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THE APPLICATION OF DECISION ANALYSIS METHODS TO SOURCE SELECTION IN THE UNITED STATES AIR FORCE

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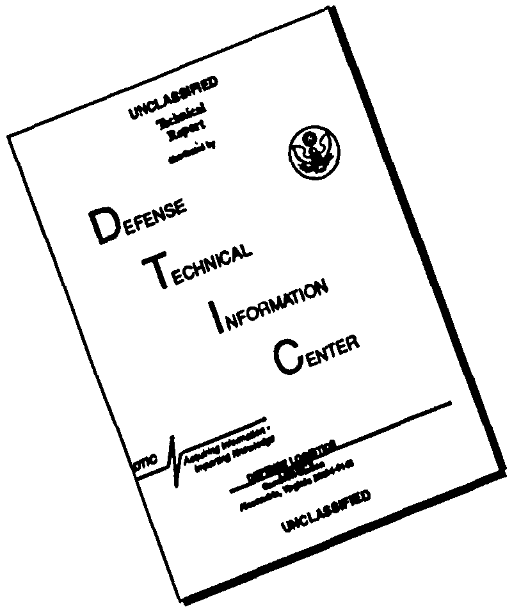

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THE APPLICATION OF DECISION ANALYSIS METHODS

TO SOURCE SELECTION

IN THE UNITED STATES AIR FORCE

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June 10, 1991

"We are deceiving ourselves if we naively believe that we are not as human as the people around us and that we do not tend to aim opportunistically for conclusions that fit prejudices markedly similar to those of other people in our society. By keeping to higher valuations and by assigning prime importance to observed facts, we only partly purge these biases from our mind."

(G. Murdal, Objectivity in Sociai Research, 1969, p. 43)

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ABSTRACT

This research investigates the efficacy of applying formal decision analysis methods to the selection of the "best" contractor for defense systems acquisition. Specifically, Multiattribute Utility Theory (MAUT) and the Analytic Hierarchy Process (AHP) are applied to source selection within the United States Air Force. The source selection process is described. MAUT and AHP are applied to an actual Air Force source selection case study. We conclude the Air Force source selection process can benefit from the application of decision analysis.

1. INTRODUCTION

The defense budget increased significantly during the Reagan Administration, resulting in enormous expenditures for weapon systems. Along with these increased defense expenditures came many reports of fraud, waste, abuse, and inefficiency. Reports of $600.00 toilet seats and $120.00 hammers outraged the American public and prompted close scrutiny of the acquisition process. In July, 1985 President Reagan commissioned a Blue Ribbon Panel to investigate, improve and restore public confidence in the weapon systems acquisition process. The Department of Defense is now implementing most of the recommendations of the "Defense Management Review" performed by this Panel, formally called the Packard Commission.

The Packard Commission studied and recommended improvements in acquisition organization and procedures, building prototypes and testing, cost and performance measures, program stability, competition, management of acquisition personnel, and government-industry accountability (Kovacic 1987). There is however, yet another aspect of the systems acquisition process which should be studied and improved: *decision making by acquisition personnel*. This paper investigates how decision making might be improved by the use of formal decision analysis methodologies. In particular, we explore how Multi-Attribute Utility Theory (MAUT) and the Analytic Hierarchy Process (AHP) might be employed to improve the source selection phase of the weapon systems acquisition process. Source selection is that part of the acquisition process in which the contractor or supplier of the weapon system is chosen.

1.1 NEED FOR THIS RESEARCH

The source selection procedures which must be followed are specified in Department of Defense Directives, Federal Acquisition Regulations, and regulations and directives imposed by the individual services and major commands. (c.f. Air Force Regulation 70-15) This study is concerned only with the source selection process employed within Systems Command of the United States Air Force.

There are several aspects of the formal source selection process which are congruent with the established decision analysis methodologies mentioned above. In particular, the current source selection process requires that:

1. the criteria for the source selection decision be clearly specified,

2. the relative priority of the criteria be established,

3. the attributes which measure how well contractor proposals meet specified requirements be defined,

4. the proposals be evaluated on the basis of these attributes and criteria, and

5. the "best" proposal be selected based upon the analysis conducted in steps 1 through 4, above.

It is in steps 4 and 5 where differences emerge between current source selection practices and established decision analysis methods. Whereas MAUT would recommend selection of the contractor whose proposal would "maximize expected utility" and AHP would recommend selection of the contractor whose proposal has the highest "overall composite priority,"

> *the current source selection process provides no guidance as to how judgements and evaluations performed in steps 1 through 4 should be synthesized to yield the preferred alternative.*

This issue is the central focus of this research: *Can decision analysis improve source selection decisions, especially in the synthesis of judgements and evaluations to yield a ranking of contractors?*

The need for a thorough, consistent and rational analysis is clearly recognized in the directives and regulations which guide the source selection process. As stated in Air Force Regulation 70-15/AFFARS Appendix AA:

> The principal objective of the major source selection process is to select the source whose proposal has the highest degree of credibility and whose performance can be expected to best meet the government's requirements at an affordable cost. The process must provide an impartial, equitable, and comprehensive evaluation of the competitors' proposals and related capabilities. The process should be accomplished with minimum complexity and maximum efficiency and effectiveness. It should be structured to properly balance technical, financial, and economic or business considerations consistent with the phase of the acquisition, program requirements, and business and legal constraints. It must be sufficiently

flexible to accommodate the objectives of the acquisition and a decision must be compatible with program requirements, risks, and conditions. (p. 3)

The Federal Acquisition Regulation regarding source selection (FAR SUBPART 15.6) specifies similar objectives:

> Source selection procedures are designed to:
> (a) Maximize competition;
> (b) Minimize the complexity of the solicitation, evaluation, and the selection decision;
> (c) Ensure impartial and comprehensive evaluation of contractors' proposals; and
> (d) Ensure selection of the source whose proposal has the highest degree of realism and whose performance is expected to best meet stated Government requirements. (pp. 1-2.)

Thus, it seems the source selection process could benefit substantially from decision analysis.

1.2 PREVIOUS RESEARCH

This research is not the first to investigate this issue. Goren (1981) identified the following "major problems, deficiencies, and difficulties" with the source selection process:

> 1. Difficulties in circumscribing the decision factors and consolidating them all for a final decision. This stems from the complex, multi-objective nature of the acquisition decisions.
>
> 2. Lack of balance of political impact of individuals, groups and organizations, imposed upon the decision-making process. Disorder in the representation of those who have stakes in the decision.
>
> 3. Existence of phenomena such as biased decision presentation, which is amplified by the inevitable reliance of top-level decision makers on their subordinates' evaluations.
>
> 4. Aversion to the usage of quantitative techniques as top-level decision aids which stems from the lack of confidence in the capability of these techniques to incorporate intuitive, judgmental issues. (p. 130)

These deficiencies were ascertained, in large part, through an opinion survey and interviews of those working in the systems acquisition field.

