NASA Business Case Guide For Facilities Projects

April 20, 2006

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Guide Summary

The Facilities Engineering and Real Property Division (FERPD) of the National Aeronautics and Space Administration (NASA) Headquarters has developed this Business Case Guide to support FERPD's role as an advocate for facilities and real property within NASA. Business cases and the associated analyses for proposed facilities and real property projects are needed to ensure that NASA develops the right set of facilities and infrastructure to support its diverse missions and the vision for space exploration. The requirement of a business case supports NASA's Real Property Asset Management Plan and the associated Real Property Management Goals. The business cases specifically support Real Property Management Goals to ensure that NASA constructs and operates real property to meet mission requirements.

Under the vision for space exploration NASA will need to review its current real property holdings, and be able to support budget requirements for maintenance of the existing infrastructure, or for the development of new infrastructure. Additionally, the infrastructure and facilities required to support the vision for space exploration may be at a NASA Center, or in another federal agency, or within the private sector. This Business Case Guide, therefore, provides the framework for developing a strong business case for any of these potential scenarios.

This document supports the preparation of business cases for proposed projects involving land, structures, single facilities, or a complex of facilities and structures. The Guide includes a bibliography of business case tools including websites, both federal and private sector, literature, and current training opportunities.

What is a "Business Case Analysis?"

A business case analysis is a tool for planning and decision-making. It is an analysis that links estimates of costs and benefits with stated requirements and expectations for projected outcomes. The overriding purpose of a business case is to make transparent to the various decision-making and operating groups the objectives to be met by a facilities investment, the underlying assumptions and alternatives, and the attendant costs and potential consequences of alternative actions.

A business case should provide an in-depth description of the project (including requirements, risks, mitigation and benefits) as well as the financial justification for the investment decision. To effectively provide this justification it is critical that the process, scope, assumptions and any biases of the business case developers be clearly understood and communicated.

This Guide describes a standard process for identifying and analyzing alternative solutions to meet the goals identified of the proposed project. A business case analysis should be accurate, clear, and unbiased.

- ***Accurate*** – An effective business case should reflect the best estimates of costs and future benefits for each analyzed alternative. All meaningful costs and all meaningful benefits should be included and validated against the best available data sources.

Uncertainty and variances in estimated values should be consistently captured and reported. Intangible factors should be presented and analyzed consistently.

- ***Clarity*** – Business cases should be easily understood by all project stakeholders. The project approach, the analysis of alternatives and the recommended decisions should all be clearly presented.
- ***Unbiased*** – All meaningful alternatives should be presented and analyzed in a consistent manner. Where there are political considerations or where there exists a greater intrinsic benefit with a specific approach, then these biases should be made clear.

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Acronyms

BCR	Benefit-to-Cost Ratio
BRAC	Base Realignment and Closure
DPB	Discounted Payback
COBRA	Cost of Base Realignment Actions
EA	Economic Analysis
EIFS	Economic Impact Forecast System
EPA	Environmental Protection Agency
FERPD	Facilities Engineering and Real Property Division
GAO	General Accounting Office
IRR	Internal Rate of Return
IT	Internet Technology
LCCA	Life-Cycle Cost Analysis
LEED	Leadership in Energy and Environmental Design
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Protection Act
NPR	NASA Policy Requirement
NPD	NASA Policy Directive
NB	Net Benefits
NPV	Net Present Value
NS	Net Savings
OMB	Office of Management and Budget
ORR	Overall Rate of Return
SIR	Savings-to-Investment Ratio
SPB	Simple Payback
VE	Value Engineering

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I. Introduction

A. Project Advocacy

The Facilities Engineering and Real Property Division (FERPD) is an advocate for facilities and real property throughout the agency. In order to accomplish this responsibility, FERPD and facility organizations at the NASA Centers need to prepare strong business cases for proposed actions.

The business cases also support the broader goals of the NASA Real Property Asset Management Plan. This guide and the business cases developed for specific real property projects support our ability to ensure that NASA has the right set of facilities to meet mission requirements. This guide and the business cases specifically support:

- Real Property Management Goal 3: NASA will construct and operate new real property to meet mission requirements only when existing capabilities cannot be effectively used or modified.
- Real Property Goal 5: NASA will sustain, revitalize, and modernize its real property required by the NASA Mission.

These business cases are needed to ensure that NASA develops the right set of facilities and infrastructure that support its diverse missions and the vision for exploration. Under the vision for exploration, NASA will need to review its current portfolio and develop business cases for maintenance of existing infrastructure or development of new infrastructure, whether in the private sector or within the federal sector, including NASA.

In this regard it is significant that the NASA Policy Requirement (NPR) 7120.5C, *NASA Program and Project Management Processes and Requirements*, in Section 3.2.1.2.f.3, specifies:

> "A business case justification shall be performed for any proposed acquisition or major modification of infrastructure (*e.g.*, facilities, internet technology (IT))."
>
> a. The business case shall include:
>
> i. full life cycle cost (including operations, sustainment, and disposal),
> ii. benefit estimates,
> iii. alternatives and sensitivity analyses, and
> iv. risk assessments."

This *Business Case Guide for Facilities Projects* explains the business case development process. It also describes existing literature and current real estate business cases for the acquisition of land, structures, single facilities, or a complex of facilities and structures.

A bibliography of business case tools, including websites, as well as current and existing training opportunities, is also contained within the guide. Finally, a series of appendices is provided that contain examples of business cases.

Additionally, it is strongly recommended that persons developing a business case review the discussions on cost estimating in the *NASA Cost Estimating Handbook*. The NASA Cost Estimating Handbook is a top-level overview of cost estimating as a discipline and is a useful reference document, providing many pointers to other sources. This document may be accessed at:

http://www1.jsc.nasa.gov/bu2/NCEH/NASA%20CEH%20Final%20Production%20Copy%20April%202002.pdf

B. OMB Requirements

The Office of Management and Budget (OMB) Circular A-94 (http://www.whitehouse.gov/omb/circulars/a094/a094.html) provides general guidance for conducting benefit-cost and cost-effectiveness analyses, which is a component of every federal business case analysis. The Circular also provides specific guidance on the discount rates to be used in evaluating federal programs whose benefits and costs are distributed over time. The general guidance will serve as a checklist of whether an agency has considered and properly dealt with all the elements for sound benefit-cost and cost-effectiveness analyses. The goal of the Circular is to promote efficient resource allocation through well-informed decision-making by the federal government.

The Circular sets general guidelines for an economic analysis. It suggests that alternative means should be considered and assumptions should be discussed and taken into account. Both tangible and intangible costs should be considered. Incremental costs and benefits should be analyzed and sunk costs (that occurred in the past, such as design costs) be ignored. When inflation is considered, the gross domestic product deflator from the administration's economic assumptions for the period of analysis is recommended. The circular discusses use of real versus nominal discount rates and requires use of the nominal rate when leasing is an alternative. When leasing is an option, imputed costs for land, taxes and insurance are required. It also suggests use of sensitivity analysis or a similar technique to determine: the effect of uncertainties on the economic analysis; and analysis of the impact of changes in the discount rate used in the economic analysis.

II. The Business Case

A. Business Case Description

A business case is the primary document supporting an expenditure of capital funds or other resources. The business case is a planning and decision-making support document that is needed to justify the acquisition of - or improvement to - a capital asset; to analyze a project's life cycle cost, and to mitigate risk.

A business case supports investment decisions involving what to buy, how much to spend, what returns to expect, and when to implement. It presents the expected cash flow consequences of competing alternatives, over time, and includes the assumptions for quantifying benefits and costs. A business case enables decision-makers to base investment decisions on facts while discovering the potential risks and rewards of the specific project. The true value of the business case is not as a document to protect against audits; but rather, its importance resides in its ability to clarify the thinking of decision-makers as they evaluate the merits of alternative investments for the organization.

A Business Case is designed to answer questions such as:

- What are the likely financial and other business consequences if the organization takes a particular action?
- Which alternative for action represents the best business decision?
- Will the returns justify the investment?
- What will this action do for overall organizational performance?
- Why are we doing this project?
- What is the project about?
- How much will it cost?
- How long will it take?
- What are the risks of doing the project?
- What are the risks of not doing the project?
- How will we measure success?
- What alternatives (including existing infrastructure) do we have?

