guidance does not apply to economic analyses and life cycle studies used to make project justification decisions during the planning and programming process.

A14.4.2. **General.** Comparative analyses shall be conducted as part of the design process to ensure the selection/rejection of design alternatives is not based solely on construction costs, but also on the lowest life cycle costs (LCC), that is, lowest total cost of ownership. **(T-2).** The depth and degree of formality of these analyses shall be determined on a case- by-case basis to ensure that the potential benefit from information accruing from the analysis is commensurate with the effort for the analysis. Results of generic studies or results of previous analyses of alternatives similar to those currently under consideration may be used in lieu of performing a new study provided the previous study was based on similar design conditions, criteria, and methods. Previous studies should be updated as required to reflect changes of conditions significant enough to impact the design decision. All comparative analyses and other justification for the selection of a design alternative, whether a previous study or a new one, shall be clearly documented in the appropriate section of the project design analysis. **(T-2).**

A14.4.3. **Methods.** All analyses shall consider the total LCC for design alternatives, where the LCC includes all costs and revenue associated with an alternative over its expected life, including but not limited to construction/acquisition, energy, maintenance, operation, repair, replacement, alteration, disposal costs, and retention values. **(T-2).** The present value discounting approach shall be used to adjust for the differences in timing of cost and benefits unless otherwise specified by other directives or by public law. **(T-2).** Discounting should be applied to all cost and benefits over the appropriate analysis period. Specific criteria are as follows:

A14.4.3.1. **Energy Related Studies.** All energy related economic studies (in which energy costs are relevant, regardless of their magnitude relative to other costs) shall use the current discount rate published by the National Institute of Standards and Technology (NIST) in their annual supplement to NIST Handbook 135, and disseminated by the appropriate Service Headquarters Office. **(T-2).**

A14.4.3.2. **Non-energy Related Studies.** All economic studies other than energy related economic studies shall use the current discount rates published annually by the OMB as Appendix C to OMB Circular A-94, and disseminated by the SAF/FMC. **(T-2).**

A14.4.3.3. **Analysis Period.** When using Terminal Value, the analysis period shall be the life expectancy of the alternative with the shortest life. **(T-2).** When using Uniform Annual Cost, the period of analysis will match the life expectancy of the facility in each alternative. **(T-2). Note:** An adequate cost analysis of a utility system should be over a term greater than 25 years. Generally, design lives of Electrical, Natural Gas, Water, and Wastewater systems are a minimum of 50 years. LCCs over a shorter term tend to be very inaccurate

A14.4.3.4. **Cash Flow.** In general, cash flow used in the analysis will be based on the estimated calendar dates on which the events and cost/benefits are projected/scheduled to occur. Construction/acquisition costs may be assumed to be incurred as a single lump sum, preferably at the time corresponding to the midpoint of the construction/acquisition process. Other cash flows that occur periodically throughout the year (e.g., cost of fuel, electricity, water, maintenance) may be assumed to be incurred as a single lump sum, preferably at midyear. In circumstances where the above assumptions add unnecessarily to the complexity of the calculations, all cash flows may be assumed to occur at the end of the year in which they are actually scheduled/projected to occur.

A14.4.3.5. **Costs.** As a minimum, costs will be reported in present value terms. **(T-2).** Otherwise, costs must be clearly labeled as to the year and type of dollar. In projecting future costs, an allowance for future price-level changes, (i.e., escalation), will be made for costs expected to change at rates higher or lower than the general rate of inflation. For energy studies, fuel/energy costs shall use escalation rates as published by NIST in Handbook 135. **(T-2).**

A14.5. Program Evaluation:

A14.5.1. A Program Evaluation is an economic analysis of on-going operations to ensure established goals and objectives are being attained in the most cost-effective manner. A program evaluation compares actual performance with stated program objectives. A program evaluation must be performed when directed by the program's leadership or higher authority, or when prescribed by functional directives. **(T-2).**

A14.5.2. Responsibilities Assigned. The official who implements a program, or a higher authority, directs that a program evaluation be completed at a specific future date. The functional manager, with the assistance of the financial management staff, then establishes a plan to collect and maintain the cost and benefit data necessary for the evaluation.