Goren concludes that:

> 1. The MAUT procedure should be used as the major tool for presenting and evaluating alternatives for acquisition decisions at the top level.
>
> 2. For each major system, MAUT should serve as a comprehensive, ongoing, updated, evaluation framework through the whole acquisition life cycle. (pp. 132-133)

He reached these conclusions despite the fact that he did not attempt to actually apply MAUT to source selection, nor did he construct a realistic MAUT model.

Donnell and Ulvila (1980) conducted a decision analysis of the Advanced Scout Helicopter (ASH) candidates for the U.S. Army. They assisted the ASH Special Study Group which was tasked with selecting an effective and affordable ASH and demonstrating that the selected ASH was the most cost effective of the candidates.

They accomplished this by constructing an evaluation model designed to capture objective as well as subjective factors relevant to the decision at hand. There were thirteen candidates and over seventy relevant attributes to be considered. The output of the resultant MAUT model was a "numerical representation of the worth of each ASH candidate." (p. 1) They provided a detailed discussion of the model and its development.

Donnell and Ulvila did not recommend a final ASH because their model was only an initial attempt to structure the problem. They felt their model required refinement in order for them to reach a final recommendation. They noted, however, that the modeling process allowed the Special Study Group "to more fully understand tradeoffs of the competing decision-related variables." (p. 89) They also pointed out the benefits of modeling this problem using MAUT:

> "...all numerical assessments (were) supported through written rationale, and it (was) possible to vary any score or weight that may be in question and to determine the impact of such variations on the result.

Moore and Neve (1987) employed the AHP to determine the relative importance of criteria in the selection of contractors for the construction of DoD facilities. They listed relevant criteria which, they contend, are generally agreed upon by the "construction community." They then

> ...queried DoD facility construction, procurement, construction (sic), and engineering experts from the Air Force, Army, and Navy to determine which factors they felt to be important on the basis of their judgement and experience...The intent of the ranking was to establish a sample weighting that could be used as a starting point

> for developing evaluation and selection plans...The results of the rank ordering displayed some variance, but were statistically significant at the 95% level. With few notable exceptions, engineering, procurement, and construction experts agreed on the importance of the variables. (pp. B-1 - B-2)

Thus, the AHP was used only to ascertain the relative importance of the generally agreed upon criteria. No discussion is provided about building a complete hierarchical decision model and conducting a complete AHP analysis to recommend a preferred contractor.

Cook (1986, 1987, 1989) has done considerable work in applying AHP to source selection. He (1986) used AHP to

> ...help contracting and program managers identify and evaluate the relevant criteria, subcriteria, and alternatives to be considered in formulating a comprehensive strategy, and to enable these professionals to integrate their experience, judgement, and the facts that are available into a coherent, comprehensive competition strategy. (p. 273)

Cook (1986) applied the AHP, as implemented in the software package Expert Choice (1983) to select a contractor for an Air Force fighter aircraft engine. He proved the feasibility of applying this decision analysis methodology to such problems. He concludes:

> Is there a need for Expert Support Systems in the government procurement arena? The answer seems to be yes, at least in the complex competition strategy formulation process. The decision is based on a number of criteria and subcriteria, and offers several alternative techniques for introducing competition into government procurement.
>
> This paper has presented an ESS model, based on the Analytic Hierarchy Process and using Expert Choice, that enables the decision makers to organize and structure their judgements. It facilitates the innate decision process we use in simple decisions and allows that logic to be applied to complex decisions. It enables the decision maker to perform "what if" exercises to quickly trace the effect of changes in judgement or in conditions outside his control. Finally, Expert Choice and the model are easy to use, require little training time for initial use, and run on the most popular microcomputers. (pp. 286-287)

Cook (1989) also used the AHP to assist in a decision regarding "component breakout" to encourage competition in the procurement of major weapon systems. "Component breakout" is separating major components from the prime contract and obtaining those in separate procurement actions. Thus, each component is subjected to the acquisition process separately thereby encouraging competition and "multiple sources." His paper chronicles an actual case study for the procurement of the F-15 fighter aircraft radar system. He concludes:

> 1. The decision itself was transformed from unstructured to structured.
>
> 2. The DSS increased group and management confidence in the decision process and in the group recommendation.
>
> 3. The decision took less time, in the opinion of the group members, than would have been required using an alternative methodology.
>
> 4. As a result of the imbedded documentation and audit trail, the team was able to present its findings and recommendations in a rational manner when briefing the program director, thus winning the director's approval. (pp. 11-13)

Vickery (1989) developed a fictitious source selection case and asked a number of individuals to analyze the problem and decide which contractor should be awarded the contract. One group was introduced to AHP and the other was not. The quality of their decision was judged according to six criteria: effectiveness, consistency, speed, difficulty, understanding, and confidence. While the AHP group reported significantly higher "speed" and "understanding," and significantly lower "difficulty," there was no significant difference in decision "effectiveness" or "consistence." Vickery offers several plausible explanations of why this could be the case, including the possibility the case was too simple. One interesting result was every person in the control group used an ad hoc method which was similar to the AHP, lending credence to the theory that the AHP "facilitates the innate decision making process" as suggested by Cook (1986).

1.3 Conclusions and Recommendations of This Research

It is the conclusion of this research that formal decision analysis should be used to improve the source selection process. In particular, decision analysis would assist evaluators in structuring this important problem, ascertaining the criteria upon which the decision should be based, deriving weights for these criteria, and evaluating contractor proposals against these criteria. Moreover, decision analysis would facilitate a more logical and consistent synthesis of judgements into a final ranking of contractor proposals.