A business case should examine both the financial implications of a particular alternative, such as life-cycle costs and other quantifiable objectives, as well as other intangible objectives that are difficult to place a dollar value on. These less quantifiable objectives, including improved employee morale or improved corporate image, should be identified up front in the performance of the business case analysis.

When the analysis concerns obtaining a building or other structure, the analysis should include acquisition alternatives such as choosing sustainable design over lowest cost, use of existing NASA infrastructure, or purchasing or leasing an existing facility versus designing and constructing a new facility. In addition; life-cycle alternatives and disposal alternatives should be addressed. All of this will allow decision makers to better understand the potential

consequences of facilities investment decisions and to make informed choices in regard to owning, leasing, reinvesting in, or constructing facilities.

B. Business Case Objectives

The primary objective of writing a business case is to get project approval and funding. The following should also be kept in mind to increase the chance of success:

- Make it interesting; remember that someone will have to read it.
- Keep it clear and concise.
- Minimize jargon and conjecture.
- Communicate all facts as part of the overall story.
- Provide the reader with a picture or vision of the end state.
- Demonstrate the value the project brings to the Agency and specific customers.

C. Business Case Benefits

The benefits obtained by writing the business case analysis include:

- Organization of thoughts, activities and knowledge
- An objective review of the project
- The ability to identify holes, inconsistencies or weaknesses in the effort
- An improved ability to communicate the purpose of the project
- Financial justification for the project.

D. Business Case Outline

The outline for a complete business case analysis includes the following key elements:

I. Executive Summary

II. Project Summary

II.A *Project Definition/Problem Statement*

II.B *Assumptions*

II.C *Alternative*

II.D *Data Plan*

II.E *Data Collection*

III Life Cycle Cost Analysis[1]

III.A *Alternatives*

III.B *Cost Analysis/Cost Comparison*

III.C *Benefit Analysis*

III.D *Risk Analysis*

III.E *Sensitivity Analysis*

IV. Conclusions and Recommendations

V. Tables and Graphs

[1] This may be an analysis run from Life Cycle Cost software such as ECONPACK

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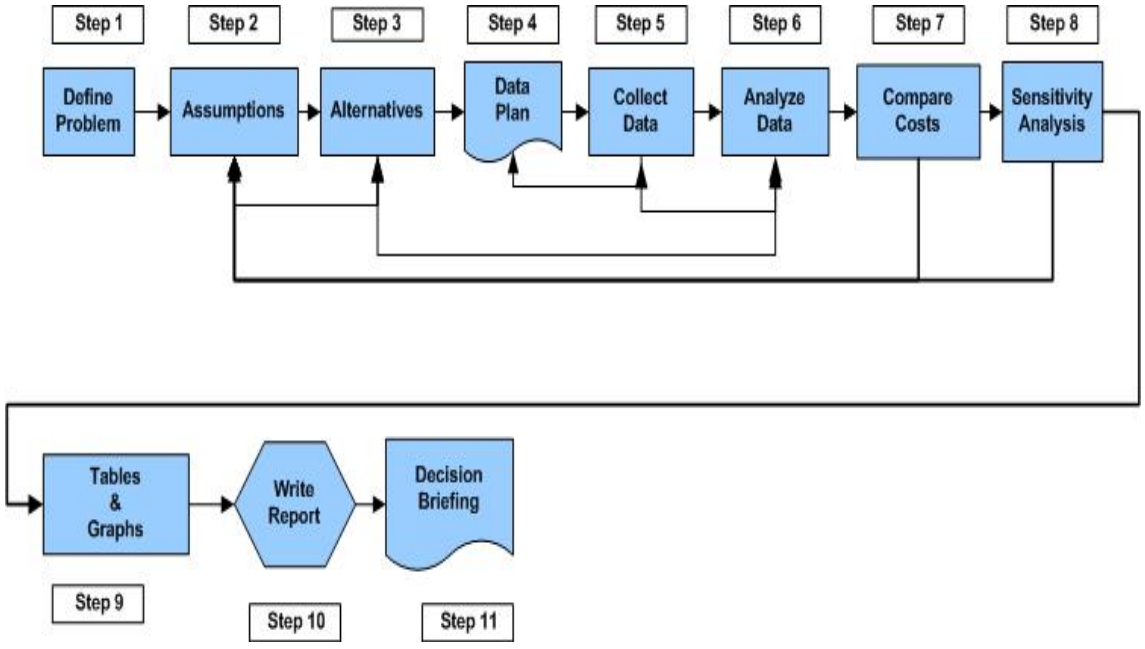
III. The Business Case Process

A. Business Case Development

Business case development is a process of analyzing the objectives, as defined in the given problem, to define quantifiable as well as qualitative benefits and to determine likely costs under alternative scenarios. The business case should provide convincing evidence that justifies an investment decision. To be convincing, the benefits and costs should be credible, unbiased, and presented in a format that follows financial, accounting, and statistical standards and norms. The business case analysis process consists of 11 steps (see diagram below).[2]

B. THE 11 Step Business Case Process

Figure III-1 Process Diagram for Business Case Analysis



Step 1: Define Problem

Defining the problem is the single most important step in the analysis. Without a succinct statement of what is to be investigated, it is not possible to proceed in a meaningful way. This step sets the tone and the level of objectivity for the whole analysis.

[2] *Investments in Federal Facilities: Asset Management Strategies for the 21st Century* Copyright © National Academy of Sciences. All rights reserved. http://www.nap.edu/catalog/11012.html.

Fortunately, the problem of defining the objective usually lends itself to a straight forward solution in the area of facilities procurement. Typical facilities planning objectives might be to:

- Provide 1,000 square meters of administrative space,
- Meet Environmental Protection Agency (EPA) pollution abatement requirements, and
- Provide parking.

The actual wording of the problem or objective is also very critical. It should reflect a totally unbiased point of view concerning methods of meeting the objective. Here is a quick example:

1. Provide office space for 200 persons.
2. Construct new 1,000 square meters office building.

The preferred method of stating the objective (between the two statements above) is the first because does not state the objective in the form of a solution (to construct a new facility). Unbiased statements of objective should always be used.

Step 2: Assumptions

There are a variety of assumptions and estimates that must to be made at the beginning of the process to facilitate comparisons, including discount rates, lease termination dates, moving costs, leasing fees, construction cost location factors, and inflation.

Important assumptions, constraints, and conditions having major influence on the analysis and its conclusions should be described. The following should be considered as a minimum: The discount/inflation rates to be used in the analysis, residual/salvage value calculation parameters, important data concerning the project scope, local conditions, regulations, ordinances, etc.

Frequently, you must formulate assumptions before reasonable alternatives can be generated. This may be a reiterative process while preparing the analysis. The sensitivity of the assumptions should be tested during the sensitivity analysis.

In addition to assumptions, potential constraints must be considered. Constraints are factors external to the relevant environment that limit alternatives to problem solutions. They may be:

- Physical, as with a fixed amount of space,
- Time-related, as with a fixed deadline,
- Financial, as with a fixed or limited amount of resources, or
- Institutional, as with organizational or agency policy/regulations.

Whatever their particular characteristics, these external constraints or barriers are beyond your control and provide boundary limitations for alternative solutions to a particular problem.

Caution should be exercised in deciding upon assumptions and constraints to the problem being analyzed. An alternative is feasible only when it satisfies all the restrictions. Use of unduly restrictive assumptions and constraints will bias an analysis, precluding investigation of feasible

alternatives. Conversely, failure to consider pertinent assumptions and constraints can cause the recommendation of a technically or institutionally infeasible alternative.

Step 3: Alternatives

Alternatives should be listed and briefly described. At a minimum, each of the following alternatives should be considered:

- Status Quo (do nothing)
- New acquisition or construction
- Leasing
- Modification of existing assets (*i.e.*, renovation, upgrade, revitalization, etc.)
- Use of other government facilities
- Renovation/new construction mix
- Use of other facilities on Center
- Obtaining needed facilities through privatization initiatives.