A14.5.3. General Program Evaluation Procedures when preparing a program evaluation comparative analysis:

A14.5.3.1. Set reference points (baselines, milestones, and goals) for the analysis as soon as possible.

A14.5.3.2. Determine if an analysis supporting previous decisions is available. Previous comparative analyses may help start the process of analyzing the program or operation's goals, assumptions, alternatives, costs and benefits, outputs, or effectiveness. However, avoid excessive reliance on a previous analysis when the situation or contributing variables have changed.

A14.5.3.3. Identify performance measures from the program or operation. It may be helpful to compare performance measures with related on-going programs.

A14.5.3.4. Performance measures are inherently quantitative. If adequate data does not exist for measuring performance, work with experts to determine adequate measures and begin accumulating such data. The data must be auditable and reflect significant organizational missions and functions, satisfaction of customer needs, timely accomplishment of processes, relevant environmental impacts, or resources consumed or required.

A14.5.3.5. Identify and discuss important qualitative benefits (e.g., improvements in process quality, mission fulfillment, health, safety, morale, security factors).

A14.5.3.6. Whenever trends are significantly different from previous estimates, examine specific reasons for the variance.

A14.5.4. Methodology. The following step-by-step procedure can be used to facilitate output measurement.

A14.5.4.1. Step I - Identify All Relevant Outputs. Government programs/projects have at least one and often two or more objectives. These objectives may be prescribed by law, established by policy or may be based on historical practice. There should be a causative relationship between activities, as measured by the output indicator and the resources consumed (costs). A restatement of resources consumed is not a good way to measure output. For example, a statement of the man-hours required to do a job is simply another way of accounting for resources consumed and tells little about what is accomplished. The difference between costs of competing alternatives, i.e., differential costs or costs savings, is not an "output" for purposes of program evaluation.

A14.5.4.2. Step II - Establish Data Sources. Avoid generating unnecessary work by determining if adequate information is already available in some form. Consider sources such as: established reports, opinions and judgments of experts, observations and tabulations of steps in work process, outside organizations and information centers.

A14.5.4.3. Step III - Collect, Summarize, Evaluate, Validate and Display or Present Output Data. Select a technique for summarizing the data in a tabular, graphic or other format as appropriate. The analyst has discretion in deciding the method employed and techniques.

A14.5.4.4. Step IV - Compare Output Data with Resources Consumed. In the analysis, identify the output and costs associated with a particular alternative or activity. If practicable, construct graphic relationships of output to cost to observe trends developing or to detect evidence of possible substandard performance. When output data are not quantitative, the analysis is more difficult. In such cases, identify project outputs in precise terms and compare the outputs to the required resources so that the decision-maker can determine the most reasonable course of action.

A14.6. Product Support Business Case Analysis:

A14.6.1. A Business Case Analysis is a statutory requirement for all major weapon systems based on Title 10, United States Code (USC) Section 2337. DoDI 5000.02, *Operation of the Defense Acquisition System* states the Business Case Analysis will be included as an annex to the Life Cycle Sustainment Plan. **(T-0).**

A14.6.2. Product Support Business Case Analyses must comply with the guidance in this manual. See Air Force Pamphlet 63-123, Product Support Business Case Analysis, for additional guidance on preparing a Product Support Business Case Analysis.

A14.6.3. The Product Support Business Case Analyses for Acquisition Category 1, Defense Business Systems Category I and select programs are approved at the SAF/FMC Level. Category II and III are approved at the MAJCOM or Center Level.

A14.7. Foreign Currency Conversion:

A14.7.1. This section provides additional guidance on and examples of foreign currency conversions. The guidance in this Attachment addresses, in turn, constant and nominal dollar analysis. The guidance assumes the analyst has collected some costs expressed in foreign currency.

A14.7.2. Constant Dollar Analysis. Obtain a forecast of the exchange rate for the FY which will be 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. **Note**: Exchange rates are ordinarily cited on the basis of national currency unit per US dollar (e.g., Yen per dollar). An exception is often the British Pound Sterling, which frequently is cited as dollars per pound. Check the source for the basis of the rate.

A14.7.3. 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 nominal 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 nominal dollars.