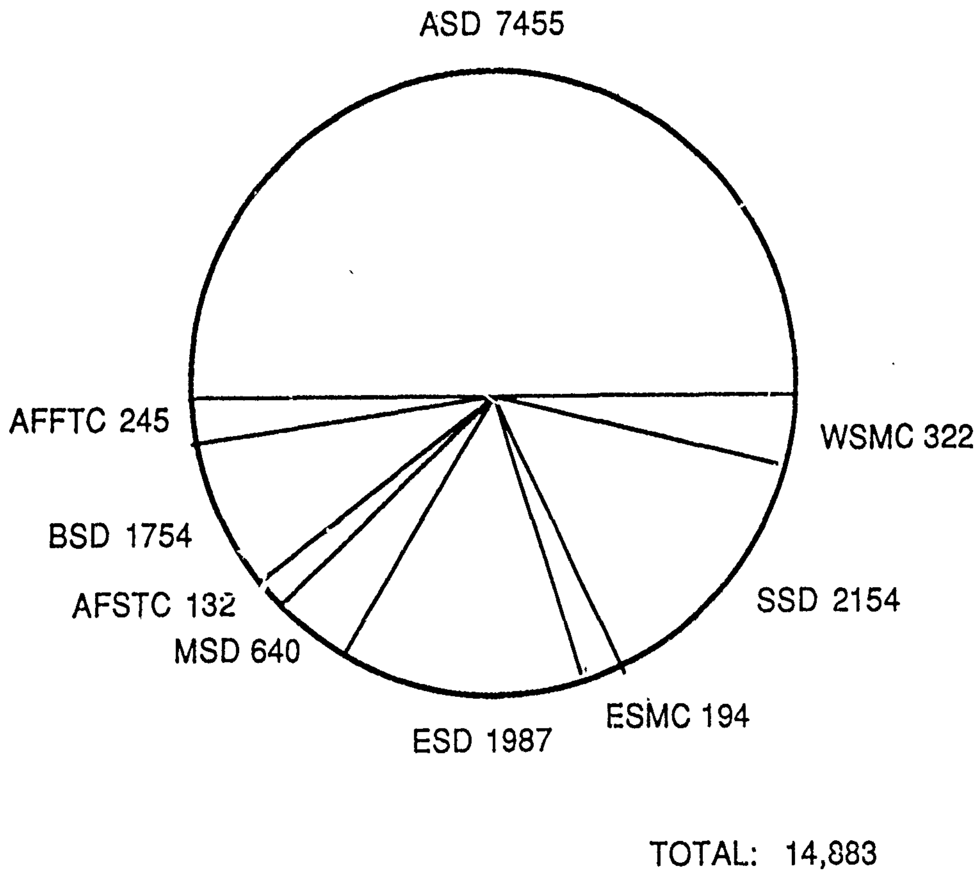
1.4 Organization of the Paper

In Section 2, we describe the current U.S. Air Force source selection process to include organizational structure, individuals involved and their responsibilities, stages of the source selection process with emphasis on the evaluation and decision methods. Advantages and disadvantages of the current process are discussed, and areas for improvement are identified. An actual case study is introduced which provides the basis for the MAUT and AHP models developed in Sections 4 and 5. Section 3 discusses decision analysis with emphasis on the fundamental process, advantages and disadvantages. In Section 4, MAUT is described, applied to the actual case, and its deficiencies and advantages noted. Section 5 provides an analogous discussion and application of the AHP. Finally, conclusions and recommendations for further research are discussed in Section 6.

2. CURRENT SOURCE SELECTION PROCESS

2.1 The Magnitude and Importance of the Source Selection Problem

Source selection involves billions of dollars each year and employs thousands of people within the Department of Defense. In fiscal year 1988, within Air Force Systems Command alone, there were approximately 15,000 contracting actions worth about $23 billion. These actions were divided among the product divisions as illustrated in Figures 1 and 2.



ASD: Aeronautical Systems Division
AFFTC: Air Force Flight Test Center
BSD: Ballistic Systems Division
AFSTC: Air Force Space Test Center
MSD: Munitions Systems Division
ESD: Electronic Systems Division
ESMC: Eastern Space and Missile Center
SSD: Space Systems Division
WSMC: Western Space and Missile Center

FIGURE 1: Number of Contracting Actions, U.S. Air Force Systems Command, FY 1988

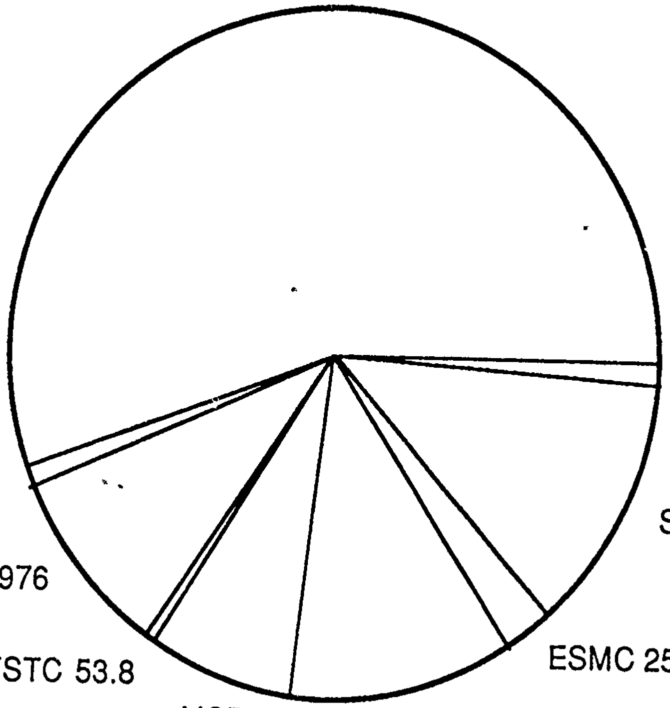


FIGURE 2: Value of Contracting Actions, U.S. Air Force Systems Command, FY 1988

2.2 Organization of Source Selection

The source selection process can be overwhelming given the complexity of modern weapons systems. In the last twenty years Congress has attempted on several occasions to improve the systems acquisition process, beginning with the Hearings before the Senate Armed Services Committee in December of 1971 and ending with their latest review conducted by the Packard Commission in 1986 (c.f. Smith, et al (1987)).

The Air Force has outlined the systems acquisition process and procedures in regulations and directives. Of particular interest to this research is Air Force Regulation 70-15. AFR 70-15/AFFARS, Appendix AA, describes a typical source selection organizational structure. See Figure 3.

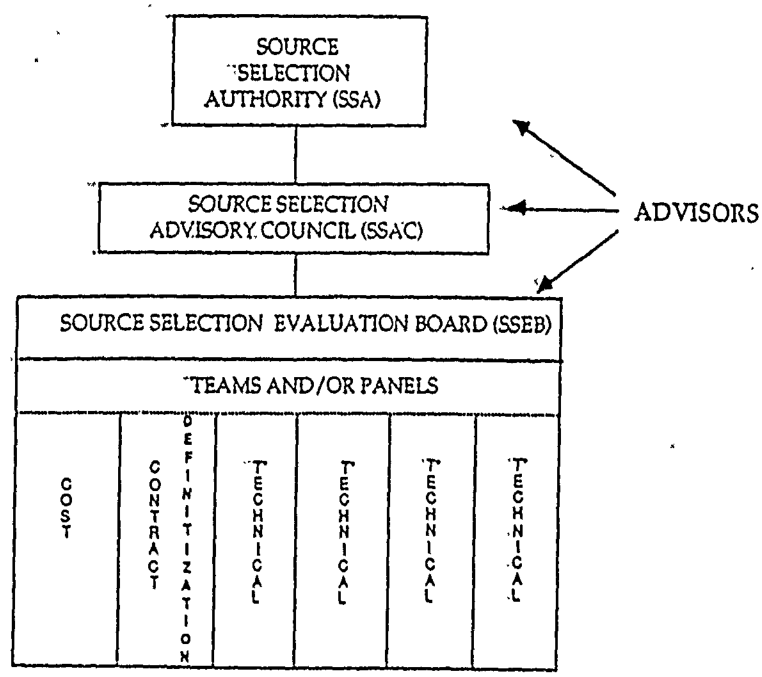


FIGURE 3: Source Selection Organization

Source selection activity is structured hierarchically which provides the *depth* and the *breadth* needed to evaluate the merits of the contract proposals. The Source Selection Authority (SSA) is the individual who will decide the contract winner. He/she has available the guidance, advice and expertise of the Source Selection Advisory Council (SSAC). The SSAC is composed of senior government personnel with extensive source selection experience.