Creating an effective business case requires an understanding of the "as-is" or "business as usual" scenario, as well as of alternative prospective scenarios. This requires a team that has adequate knowledge of existing operational processes and metrics, an understanding of organizational goals, vision, and strategy, and an ability to incorporate and assess existing, proven solutions from other organizations and, if reasonable, to envision innovative solutions. For each potential solution to the problem, the team must be able to identify benefits and costs, and to analyze these financial metrics to create the business case.

Step 4: Data Plan

The data plan supports collection of the necessary data. It should briefly summarize the evaluation criteria and the relative weighting used in evaluating each alternative. Such items as payback periods, assumed lifecycle, cost and benefit ratio, risk/sensitivity analysis, and return on investment should be considered.

Step 5: Collect Data

Collecting the needed data will depend to some extent on the size and nature of the problem. Emphasis should be placed on gathering data that demonstrates the costs and benefits of the identified alternatives. The principal benefit is the completion of a stated objective. Since this is a benefit common to all the alternatives, its inclusion in the calculations will not affect the ranking of the alternatives. Consequently, quantification of the principal benefit is unnecessary. It is only the differences in costs between alternatives that are important to making sound economic based decisions.

Benefits are often difficult to measure. Despite this inherent difficulty, it is necessary to assess quantitatively the benefits associated with each alternative under consideration to the maximum extent possible. The quantifiable dollar benefits of each alternative are considered "cost offsets" for that alternative. Non-tangible benefits are more difficult to evaluate and quantify. "Increased

morale" or "increased safety" should be identified as non-tangible benefits and included in the analysis with a narrative description.

It is important to obtain the best available cost and benefit estimates. Because the validity of the analysis is dependent upon the credibility of the estimates, it is essential to document sources and derivations of cost and benefit data.

Step 6: Analyze Data

When comparing and ranking alternatives there are normally three criteria to distinguish between alternatives:[3]

- Least cost for a given level of effectiveness,
- Most effective for a given constraint, and
- Largest ratio of effectiveness to cost.

Several types of financial analyses can be used to determine these values to support alternative comparison and ranking alternatives; a) cost of building ownership, b) benefit/cost, and c) cost-effectiveness. At the same time, "exit strategies" should also be considered.

Cost of Building Ownership. The cost of ownership of a building has been defined as the total of all expenditures an owner will make over the course of the building's service lifetime.[4] The cost of ownership typically will include planning, design, and construction (first costs); maintenance, repairs, replacements, and alterations; normal operations such as heating, cooling, and lighting; and disposal. These costs are also referred to as life-cycle costs.

Benefit-to-Cost. A common method of selecting among alternative investments is to determine the ratio of a project's total benefits to its total costs—that is, the benefit/cost ratio. A benefit/cost ratio greater than 1.0 indicates that the benefits of the project outweigh the costs, while a ratio less than 1.0 means the opposite. Obviously, the higher the ratio for a particular alternative, the more attractive that project will be relative to other competing projects. Using benefit/cost analysis requires considerable care because the costs and benefits will be experienced at different times and their magnitudes may vary considerably. For example, in a building project, the relatively large first costs will be experienced early in the project's life and followed by smaller recurrent costs for maintenance, operations, repair, and replacement. Benefits generally will be small or nonexistent initially but may accrue to fairly large values late in the life of the project. Although the costs and benefits can be discounted to a single present value, doing so will require multiple assumptions about interest rates, timing, and the future

[3] Note that NASA facility project analysis utilizes ECONPACK. The software and methodology is described in detail in Appendix E to this Guide. The steps that follow from this point through Step 8 are part of the ECONPACK software capability. The analysis derived from ECONPACK may be included in the Business Case as the as the Life Cycle Cost Analysis, Section 3 of the Business Case Outline (see Section II.D).

[4] National Research Council (NRC). 1990. *Committing to the Cost of Ownership: Maintenance and Repair of Public Buildings*. Washington, D.C.: National Academy Press

values of these elements. Despite these cautions, benefit/cost analysis can be a powerful tool for evaluating alternatives.

Generally, there are four possible configurations into which alternatives may fall:

- Equal Costs/Equal Benefits: Because the cost and benefits cancel each other out, the recommendation would be determined by non-economic factors.
- Equal Costs/Unequal Benefits: The costs cancel each other out so the recommendation would be determined by the alternative that has the most benefits.
- Unequal Costs/Equal Benefits: The recommendation for this configuration would be based upon the alternative having the least costs.
- Unequal Costs/Unequal Benefits: When both the costs and benefits of alternatives are unequal both sides of the benefit/cost equation must be considered. The basis for recommendation for this configuration would be based upon the highest benefit to cost ratio.

Cost Effectiveness. When only the cost side of a project can be quantified, an alternative means of analysis and comparison is required. Since benefit/cost analysis is predicated on the ability to express *benefits* in monetary terms (either as a cash inflow or a cost avoided), this method allows analysis when only the cost side of a project can be quantified. Cost-effectiveness analysis was originally developed as a means of evaluating environmental projects where, for example, the benefits of enhanced air or water quality or the value of wetlands were difficult or impossible to quantify accurately in monetary terms. In these cases, performance objectives were established for the action, and the project that met all desired objectives at the lowest cost was considered the most cost-effective. Despite mixed success with efforts to monetize environmental benefits, cost-effectiveness analysis is a useful business case tool when only the costs of a project are well defined.

Exit strategies. Methods for disengaging from an investment need to be analyzed as part of the business case analysis. One exit strategy is to lease the required space in the first place. If requirements change, an organization can move out of leased space relatively quickly without the burden of selling or otherwise disposing of the property. For space that is to be acquired through purchase or construction, one exit strategy is to build flexible (generic) space that can be relatively easily adapted to other uses to meet changing requirements. For some specialized facilities, such as those for power generation, and some types of research, the only exit strategy may be demolition, cleanup, and disposal. The use of biodegradable or other environmentally friendly materials for a facility or special waste disposal methods may result in lower disposal costs. (See also Appendix D – Analysis of Exit Strategies, for further discussion on this topic.)

Step 7: Compare Costs

At the heart of the business case is comparison of the alternatives. Once the costs for each alternative have been developed, the least-cost alternative may appear to be the most attractive. However, the least-cost alternative might not be the most cost-effective alternative, and therefore not the best or recommended alternative. Alternatives should be compared to one another, as well as to the status quo, not just on the basis of cost, but on the basis of benefit to the agency. In

that manner, a recommendation can be formulated that addresses the costs and the benefits based on the problem statement, and which represents the best business decision

A number of standardized, repeatable, analytical measures (or "metrics") are typically used in cost comparison. These include *net present value, internal rate of return, discounted cash flow, return on equity, return on net assets*, and *earnings per share*. The metrics chosen are those that best represent the values of the organization. (See also, Appendix B).

Step 8: Sensitivity Analysis

Since uncertainty is almost universally present in economic decision-making, some type of sensitivity analysis should always be considered when performing an economic analysis. When doubts and uncertainties enter an analysis, it is necessary to test the sensitivity of the results to the cost estimates or other assumptions in order to portray a complete picture. A sensitivity analysis measures the relative magnitude of change in one or more elements of an economic comparison that will re-order the ranking of alternatives.

Sensitivity analysis provides feedback within the economic analysis process by indicating that alternatives, estimates and assumptions are in need of further refinement. If a change in a parameter or an assumption results in a significant change in the results, then the results are sensitive to that parameter or assumption. The review of different parameters and assumptions under varying conditions shows that the economic analysis process is iterative. A sensitivity analysis is needed to examine the potential impact of the cost estimates and assumptions. A sensitivity analysis measures the relative magnitude of change in one or more elements of an economic comparison that will re-order the ranking of alternatives. There should be a logical justification on why certain cost items were chosen for cost sensitivity over others. Because uncertainties are always present, it is necessary to test their effects and influences on the sensitivity of the analysis. Cost factors and assumptions need to be analyzed to portray a complete picture.

There are two branches of sensitivity analysis: risk analysis and uncertainty analysis. Risk analysis addresses variables which have a known (or estimated) probability distribution of occurrence. In risk analysis applied probability and statistics techniques may be used to great advantage. Uncertainty analysis concerns itself with situations in which there is not enough information to determine probability or frequency distributions for the variables involved.

If the preference ranking of alternatives establishes one option as markedly superior to the rest there is no need to be overly concerned about the sensitivity of this choice to nominal variations in the values of input parameters. It is when an economic choice is not clear that further investigation is most appropriate.

Step 9: Tables and Graphs

Tables and graphs should be developed to visually depict and succinctly layout the characteristics of the alternatives. In this regard, ECONPACK software has a graphics function

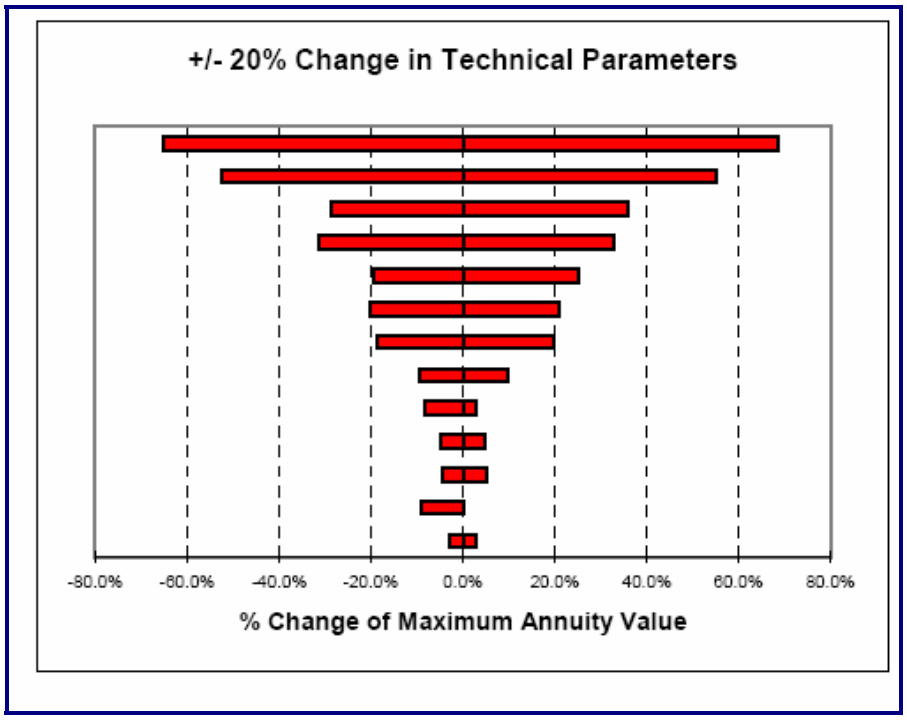
that provides modifiable graphics to aid in the understanding and interpretation of the data (see Appendix E). ECONPACK graphs include:

- Net Present Value (NPV) comparison of alternatives
- Savings to investment ratios
- Cost sensitivity analyses
- Discount rate sensitivity analysis

Other examples of graphs and tables are shown below.

Tornado Sheet identifies the impact of changes to key assumptions and parameters and assesses the sensitivity of the model to the range of values for each key parameter. The tornado sheet below shows a sensitivity analysis using the tornado graph. The percent change in maximal annuity value (x axis) was calculated as each input (y axis) was varied ± 20%, while remaining inputs were maintained at baseline levels. Inputs that affect the annuity value the most are listed first.

Figure III-2 Example Tornado Sheet



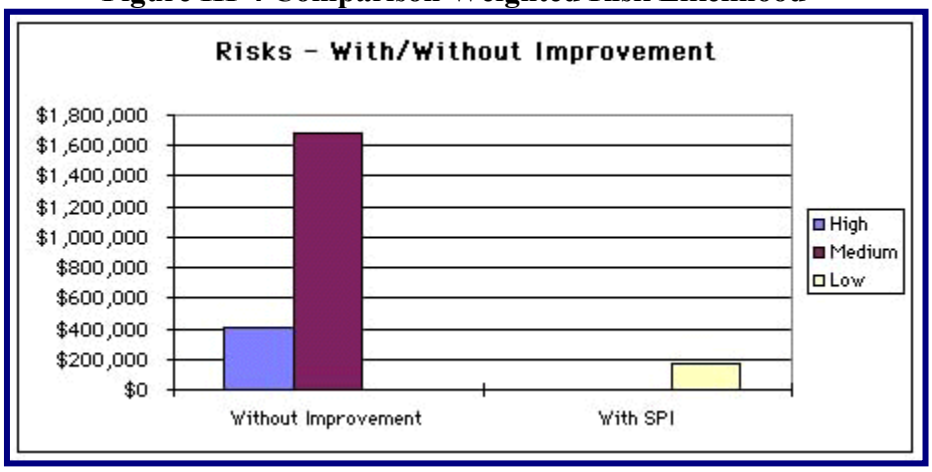
Simple Spreadsheet Comparison - identifies the differences between the options, as shown below.

Figure III-3 Simple Spreadsheet Comparison

Simple Spreadsheet Comparison		
Metric	**Without Improvement**	**With Improvement**
Current # of Software Engineers	300 Employees	300 Employees
Employee Satisfaction	74%	96% (est.)
Turnover Ratio	10%	2% (est.)
Number to be Replaced/Year	30 Employees	5 Employees
Recruiting $/Replaced Employee	$2,500	$2,500
Relocation $/Replaced Employee	$15,000	$15,000
Training $/Replaced Employee	$3,000	$3,000
Average Months to Replace	4 Months	4 Months
Total Recruiting Costs	$75,000	$12,500
Total Relocation Costs	$450,000	$75,000
Total Training Costs	$90,000	$15,000
Yearly Turnover Costs	**$615,000**	**$102,500**
Savings in Turnover Costs		**$512,500**

Comparison Weighted Risk Likelihood - identifies the costs, by options, in association with risk shown in a bar graph below.

Figure III-4 Comparison Weighted Risk Likelihood –



Step 10: Write Report

The business case written report should tell the project story in straight forward, easy-to-understand language. If done correctly, the business case will provide compelling justification for a change by outlining the selected alternatives and describing the best solution and its possible impacts.

Step 11: Decision Briefing

The decision briefing provides management with a snapshot of the business case and the recommended action. It must be persuasive. Remember, a business case analysis is a process of analyzing the objectives defined in the given problem to derive quantifiable, as well as qualitative benefits and to determine likely costs under alternative "solution" scenarios. The business case should provide convincing evidence that justifies an investment decision. To be convincing, the benefits and costs should be credible, unbiased, and presented in a format that follows financial, accounting, and statistical standards and norms.

The focus of the decision briefing should be on the bottom-line benefits to the Agency. All of the other information in the business case should be summarized as supporting details.

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Appendix A – Checklist for Analysts and Reviewers

The following checklist is provided to aid economic analysts and reviewers in insuring that economic analyses are correct, complete, and well-documented.

1. THE OBJECTIVE, ASSUMPTIONS AND ALTERNATIVES

a. Is the stated problem the real problem?
b. Is the objective, as stated, unbiased as to the means of meeting the stated objective?
c. Are all reasonable assumptions identified and explained?
d. Are assumptions too restrictive? Too broad?
e. Are intuitive judgments identified as such? Are uncertainties treated as facts? Can the facts be verified?
f. Are potential mission change constraints to the economic life of an alternative given due consideration? Has the impact of technological change been fully considered?
g. If a scenario has been used, is it realistic?
h. Are the alternatives well defined and discrete? Do they overlap?

2. THE COST ESTIMATES

a. What cost estimating methods were used?
b. Are they appropriate?
c. Are all relevant costs included?
d. Are sunk costs properly excluded?
e. Are the sources of cost data indicated? Are these sources accurate and appropriate?
f. Have all cost estimates been made in base year constant dollars?
g. What escalation projections were used?
h. If parametric cost estimating was used, are the Cost Estimating Relationships statistically valid?
i. Are the estimates interpolated within the range of historical data or has extrapolation been used?
j. Was an average cost used where a marginal cost is appropriate?
k. Are cost factors current and supportable?