The Source Selection Evaluation Board (SSEB) however, conducts the detailed evaluations. The SSEB is divided into "Item Teams," which comprise the SSEB. These are charged with evaluation of a specific area of the contract proposals. Each Item Team contains several members, each with expertise and experience relevant to the team's assigned area of responsibility.

The System Program Office (SPO) manages the entire acquisition process and oversees contractor performance. The SPO often employs a "matrix" organizational structure to obtain the technical services and expertise of others not formally assigned to the SPO.

2.3 A Brief Overview of Source Selection

Once the Source Selection Plan (SSP) is developed by the SPO, with the advisement of the Business Strategy Panel, and approved by the Source Selection Authority, the SPO prepares a final solicitation for potential contractors who intend to bid for the contract. Prospective contractors respond to the government's solicitation within a specified time frame with proposals clearly describing how they intend to meet the government's expectations. When the government receives the proposals, the source selection has officially begun. Figure 4 shows a time line for a typical source selection.

The evaluation of the proposals is perhaps the most difficult aspect of source selection, and is certainly the most subjective. A myriad of technical, cost and managerial factors are considered in the source selection decision. Technical, cost and management experts are organized into "Item Teams," each tasked with investigating and evaluating a specific area of the proposals. These teams evaluate the proposals against the criteria specified in Source Selection Plan.

The evaluation criteria are defined as precisely and unambiguously as possible, but are often subject to contractor interpretation. This is because of the uncertainties involved with researching and developing new technologies. As a result, the Item Teams must also assess the risk inherent in the factors they are tasked to evaluate. The lack of operational test data often necessitates subjective assessments of risk.

SOURCE SELECTION EVENTS

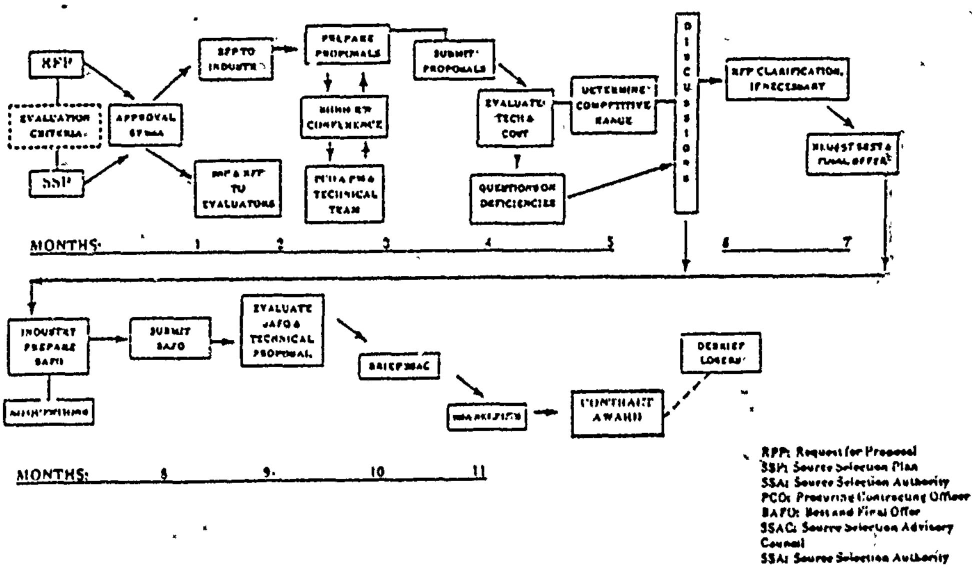


FIGURE 4: Time Line for Source Selection

In an attempt to gauge contractor performance, each Item Team must grade the contractor against the standards found in the original solicitation. As the example from AFR 70-15/AFFARS Appendix AA (Figure 5 below) shows, the government would evaluate the contractors' proposals against the following "evaluation (or assessment) criteria:"

1) Soundness of Approach

2) Understanding of the Problem

3) Compliance with Requirements

4) Past Performance.

Each "area, item and factor" of a contractor's proposal is graded using the following color code scheme:

(a) Blue: Exceptional. Exceeds specified performance or capability in a beneficial way to the Air Force; and has high probability of satisfying the requirements; and has no significant weakness;

(b) Green: Acceptable. Meets standards; and has good probability of satisfying the requirement; and any weakness can be readily corrected;

(c) Yellow. Marginal. Fails to meet evaluation standards; and has low probability of satisfying the requirement; and has significant deficiencies but correctable; and

(d) Red: Unacceptable. Fails to meet minimum requirement; and deficiency requires a major revision to the proposal to make it correct.

Figure 5, below, is an example of how this color scheme is employed.

EXAMPLE OF MATRIX EVALUATION

AREA: TECHNICAL DESIGN AND INTEGRATION

ITEM SUMMARY	↑ G (L)	Y (M)	Y (M)	R (H)	B (L)
SPECIFIC CRITERIA / ASSESSMENT CRITERIA	ITEM: RELIABILITY, MAINTAINABILITY AND PRODUCIBILITY	ITEM: SYSTEMS ENGINEERING AND INTEGRATION	ITEM: AIRFRAME DESIGN	ITEM: WEAPON CONTROL SYSTEMS DESIGN	ITEM: COMMUNICATIONS SUITE DESIGN
SOUNDNESS OF APPROACH	↑ G	↓ Y	Y	R	B
UNDERSTANDING OF REQUIREMENT	↑ G	Y	G	Y	B
COMPLIANCE WITH REQUIREMENT	G	Y	G	Y	G

FIGURE 5: Color Rating Scheme

As will be explained in more detail in subsequent sections, the assignment of color codes corresponds directly to describing the outcomes or values of the attributes for each decision alternative in the context of decision analysis. For example, the "Technical Area," might include the factor "System Engineering" and the item "Armament Integration." Armament Integration might be assigned a color "Green" and "Low" risk, implying that the alternative (the particular proposal being evaluated) is likely ("low" risk) to attain an acceptable ("Green") level of performance on this attribute ("Armament Integration").

2.4 Advantages of the Current Source Selection Decision Process

The current evaluation process, i.e. the assignment of colors and levels of risk to areas, items, and factors, is designed to ensure a thorough and complete evaluation. First, this coordination and review process includes high level, experienced individuals, who probably were evaluators themselves on past source selections. The source selection decision is reviewed by several independent agencies and individuals, from Headquarters Air Force Staff to the Product Division of Air Force Systems Command to which the SPO belongs. Second, feedback during the entire source selection process between the government and each contractor promotes communication, clarification of misunderstandings, and correction of discrepancies. The government also may solicit additional information or ask for clarification during Bidder's conferences before the formal portion of the source selection begins. Once the formal source selection begins (i.e. after the government receives the contractor proposals), the communication continues through contractor inquiries and deficiency reports.