3. THE BENEFIT DETERMINATION

a. Does the analysis ignore some portion of total output?
b. Were criteria used to measure benefits justified by the context of the study?
c. Was the benefit, in fact, immeasurable? Has there been a rational assessment of non-quantifiable factors?
d. Was expert opinion used? Were these experts properly qualified?
e. If savings have been claimed, will a budget actually be reduced?
f. Have all advantages and disadvantages of the alternatives been identified? Are there any important externalities?
g. If an efficiency/productivity increase is projected, is there a documented need for greater output?

4. TIME-DEPENDENT CONSIDERATIONS

a. Was lead time between the investment and the start of economic life accounted for?
b. Was present value analysis properly performed?
c. Are the economic lives used reasonable? Are they based upon guidelines?
d. Is terminal value important in this analysis?
e. If differential escalation has been assumed for a particular cost element, has the expectation that long-term cost escalation, different from general inflation, been adequately documented?
f. If lead time differs between alternatives, have the economic lives been aligned?
g. Have any relevant growth, "learning curve" and technological change predictions been incorporated in the analysis? Are they realistic?

5. THE SENSITIVITY ANALYSIS

a. If differential escalation was assumed, has a base case analysis with no assumption of differential escalation been performed?
b. Has sensitivity analysis of the results to changes in dominant cost elements, economic life, etc., been performed? If not, why not?
c. Has break-even analysis been performed?
d. Have all relevant "what if" questions been answered?
e. Have graphs been used to display sensitivity analysis information?
f. If a risk analysis has been performed, how were the probability estimates derived?
g. What do the sensitivity analysis results imply about the relative ranking of alternatives?

6. SELECTING FROM ALTERNATIVES

a. Are the recommendations logically derived from the material?
b. Is interference from co-extensive or parallel operations ignored?
c. Are the recommendations feasible in the real world of political, cultural, or policy considerations?
d. Are the recommendations based upon significant differences between the alternatives?
e. Do benefits exceed costs for alternatives considered?

Appendix B – Economic Analysis Measures

There are many methods available to calculate specific economic performance measures. Used appropriately, these methods allow the planning and design team to analyze the economic consequences of particular design decisions and to fairly evaluate alternative approaches. The various economic analysis methods include:

- Life-Cycle Cost Analysis (LCCA)
- Net Benefits (NB) and Net Savings (NS)
- Benefit-to-Cost Ratio (BCR) and Savings-to-Investment Ratio (SIR)
- Internal Rate of Return (IRR)
- Overall Rate of Return (ORR)
- Discounted Payback (DPB) and Simple Payback (SPB)

1. Life-Cycle Cost Analysis (LCCA)

LCCA is the basic method recommended in 10 CFR §436A (Rules for Federal Energy Management and Planning Programs), and OMB Circular A-94 (Guidelines and Discount Rates for Benefit-Cost Analysis for Federal Programs), for evaluating the economic performance of federal investments in buildings or building systems. LCCA involves computing the Life-Cycle Cost (LCC) for competing design alternatives, considering all significant costs over the economic life of each alternative (expressed in equivalent dollars), then comparing them and choosing the alternative with the lowest LCC. LCCA is particularly useful in evaluating building performance from an energy consumption perspective. The other methods described below are usually used as supplementary measures of cost-effectiveness to the LCCA.

2. Net Benefits (NB) and Net Savings (NS)

Net Benefits and Net Savings are analytical methods used to describe time-adjusted economic benefits or savings between competing alternatives. NB is used to examine how costs of competing alternatives impact investment opportunities (*e.g.*, real estate income or factory output) measured in positive outcomes relative to a base case. The NS method is the NB method recast to fit the situation where there are no important benefits in terms of revenue, but there are reductions in future costs (savings).

3. Benefit-to-Cost Ratio (BCR) and Savings-to-Investment Ratio (SIR)

BCR and SIR are numerical ratios whose size indicates the economic performance of an investment. For example, a BCR of 1.5 means that one can expect to realize $1.50 for every $1.00 invested in the project over and above the required (baseline) rate of return. A primary application of BCR and SIR is to set funding priorities among competing projects when there is a limited overall program budget.

4. Internal Rate of Return (IRR)

IRR is a measure of the annual percentage yield on investment. The IRR is compared against the investor's minimum acceptable rate of return to determine the economic attractiveness of the investment. This often misunderstood method is primarily used in *pro forma* analysis in industrial and financial circles.

5. Overall Rate of Return (ORR)

ORR is the annual yield from a project over the study period, taking into account reinvestment of interim receipts. Project earnings and earnings from reinvestment are accumulated to the end of the study period and set equal to the present value of cost to compute the ORR. This method offers another means of analyzing and ranking the economic performance expectations of competing alternatives.

6. Discounted Payback (DPB) and Simple Payback (SPB)

DPB and SPB measure the time required to recover investment costs. If one ignores the time value of money (assume a zero discount rate), the method is called "simple payback." If one takes into account the time value of money (assume a positive discount rate), the method is called "discounted payback". DPB is a more accurate measure of payback than SPB.

7. Value Engineering (VE)

VE is separate from but related to economic analysis methods. It is a cost management practice; a systematic evaluation procedure directed at analyzing the function of materials, systems, processes, and building equipment for the purpose of achieving required functions at the lowest total cost of ownership. Major public works projects may undergo both VE studies and LCCA, and while the two practices serve separate purposes; their consideration of design alternatives is often interrelated. For example, value engineering can be used to complement a life-cycle cost analysis when selected LCC alternatives cannot be adopted without exceeding the project budget. VE can be utilized to reduce initial costs of design features other than those under study in a LCCA. If the VE effort results in sufficient reduction in initial costs, savings may allow selected LCC alternatives to be adopted within the overall program budget, thus optimizing the long-term cost-effectiveness of the project as a whole. Perhaps the most challenging aspect of a VE analysis is the evaluation of the non-quantifiable benefits of design, materials, or system attributes. Aesthetics, occupant comfort and performance, environmental impact, historic preservation, and the like may be key design objectives that drive budget decision making and contribute enhanced value to the project. It is important to understand that while some alternatives are quantifiable, qualitative elements such as better aesthetics and increased worker productivity can also influence the economic analysis and decision-making process.

Occasionally, there are situations that simply do not lend themselves to quantitative measures of benefits. These projects may provide benefits such as

- Improved quality of the working environment,

- Preservation of cultural and historical resources,
- Safety and security of the building occupants, and
- Other similar qualitative advantages.

Although they are very difficult to assess, these benefits should be documented and portrayed in a life-cycle cost analysis.

This is the least preferred method of analyzing benefits due to its subjectivity and inherent lack of precision. However, under certain conditions, this method must suffice; and if the following guidelines are observed, qualitative statements can make a positive contribution to the analysis.

- Identify all benefits associated with each alternative under consideration. Give complete details.
- Identify the benefits common in kind but not to the same degree among the alternatives. Explain all differences in detail.

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Appendix C – Sustainable Facility Design

According to GSA's Real Property Sustainable Development Guide (http://www.gsa.gov/gsa/cm_attachments/GSA_DOCUMENT/sus_dev_guide_R2O1X_0Z5RDZ-i34K-pR.pdf), Federal projects most likely to be approved are those with the lowest first cost. Unfortunately, these "lowest first cost" projects are not always the most sustainable or maintainable. Faced with a variety of competing demands - program funding requirements, life-cycle and present value costs, environmental considerations, economics and social issues - managers find themselves torn between recycling seemingly economical, "tried-and-true" solutions and moving to new ways of doing business that balance environmental sensitivity and long-term benefits with other costs.

Sustainable/maintainable design considerations today can result in operational savings in later years, increased worker productivity, and reduced contingent liability. New thinking and new economic parameters must be considered. Sophisticated design and construction strategies, and inclusion of "green" clauses in procurements can result in even lower first costs; and the life-cycle costs, including a project's environmental and economic impacts throughout its lifetime - are usually lower. In some cases, first cost may be the same - as when a building shell upgrade results in a smaller mechanical system - but the savings come in reduced operating and maintenance costs.

Additional information may be found in NASA Policy Directive (NPD) 8820.3, "Facility Sustainable Design", NPR 8820.2A "Design and Construction of Facilities", and NPR 8820.2E, Facility Project Implementation Guide. The US Green Building Council website (http://www.usgbc.org/) provides access to the Leadership in Energy and Environmental Design (LEED) site which has a wealth of information.