2.5 Areas of Potential Improvement

Standardization among all source selections is insured by the regulations, directives, and policies of the Department of Defense, the Air Force, Systems Command and the individual Product Divisions. The "envelope" of operation is narrow enough to protect both the government and contractors yet flexible enough to promote creativity and innovation. Indeed, the Program Manager is encouraged to establish a flexible acquisition strategy.

The one area, however, most amenable to improvement is the evaluation of proposals and synthesis of these judgements to yield a ranking of the proposals. It is at this point in the source selection process the evaluators and decision makers could most benefit from decision analysis.

Numerical scoring, rather than the color rating scheme, was used previously but this method was de-emphasized with the introduction of AFR 70-15 in 1984 (Malishenko (1987) and ASD Pamphlet (1981)). The current policy, as stated in AFR 70-15/AAFARS Appendix AA, paragraph 3-4, is:

> b. Colors, symbols, or numbers may be used to indicate proposal ratings at the factor and subfactor level. At the item level, color codes shall be used to depict the rating that has resulted from applying the assessment criteria to the specific criteria in a matrix fashion. If the SSP requires a summary rating at the area level, color codes shall be used. Ratings must be accompanied by a consistent narrative assessment of the basis for the rating.
>
> c. If at any level of indentation, a contractor's proposal is evaluated as unacceptable (fails to meet minimum requirements and deficiency requires major revision to the proposal to make it correct, e.g. color code is red), this fact must be included in the rating and narrative assessment at that element level and each higher element of indentation. Therefore, a red or unacceptable rating at any level must be carried to the highest level.
>
> d. The following elements are not rated:
>
> (1) financial capability, Production Readiness Reviews, and preaward surveys, although these may be considered by the SSAC.

(2) Cost (or price), although these may be weighted by the SSAC.

e. Color codes are mandatory at the item level, and if areas are rated, color codes shall also be used for the areas. There are alternative methods that may be used at the factor and subfactor level to accomplish the rating. (p. 15)

In our view, the current evaluation process suffers from the following deficiencies:

1. It is inconsistent, in that colors, numbers and/or symbols can be used to in the same evaluation.

2. There is no theoretically sound way to synthesize the many judgements into a consistent, logical, and defensible conclusion using the current procedures.

3. Color ratings do not permit enough refinement for the required judgements.

4. The current process is consistent with accepted or traditional decision analysis until the evaluation and synthesis phases. "It's close, but...."

5. Areas, items, factors, and subfactors defined in the Source Selection Plan precisely define a hierarchical model of the source selection decision problem. Such models are common, well known, and have been thoroughly studied in decision analysis.

6. The areas, items, factors, and subfactors important to the decision are, at best, listed only by order of importance. Measures of the relative importance among them are not provided.

7. Financial considerations can easily be incorporated as important areas, items, factors, or subfactors in the decision model. If they are considered by the SSAC, they should be included in the model.

Next, we present a case study to which decision analysis will be applied to test its usefulness, efficacy, and benefit.

2.6 Case Study

Before introducing decision analysis and applying it to source selection, we describe an actual source selection currently in progress. The sensitive nature of source selection precludes us from identifying the particular weapons system and contractors involved. We do describe, however, the actual criteria which were used in the evaluation of the proposals. The particular evaluations provided for the case are fictitious, again with the intent of protecting confidentiality.

This source selection involves four potential contractors. Four areas will be evaluated. These are listed below in descending order of importance along. Additionally, each area is further broken down into its constituent items.

(1) Technical
- Reliability/Maintainability
- Producibility/Quality
- Systems Engineering
- Flight Systems
- Avionics
- Support Systems

(2) Supportability
- Organizational Structure
- Management Policies, Practices and Planning
- Supportability Program Implementation
- Logistics Capabilities

(3) Management Capability
- Program Management
- Future Competition
- Systems Test
- Manufacturing
- Quality Assurance
- System Safety
- Training Systems Management
- Security

(4) Cost
- Realism
- Reasonableness
- Completeness

Each item is further broken down into factors, and factors further broken down into subfactors. The complete listing of areas, items, and factors for this case is provided in Appendix 1, where they appear in an indented paragraph format.

Each of the areas, items, and factors is rated against the following criteria:

(1) Soundness of Approach

(2) Understanding of the Problem

(3) Compliance with Requirements

(4) Past Performance

Each of the criteria are assumed to be of equal importance.

3. DECISION ANALYSIS (DA)

As the complexity in a decision problem increases, the objective data available decreases, thereby forcing the decision maker to rely more on subjective judgements. In these instances, the literature shows that making decisions by a holistic or intuitive approach rarely suffices. A decision maker cannot mentally assimilate, simultaneously consider and cognitively process all the information involved in a complicated decision problem. Decision analysis (DA) is intended to assist the decision maker; it is intended to promote logical consistent and rational analysis to yield "good" decisions." To quote, Keeney (1982):

> *Decision analysis is the formalization of common sense for decision problems which are too complex for informal use of common sense. (p. 806)*

In this paper, we consider tow decision analysis methodologies within the purview of DA: multiattribute utility theory (MAUT) and the analytic hierarchy process (AHP).

Decision analysis can be either descriptive or normative. Descriptive decision analysis is the way decision makers actually make decisions, whereas normative decision analysis is the way decision makers should make decisions, according to some prescribed theory. The descriptive research (Kahneman, Slovic & Tversky, 1982, and von Winterfeldt and Edwards, 1986) shows decision makers almost invariably violate the normative approaches to decision making. These two fields of research are not necessarily distinct. A normative theory should be based upon an axiomatic foundation that is congruent with the way humans actually think about decisions. The objective of normative decision analysis is, as Keeney (1989) states, to help decision makers make more informed and better decisions.

The major players during a DA are the decision maker(s) (and delegated experts) and decision analyst(s). The decision maker is the expert in the decision domain, whereas the decision analyst is an elicitor, formulator, and evaluator of information and preferences; he is not necessarily an expert in the problem domain, although he does become very familiar with it through interaction with the experts and decision makers.

There are several popular misconceptions about DA. Decision analysis is not a replacement for the decision maker, simply a "decision tree," a computerized "black box," or a rigid approach that provides the de facto solution to the decision problem. Instead, decision analysis is a process with the purpose of *helping* the decision maker make "better" decisions. Decision analysis provides the necessary framework for making *consistent, logical, communicable and defensible decisions.* Decision analysis focuses the attention of the decision maker on the important, as determined by the decision maker, aspects of the problem. Howard (1988) summarizes DA as:

A systematic procedure for transforming opaque decision problems into transparent decision problems by a sequence of transparent steps. Opaque means "hard to understand, solve, or explain; not simple, clear, or lucid." Transparent means "readily understood, clear, obvious." In other words, decision analysis offers the possibility to a decision maker of replacing confusion by clear insight into a desired course of action. (p. 680)

Decision analysis employs an analytic approach, intended to "divide and conquer" a complex problem. It first decomposes the decision problem into its component parts:

1. alternatives: choices or possible courses of action
2. outcomes: possible consequences for a particular choice
3. likelihoods of outcomes: possibility that an outcome will occur.