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Appendix D – Analysis of Exit Strategies

"Best-practice" organizations typically develop and evaluate exit strategies — methods for disengaging from an investment — as part of the business case analysis to provide important insight about the potential consequences of investing in a long-term, non-liquid asset such as a facility and to select the best alternative to meet the requirement.

A commonly analyzed and implemented exit strategy is to lease the required space in the first place. If requirements change, an organization can move out of leased space relatively quickly without the burden of selling or otherwise disposing of the property. In some cases, leased space may have a higher annual cost per square foot than owned space. However, it may still make economic sense to lease to ensure that the organization can divest itself of the space on short notice.

For space that is to be acquired through purchase or construction, one exit strategy is to build flexible (generic) space that can be relatively easily adapted to other uses to meet changing requirements. Flexible office or warehouse space generally has wider appeal to potential buyers or those willing to sublease excess space. Acquiring flexible office space can mitigate the risk of selling it at a financial loss and increase opportunities for selling it at a profit. Johnson and Johnson, for example, builds its biopharmaceutical facilities using flexible floor plans. With rapidly changing markets and an 8-year-long Food and Drug Administration approval process, the risk is considerable that when a project is completed, the project may be outmoded or its intended product lines may not gain approval. Johnson and Johnson mitigates this risk by constructing facilities that can be relatively easily adapted to new uses or different product lines. The Toyota Corporation takes a different approach by building in flexibility by constructing large facilities that are similar to one another in order to accommodate a broad range of uses and to reduce surprises — a portfolio approach.

Timely maintenance and repair of an owned facility can also be evaluated as an exit strategy: Investment in maintenance and repair retains or improves the functionality and performance of a facility, thereby increasing its marketability and its residual value at the time of sale.

As the merits of a proposal are evaluated, the costs and benefits of leasing versus owning, of developing flexible facilities, and of maintenance and repair, as well as the projected residual value, are analyzed to provide quality information for decision-making. Tishman Speyer Properties, for example, develops and evaluates at least two exit strategies for every proposed investment.

For some specialized facilities, such as those for manufacturing, power generation, defense or military use, and some types of research, the only exit strategy may be demolition, cleanup, and disposal. A particularly strong rationale is needed for investing in such facilities, such as a direct link to the core business lines and missions of an organization, and the cost of the intended exit strategy must be made explicit in the initial proposal. This exit strategy is evaluated to provide information about the total costs involved and to provide insight into design and operation practices that may lead to lower demolition and cleanup costs. For example, the use of

biodegradable materials for a facility may result in lower disposal costs, or special waste disposal methods may be indicated.

Appendix E - ECONPACK

ECONPACK for Windows, developed by the U.S. Army Corps of Engineers, provides the Tri-Service Standard for Military Economic Analysis Planning. ECONPACK is the software that is recommended for use by the military for business case analyses (http://www.hq.usace.army.mil/cemp/e/ec/econ/econ.htm). While using this software is not mandatory, its use facilitates meeting economic analysis requirements by providing features such as a structured environment and economic analysis guidance. ECONPACK is compatible with OMB Circular A-94, Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, and the NAVFAC P-442, Economic Analysis Handbook.

The ECONPACK program is a differential analysis in which only differences among the alternatives are of interest. This allows the omission of certain costs common to all alternatives. The program relies on three sound economic principles:

- All reasonable alternative methods of meeting an objective must be considered.
- Each alternative must be evaluated in terms of its total lifetime (life-cycle costs).
- The value of money changes over time. Adjustment must be made to costs and benefits to bring them to one point in time for a valid comparison.

The following seven basic economic analysis steps are used in the ECONPACK to organize, analyze data and present elements of the economic study so that decision-makers have valid cost comparisons for alternative solutions to a problem.

1. Seven Steps in the ECONPACK Economic Analysis (EA)

1. State the purpose (objective) of the project clearly, concisely, unbiased and, if possible, in quantitative terms. This is done so that the reviewer understands the project requirement to be met.
2. Develop a complete list of alternative ways to meet the requirement. This list must be detailed or the validity of EA may be questioned, as it will appear to be incomplete. All of the Acquisition Costs Alternatives are to be evaluated. From this list use only feasible solutions in the EA and explain why an alternative (solution) is not feasible.
3. Document any assumptions. There are always some assumptions in an EA. Assumptions include the estimated useful life of an asset, an estimated requirement, the replacement time for a building component such as a roof, and the future cost of a required repair action.
4. Collect cost and benefits data. A cost is the value of a resource – labor, materials, services, etc. An alternative has many costs, such as construction, maintenance, utilities, services, supplies, personnel, etc. Costs can be positive or negative. Negative costs are, in reality, benefits. In an economic analysis, benefits are expressed as a negative cost, such as the salvage value of a building. Salvage value is a subtraction in the summation of all costs in an economic analysis. A proper cost analysis within an economic analysis requires that the amount and timing of all costs be determined for each alternative. The following table of **Alternatives/Cost Kind** (Figure E-1 on following page) provides a list of cost to be considered for the various alternatives. Sources of data and the data

calculations must be documented, as they are very important in determining validity and accuracy. Sources are essential for reviewers' use. The analysis must include all costs and benefits associated with each alternative and document the source of the cost or estimate them. Costs must be determined and included for the entire life of the project or study period to reflect total life-cycle costs.

5. Enter the appropriate cost data for each alternative and the ECONPACK program will compare costs/benefits and rank alternatives performing the calculations accurately.
6. Perform sensitivity analysis, which is a "what-if" exercise, to test the effect of large uncertainties in costs or benefits on the ranking of the alternatives. This is particularly important if the results of the analysis do not clearly favor any one alternative, or there is a great deal of uncertainty about a cost, benefit, or assumption in the economic analysis.

Report the economic analysis results. This is to show management and decision makers the results of the economic analysis and present a documented record of the analysis.

Figure E-1 Alternatives/Cost Kinds Check List

COST KIND	ALTERNATIVE						
	STATUS QUO	NEW CONSTRUCTION	RENOVATION	ADDITION	CONVERSION	OTHER	LEASE
INITIAL INVESTMENT		X	X	X	X	X	X
OPERATIONS AND MAINTENANCE	X	X	X	X	X	X	*
PERSONNEL	X	X	X	X	X	X	X
ADMINISTRATIVE	X	X	X	X	X	X	X
UTILITIES	X	X	X	X	X	X	X
SERVICES	X	X	X	X	X	X	X
PERIODIC REPAIR/REPLACEMENT	X	X	X	X	X		
FURNISHINGS	X	X	X	X	X	X	X
EQUIPMENT	X	X	X	X	X	X	X
SALVAGE/DEMOLITION	X	X	X	X	X	X	X
TRAVEL/TRANSPORTATION/MOVING	X	X	X	X	X	X	X
LAND (IMPUTED)		L	L	L	L	L	L
INSURANCE (IMPUTED)		L	L	L	L	L	L
REAL ESTATE TAXES (IMPUTED)		L	L	L	L	L	L
LEASE		L	L	L	L	L	L
COMMUNICATIONS	X	X	X	X	X	X	X
SECURITY	X	X	X	X	X	X	X
PARKING	X	X	X	X	X	X	X
INHERITED ASSETS		X	X	X	X	X	X
REPLACED ASSETS		X	X	X	X	X	X
TOXIC SUBSTANCE REMOVAL	X	X	X	X	X	X	X

X = Cost Kind may be applicable.

L = Cost Kind may be applicable for EAs performed under OMB Circular A-94 guidance when lease is a feasible option.

* Depends upon terms of the lease.

Once this process has been completed the recommended alternative normally is the one that is least cost over the period of time for which the requirement is to be met. There are cases where the least cost alternative may not be the one recommended for funding.

2. Benefits of using ECONPACK

ECONPACK provides a standard format for entering economic parameters and documentation, as well as cost and benefit data for various alternatives. This format not only reduces resources needed for economic analysis development, it provides professional reports and graphics automatically. Additional benefits include:

- Net present values (NPV), saving to investment ratios, benefit to investment ratios, and discounted payback periods, are calculated automatically.
- Economic analysis files may be shared among ECONPACK for Windows users.
- Sample economic analyses for various types of projects are available.

- Custom inflation and residual schedules capability is provided.

ECONPACK for Windows is organized into five modules to step the user through the process of economic analysis development

- General information
- Spreadsheets for each alternative, used to enter in the cost and benefit data as well as salvage values
- Documentation on assumptions, source and derivation of costs/benefits, non-monetary costs/benefits, alternatives, results and recommendations
- Cost sensitivity analyses
- Discount rate sensitivity analysis

The ECONPACK software has a graphics function that provides modifiable graphics to aid in the understanding and interpretation of the data. ECONPACK graphs include:

- NPV comparison of alternatives
- Savings to investment ratios
- Cost sensitivity analyses
- Discount rate sensitivity analysis

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Appendix F – Cost of Base Realignment Actions (COBRA) Model

1. Background

The United States Air Force Cost Center developed the Cost of Base Realignment Actions (COBRA) model in early 1988 in conjunction with the Logistics Management Institute to evaluate the cost of Air Force stationing actions. The 1988 Base Realignment and Closure (BRAC) Commission adopted this Lotus Spreadsheet based model to evaluate and compare the relative costs of stationing alternatives. Throughout 1988, the Commission reviewed and revised the model so it could be used by all Military Departments. As a result, COBRA was used to produce all cost estimates for the 1988 BRAC Commission. At the conclusion of the Commission, the General Accounting Office (GAO) reviewed the COBRA model and provided the Commission with a list of minor model modifications and stated in their final report,

"...that the Cost of Base Realignment Actions Model used by the BRAC Commission and the Military Departments is a conceptually sound tool for evaluating costs, savings, and payback periods."

Consequently, the model was revised once more to satisfy those GAO concerns that could be accommodated. Ultimately, an updated model was released in May 1989 and was selected as the starting point to evaluate the 1991 BRAC Commission stationing actions, as well as every BRAC decision in all subsequent BRAC rounds.

Cobra may be accessed on the internet at:

http://www.defenselink.mil/brac/minutes/cobra/cobra_app.html.

2. Capabilities and Operations

COBRA is an economic analysis model. The COBRA model is included in this Guide for possible use where the closure and/or disposal of a large complex of facilities are under consideration. COBRA estimates the costs and savings associated with a proposed base closure or realignment action using data available to all analysts and users. The model output can be used to compare the relative cost benefits of alternative BRAC actions. COBRA is not designed to produce budget estimates, but to provide a consistent and auditable method of evaluating and comparing different courses of action in terms of the resulting economic impacts for those costs and savings measured in the model.

COBRA calculates the costs and savings of base stationing scenarios over a period of 20 years. It models all activities (moves, construction, procurements, sales, closures) as taking place during the first 6 years, and thereafter all costs and savings are treated as steady state. The key output value produced is the "Payback Year." This is the point in time where savings generated equal (and then exceed) costs incurred. In other words, this is the point when the realignment/closure has paid for itself and net savings start to accrue. The Payback Period is the period between the end of the realignment or closure action and the Payback Year.

COBRA calculates and reports the Net Present Value (NPV) for the 20-year planning period of each scenario analyzed. NPV is the present value of future costs of a scenario, discounted at the appropriate rate, minus the present value of future savings from the scenario. All dollar values, regardless of when they occur, are measured in constant base-year dollars. This is important because it eliminates artificial distinctions between scenarios based on inflation, while highlighting the effects of timing on model results. Costs and savings are calculated for each year of the 20-year planning period. For each year, total costs and savings are then summed to determine a net cost for that year. The net cost of each year is then added to the net cost for preceding years to determine the total net cost to that point in time. The sum of the total net costs for all 20 years is the Net Present Value of the scenario.

A sample COBRA Net Present Value Chart is depicted below. It shows the Net Present Value for each year of the 20-year planning period used by COBRA. All dollars are in base year (in this case 2006) dollars. Positive dollar values are net costs. Negative dollar values are net savings. In this scenario the Net Present Value became 0 during 2017. This is the Payback Year when savings generated equal and exceed costs incurred. The Net Present Value for the 20-year period is the net present value in year 2025. In this scenario it is approximately$6,500,000 in savings (Negative values are savings).

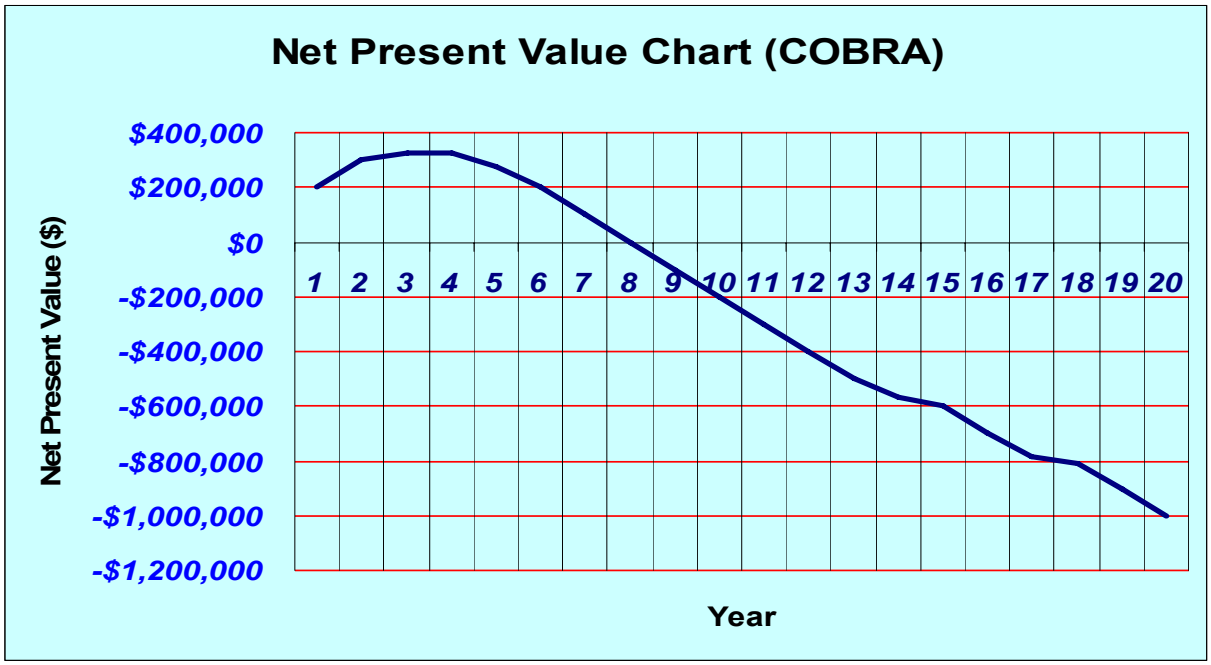
Appendix G – Economic Impact Forecast System (EIFS)

1. Background

The original version of the Economic Impact Forecast System (EIFS) was implemented in the mid-70s. Since that time, the model and database have been tailored to meet the initial analysis that is required by the National Environmental Policy Act (NEPA) for a proposed federal agency action, and as part of a two-tier approach. This system has now been implemented on the web, and is available for interactive use.

EIFS was created to provide socioeconomic impact assessment, necessitated by the passage of NEPA. NEPA requires that federal agencies consider the impacts of an action on the "human environment" before decisions are made or an action is taken, determining the significance of the impacts and taking steps to minimize their impacts. This process is intended to help public officials make better decisions; make decisions that are based on an understanding of environmental consequences; are on a par with traditional decision making parameters (technical feasibility and economic viability); and take actions that protect, restore, and enhance the human environment.

Figure G-1 Net Present Value Chart



EIFS was originally developed to efficiently identify and address the regional economic effects of proposed military actions. Over the years, the model (and supportive system) was further developed in cooperation with the U.S. Air Force, and the U.S. Army Corps of Engineer Institute for Water Resources, providing systematic, efficient and consistent analysis of regional economic effects of proposed actions. The system, consisting of a model, a supportive database, and an evaluation tool to determine significance has become a standard Army NEPA tool for addressing regional economic effects of a proposed action. Though military activities are varied

and distributed throughout the U.S., EIFS provides a standardized system to quantify the impact of military actions, and to compare various options or alternatives. It provides a standard, non-arbitrary approach that has proven valuable through two GAO reviews of base closure analyses. Its use has become a prototypical NEPA tool, allowing quick assessment of potential effects and the evaluation of their significance. The system meets the criteria for a good assessment model is theoretically sound and defensible, is available for public review and scrutiny, and pragmatic in its application.