This decomposition allows the decision to be broken into manageable pieces to facilitate understanding, insight and focused analysis. When a complex problem is sufficiently decomposed and defined as to promote clear understanding and communication, we will say it has passed the clarity test. Howard (1989) uses this term also, but in a more restricted sense. We will use the term to mean:

> *clearly defining all the decision problem components, characteristics and relevant information so the decision maker and decision analyst have a common understanding of the problem at hand.*

Often an unsuccessful DA can be ultimately traced to failure of the clarity test. Once the clarity test is passed, the decision analyst elicits information and preferences from the decision maker. A structured model of the decision problem is constructed next. Then, the decision analyst aggregates or synthesizes the judgements and information provided by the decision maker into a logical, consistent, rational and communicable conclusion.

Decision analysis is an iterative and interactive process (see Figure 6) encompassing four basic steps:

1. formulate
2. evaluate
3. refine
4. act

Each of these steps requires the decision maker's "blessing" before the DA proceeds to the next step. *The interaction between*

Each of these steps requires the decision maker's "blessing" before the DA proceeds to the next step. *The interaction between the decision analyst and decision maker is central to a successful and credible DA.*

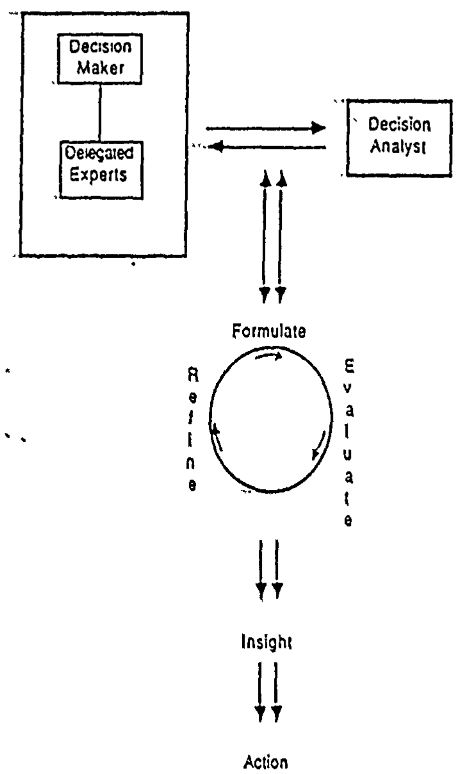


FIGURE 6: The Decision Analysis Process

Figure 7 depicts these four basic steps. The "formulate" step is the foundation for the rest of the analysis--without a clear understanding and representation of the problem, the analysis is flawed from the start, and, in essence, a "solution" for the "wrong problem" is the result.

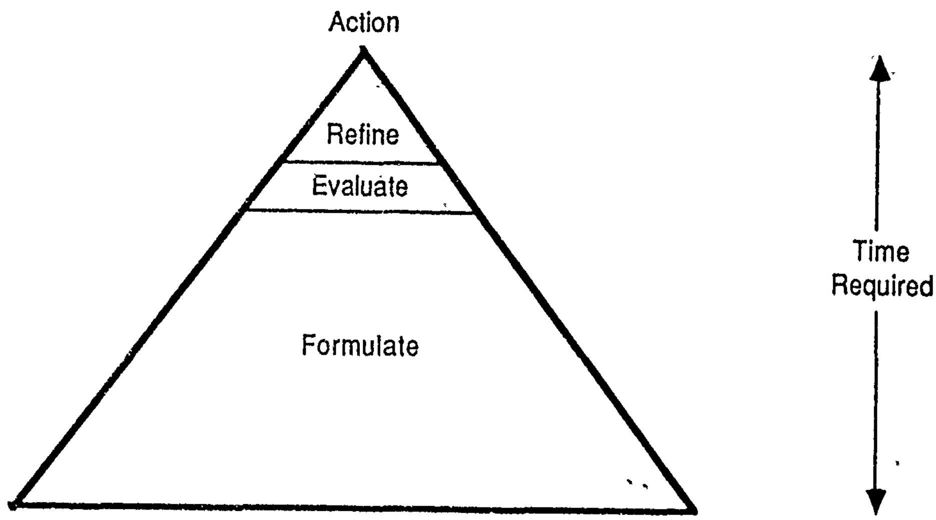


FIGURE 7: Relationship Between the Steps of Decision Analysis

Formulation involves identifying the problem, decomposing the problem into its constituent components, gathering information, clarity testing, and specifying model assumptions. During this step, the decision analyst elicits information and judgements from the decision maker. This interaction helps the decision analyst construct a model, or representation, of the decision problem. The level of detail included in and the complexity of the model depends upon the decision and decision maker; however, keeping the model as simple as possible while still capturing the essential characteristics of the decision problem is the objective. Once the model is constructed, the decision maker and the decision analyst discuss the model and it's implications. This formulation or model building step is the most time consuming step (as shown in Figure 7). Once the decision maker agrees with the representation of the problem, the analysis progresses to the next step: evaluation.

Evaluation is the step wherein the preferred alternative is determined according to the theory and methodology of the particular decision analysis technique being employed. For MAUT, the alternative yielding the "highest expected utility" is the preferred one (von Neumann and Morgenstern, 1947). For the AHP, the preferred alternative is the one with the "highest composite priority, importance, or weighting" (Harker, 1989).[1] The reader nterested in the axiomatic foundation and theory of MAUT and the AHP are referred to Keeney and Raiffa (1976) and in Saaty (1986, 1988) respectively. At a minimum, the evaluation step will include a decision recommendation and sensitivity analysis.

The next step is the refinement of the model. In this step, the analyst reviews the results with the decision maker for accuracy of assessments and reasonableness of the conclusions. Discrepancies help to isolate areas of the analysis requiring further attention and revision, thus the iterative nature of DA. If the decision maker is not satisfied with the analysis or if new information is available, the decision maker and analyst will iterate back through any or all of the previous steps. This refinement step allows the decision maker flexibility and promotes a better understanding and further insight into the problem. The final step, action, is self-explanatory.

The following quote from Howard (1980) summarizes the essence of decision analysis:

> *Decision analysis serves as vehicle for focusing all the information of experts that the decision maker may wish to bring to bear on the problem while leaving the decision maker free to accept, reject, or modify any of this information and to establish preference. (p. 7)*

The next sections provide an overview of MAUT and the AHP, illustrate the application of MAUT and the AHP to the case study, and discuss advantages and disadvantages of MAUT and the AHP.

1 The concepts of "expected utility" and "composite priority, importance, or weighting" will be discussed subsequently in sections 4.2 and 5.2.

4. APPLYING MAUT TO THE SOURCE SELECTION PROBLEM

4.1 Overview of MAUT

Most decisions involve uncertainty, risks, and conflicting objectives. MAUT allows for the modeling of such decisions in a logical, communicable and rational manner, consistent with the axioms of utility theory as defined by von Neumann and Morgenstern (1947). Uncertainty and risk are inherent in source selection. Likewise, source selection includes conflicting objectives, e.g. maximizing performance and minimizing cost.

Even though most decisions are complex, involving uncertainties, risks, and conflicting objectives, MAUT can be used to capture the decision maker's preferences, organize and systematically incorporate information relevant to the particular decision problem. This requires interaction between the decision maker and the decision analyst. Uncertainties are modeled by the use of probability theory. Probability is the state of knowledge or belief concerning an unknown future outcome. Risk is handled through the use of utility theory. Utility is a measure of the value the decision maker attaches to a particular outcome. Utility theory requires the decision maker to answer a series of gamble or lottery type questions of the form:

> "Which do you prefer a sure $1000 or the gamble: a 50-50 chance of winning $4000 or losing $2000?

The decision maker's responses to these questions provide insight into his/her attitude toward risk, as embodied in the decision problem at hand. This is because the lottery questions are constructed using the profits and costs relevant to the problem of interest to the decision maker. Conflicting objectives require the decision maker to make tradeoffs. Once the uncertainties, risk, and objectives are modeled, synthesis is accomplished by computing the weighted average of the probabilities and utilities, called expected utility.

The "best" course of action is the alternative with the highest expected utility. Maximizing expected utility requires the decision maker to behave in the (normative) manner dictated by the underlying theory of MAUT. The decision maker must follow the axioms of utility theory (Savage, 1954) or what Howard (1988) calls the "rules of actional thought." These intuitively appealing "rules" are descriptive of actual decision making. They are:

> Rule 1: All outcomes can be ordered by the decision maker according to his intrinsic preferences.

> Rule 2: Given the choice between a gamble of the worst and best outcome, and an certain outcome, the decision maker can adjust the likelihoods of the best and worst outcomes until he is indifferent between the gamble and the certain outcome.

Rule 3: The decision maker can substitute the gamble for the certain outcome without changing his preference structure.

Rule 4: Given two alternatives, the decision maker would select the alternative which yields the highest chance of receiving the best outcome.

Rule 5: Independence of uncertainties is handled through probability theory.

Keeney (1977) provides a very readable account of how one puts multiattribute utility theory into practice. Keeney's paper includes a typical dialogue between the decision analyst (Keeney) and the decision maker. Typical implementation of MAUT is accomplished in three phases: model formulation, evaluation of the model, consistency checking and modification.

Model formulation includes: generating alternatives; clearly defining attributes and their outcomes, and likelihood of those outcomes; and determining the utility function. Determining the utility function is time consuming and requires an experienced and trained decision analyst. In particular, the decision analyst must verify independence assumptions, assess indifference tradeoffs among attributes, and assess the decision maker's utility functions for each of the attributes.

The second step is evaluating the model using expected utility theory. Also, sensitivity analysis is conducted to provide additional insight into the decision problem.

The final phase provides the decision maker with consistency checks, and the model is modified if a consistency check fails.

Corner and Kirkwood (1988) provide a bibliography of MAUT applications. Additionally, Goren (1981) discusses the potential for applying Edwards' (1977) Simple Multiattribute Rating Technique (SMART), a simplified version of MAUT as presented in Keeney and Raiffa (1976), to source selection. MAUT has been successfully applied in a wide range of areas including energy, manufacturing, medicine, services, and public policy. Applications of MAUT have proven effective in contractor selection for energy supplies, evaluating solar energy project proposals, and the determination of development strategies for 542 proposed Norwegian hydroelectric projects. These applications illustrate the ability of MAUT to assist in the solution of decision problems with characteristics similar to those of the source selection problem.

4.2 Applying MAUT to the Source Selection Case Study

The application of MAUT to problems of similar scope and structure as source selection and the valuable insight that resulted from each provide ample support for the use of MAUT in source selection decisions. However, applying MAUT to the source selection problem requires the development of a different protocol than is presently used in source selection.

The decision maker must be identified, who then delegates experts to act in his behalf. Each expert would represent the various functional and technical disciplines relevant to the particular acquisition. These experts would familiarize themselves with the standards and contract requirements of the acquisition project. This effectively creates the foundation from which the model will be developed. The model should capture the decision maker's (expert's) knowledge, information and preferences concerning the source selection. Therefore, using MAUT in Air Force source selections requires a departure from the current process. However, MAUT offers a logical, defensible, and consistent approach to the source selection decision process. The next few paragraphs illustrate how MAUT could be applied to the source selection case study described in Section 2.

We applied MAUT to the source selection case study following the three phases outlined in 4.1. The first phase calls for the formulation of the model. This requires the generation of the possible decision alternatives, a step that is easily accomplished in a source selection decision problem. Alternatives are simply contractor proposals. For the case study, there were four contractors. This phase also requires the determination of attributes, which dictates the structure of the model. These attributes are determined by interaction between the decision analyst and the decision maker/experts. For a successful decision analysis, attributes must be clearly defined and understood. If necessary, this will require the decision maker to decompose or refine the attribute into lower levels, i.e., items, factors, and subfactors. The level of detail required is determined through interaction with the decision analyst and the decision maker. The decision analyst clarifies the attributes which must be examined by helping to focus the expert's attention and thought. The detail required to clearly define each attribute is problem specific and depends on the importance as well as the scope of that attribute. An attribute should only be broken down to the level at which the experts can make confident judgements.

For the case study, it was determined that four major attributes that were important in evaluating the decision. These attributes are: technical success of the weapon system, supportability of the weapon system (including logistic considerations), management capability of the contractor, and cost. Each attribute was broken down to the item level as outlined in Appendix 1.

Next, the possible outcomes of the source selection decision are determined. For the case study,the outcomes were the levels of performance or capability a proposal could achieve. These levels of success are the colors currently used in source selection: blue, green, yellow, and red, corresponding to exceptional, acceptable, marginal, and unacceptable performance.

The evaluation teams would next use expert judgement to assess the likelihoods of each contractor attaining these outcomes on each of the "items." The decision analyst elicits this knowledge in terms of probabilities. Spetzler and Stael von Holstein (1975) discuss techniques in assessing probabilities for uncertain outcomes. For the case study, the probability of technical success was influenced by reliability and maintainability of the system, producibility and quality of engineering, system engineering, flight systems, avionics, and support systems. Appendix 2 contains the assumed probabilities associated with the possible outcomes. These probabilities were determined at the item level (see Appendix 1).