EIFS is implemented as an on-line system supported by the U.S. Army Corps of Engineers, Mobile District and U.S. Army Environmental Policy Institute, through the Computer and Information Science Department of Clark Atlanta University. The system is available on the Internet to anyone with an approved user ID and password. A user ID and password maybe requested at http://eifs.cau.edu/

2. Capabilities and Operations

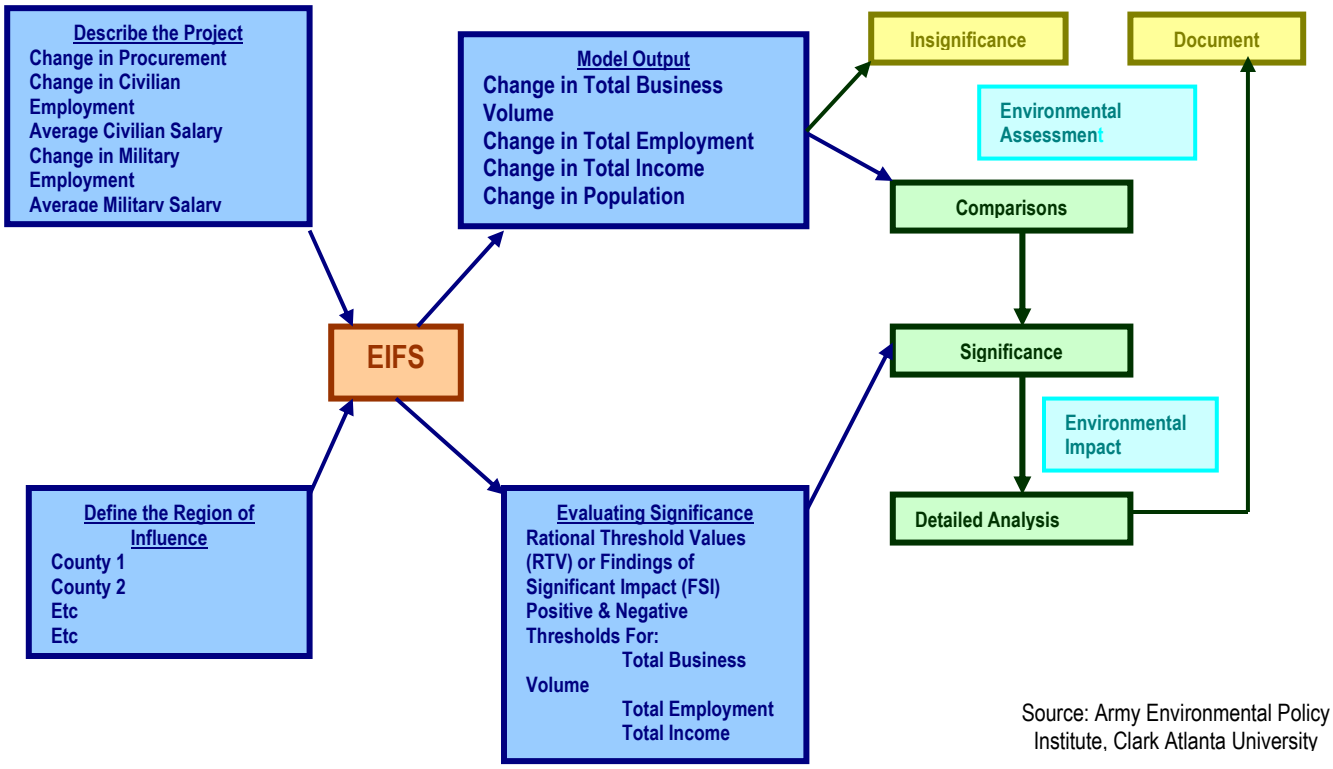
The EIFS is a web-based modeling and information system that provides regional economic analyses to planners and analysts. It draws information from a tailored socioeconomic database for any county (or multi-county area) in the United States, estimating the changes associated with any project proposal, as defined by the user, and assessing their significance. The database items are extracted from: Economic Censuses (wholesale, retail, services, and manufactures), Census of Agriculture, the Bureau of Economic Analysis employment and income time series, the BEA Labor force time series, and the County Business Patterns. Extracted data elements are stored, by county, in the EIFS database for use. The entire system – models, tools, and database – is then available to assess potential impacts on four elements of a local economy: business volume, employment, personal income, and population. While the system algorithms are simple and easy to understand, they are firmly based on regional economic theory; and a widely accepted theoretical approach for initial analyses. Over three decades of use, EIFS analyses are, in aggregate, comparable with more expensive, time-consuming, and complex approaches. The system provides flexibility for the evaluation of alternative scenarios and "what-if" games at minimal expense.

The EIFS model requires basic input data regarding the action being studied: The dollar amounts of associated construction, number of military and civilian employees that are moving in or out of the area and their average salaries, local procurements, etc. Once these inputs are ascertained, the local multi-county region of influence can be defined, and the analysis can be obtained. EIFS predicts resultant changes in total personal income, total employment, and total sales by local businesses, and total population. Once these aggregate changes are predicted, EIFS provides analyses of historical trends in the defined ROI, and uses the Rational Threshold Level and Forecast Significance of Impacts profiles to develop significance criteria. Comparisons of projected change are then easily compared to the significance thresholds to produce conclusions. If insignificant impacts result, the analysis is complete. If significant impacts are indicated, more detailed analysis will likely be required, using a more sophisticated model.

While a number of more complex tools are available, a second-tier EIFS model is under development which will exploit the EIFS database. This Automated Input-Output Model System will be incorporated into the system at a future date, providing sector-specific analysis as a means to address significant issues.

EIFS is a tool that affords initial analysis of potential impacts on regional economies. The simple model (driven by simple input data) can provide aggregate estimates that are defensible; and, coupled with analysis of historical trends, can determine if further analysis is required. This tiered approach is consistent with the requirements of NEPA (the initial EA followed by a detailed Environmental Impact Statement, if warranted). The diagram below, illustrates the general flow of the EIFS process.

Figure G-2 Economic Impact Forecast System



Source: Army Environmental Policy Institute, Clark Atlanta University

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Appendix H – Training Sources

US Army Corps of Engineers ECONPACK

The U.S. Army Corps of Engineers, at their Huntsville, Alabama Training Center, offers training courses for performing economic analyses using ECONPACK. Contact R.Smigel@**usace**.army.mil at (202) 761-5602 for more information.

American Graduate University: Cost/Price Analysis

Cost/price analysis is a core component of the American Graduate University's full-length Pricing and Financial Management Course. This three-day course is a highly-focused tutorial on the concepts of price and cost analysis. It is intended to sharpen and expand the skills of experienced practitioners and provide a solid base of knowledge and practical skills upon which less experienced personnel can build**.** The website can be found at: http://www.agu.edu/TrainingDescription.aspx?course_code=520.

Treasury Agency Services

The Department of Treasury, through its Professional Development Division offers Business case training that is designed to teach not only key business case components, but also "tricks-of-the-trade" used to improve business case quality and to develop successful OMB Exhibit 300 submissions. Course information about the Department of Treasury's offerings may be found at http://www.fms.treas.gov/tas/courses/omb-exhibit.html

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4. NAVFAC P-442 Economic Analysis. This handbook is designed to assist with your facilities investment decision-making through application of economic analysis and to provide consistent guidance for documentation of your decision. It provides economic analysis policy and procedures and should be used by all Navy commands and field offices who prepare economic analyses. This document may be found at: http://www.lantdiv.navfac.navy.mil/servlet/page?_pageid=8609,8611&_dad=lantdiv&_schema=LANTDIV&11435_ACTIVE_1777132.p_subid=60008&11435_ACTIVE_1777132.p_sub_siteid=51&11435_ACTIVE_1777132.p_edit=0 .

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