The next step in formulating the model requires the decision analyst to determine the decision maker's intrinsic preferences structure for the various outcomes. He/she does this by eliciting "utility functions." In this step the decision analyst verifies independence assumptions, assesses indifference tradeoffs among attributes, and assesses the decision maker's utility functions for each of the attributes. Since these assessments are mostly mechanical, we provide only a summary account. Further discussion regarding utility function assessment can be found in Keeney and Raiffa (1976). From Watson and Buede (1987), preference independence is defined as:

> A pair of attributes, X1, X2, is said to be preference independent of all the other attributes {Xi, i = 3,...,n} if preferences between different combinations of levels of X1, X2, with the level of all other attributes being held at constant values, do not depend on what these constant values are. (p. 26)

Also, the decision analyst verifies utility independence. Again from Watson and Buede (1987):

> An attribute X is said to be utility independent of other attributes Y, Z,... if the decision maker's preference amongst gambles on X do not depend on the levels of the other attributes. (p. 64)

For the case study, we assumed both preference and utility independence.

Next, the scaling constants (or importance weights of attributes) are determined. Normally, this requires the decision maker to make tradeoffs among attributes. For the case study, we assumed reasonable scaling constants. Once independence is assumed and scaling weights are assessed, the functional form of the utility function can be determined. How the analyst determines the precise mathematical formula for the utility function is beyond the scope of this paper; the interested reader is referred to Bell (1979). Edwards (1977) suggests the additive utility function is a good approximation to many actual utility functions. We thus assumed, for illustrative purposes, the decision maker for this case has an additive utility function of the form:

U(t, m, s, c) = Kt U(t) + Km U(m) + Ks U(s) + Kc U(c), where:

t is the technical attribute,

m is the management attribute,

s is the supportability attribute,

c is the cost attribute,

Kt is the importance weight for the technical attribute; likewise for Km, Ks, and Kc, and

U(t) is the utility function for the technical attribute, likewise for U(m), U(s), and U(c).

Sample calculations are contained in Appendix 2. Utility functions for each attribute were assessed by the method presented in Keeney (1977) and Farquhar (1984).

Next, the model is "evaluated." MAUT dictates that the preferred alternative is the one with the highest expected utility. This computation is accomplished by "rolling back" the decision tree as outlined in Raiffa (1968).

Appendix 2 contains a MAUT model representing the case study of Appendix 1. The model represents four alternatives (contractors) and four attributes (technical, supportability, management, and cost). It also contains two or three outcomes (blue or green or yellow) for each attribute. The resultant model is represented in a large decision tree (122 end points). Of the software packages ARBORIST (Samson, 1988), SUPERTREE (McNamee and Celona, 1987), and EXPRESSION TREE (Cheung and Kirkwood, 1989), only EXPRESSION TREE had the capability to handle a model of this size. This package required only that eighteen nodes be entered and was easy to use.

The MAUT analysis resulted in contractor C as the preferred alternative. Sensitivity analysis of the technical attribute was conducted by varying the likelihood of obtaining a "blue" or "green" outcome. We also tested the sensitivity of the decision to the scaling constants for the utility functions (Kt, Ks, Km, and Kc). Contractor C remained the preferred choice over all ranges for these parameters. Such an analysis would not have been possible without a software package like EXPRESSION TREE.

The last phase when applying MAUT to source selection is checking for consistency in the model and reasonableness of the utility function assessments, and, if necessary, revision and reassessment. Typically, the decision maker would review the model and preliminary results to ensure that the utility function accurately represents judgments and risk attitude of the decision maker. Also, the probabilities associated with the outcomes are reexamined and reassessed if necessary.

4.3 Advantages of MAUT

There are several advantages that MAUT provides over the present decision method of source selection. The biggest reservation about the use of a quantitative methods in decision analysis is doubt about the ability to incorporate the subjective aspects of the decision. Huber, et al (1969) have examined studies that strongly indicate that *professionals can develop and reliably use subjective evaluation models*.

The *insight* provided by the hierarchical decomposition of the problem certainly can not be overlooked. The decision problem is broken down into manageable pieces and the important aspects of the problem are presented in a logical, consistent and rational manner. Much of the benefit of using MAUT comes from the in-depth look at the problem and *clarification of the important aspects of the problem* which are essential for the development of an adequate model. In particular, *communication is enhanced* because of the necessity to focus discussion on important issues and to force the decision maker to organize and structure his or her thinking. Overall, a greater understanding and familiarity with the decision at hand is facilitated by model building. This is an important characteristic of this process.

Another important aspect of MAUT is the *ability to incorporate sensitivity analysis* into its structure. The probabilities, scaling constants, and utilities associated with a model can be varied through a range of possible *values to examine the effects on the decision*. Some areas may prove so insensitive that no value would change the end result, whereas others may be very sensitive to changes in model parameters. Thus, sensitive areas can be identified, *effectively drawing attention to the critical aspects of a particular acquisition problem*. This sensitivity analysis provides further insight into the decision problem.

One final notable advantage of MAUT over the current source selection decision process is separating the analyst role from the experts. The current process requires the source selection evaluators to be both technical expert and decision analyst. By separating the two, the expert can concentrate on knowledge and information concerning the decision problem, while the analyst concentrates on modeling and analyzing the decision problem as perceived by the decision maker(s). However, both must interact and communicate clearly in order to conduct an effective decision analysis. Separating the experts and analysts would most likely provide a more independent, unbiased, and objective source selection evaluation. In the course of asking questions to develop the model, the decision maker could be presented with a new angle or problem characteristic not previously considered. In summary, the use of an independent decision analyst would serve as a check on the source selection process to ensure that the model and evaluations are truly reflective of the decision maker's thinking.

4.4 Disadvantages of MAUT

There are disadvantages associated with incorporating MAUT into source selection. Howard (1980) notes *the quality of the analysis depends critically on the quality of the decision analyst.* Model clarity, realism and usefulness are directly impacted by the analyst's abilities.

Because MAUT involves a departure from the current source selection process, *there will undoubtedly be resistance to change.* But, just because the decision analysis process is involved and different from current methods does not mean it shouldn't be used. Howard draws this analogy (1980):

> *Because effective brain surgery is difficult does not mean that there is anything wrong with it. I would no more expect a person with little training to complete an effective decision analysis than I would expect him to perform a successful brain operation. (pp. 14-15)*

5. SOURCE SELECTION PROCESS USING AHP

5.1 Overview of AHP

The AHP is a relatively new method developed by Professor Thomas L. Saaty of the University of Pennsylvania. He began development of AHP in the early 1970's and the process continues to be refined and improved today. While the AHP is not without adamant opponents (discussed below in Section 5.5) there have been many applications to aid the analysis of complex decision problems with new applications appearing in the literature nearly every day. Golden, et al (1989), Saaty (1988) and Zahedi (1986) give an extensive list of applications in such diverse areas as conflict resolution, portfolio selection, budget allocation, accounting and auditing. There have been several conferences and special journal issues devoted exclusively to the AHP.

At the risk of oversimplification, the AHP proceeds basically as follows:

1. Analyze the components of the decision problem. This involves determination of the decision goal, criteria, sub-criteria, attributes and alternatives.

2. Specify how the components are related. Delineation of the components and relationships results in a hierarchical model of the decision problem.

3. For criteria, sub-criteria, and attributes at the same level of the hierarchy, determine the relative importance, priority or weighting of the corresponding criteria or sub-criteria. This is accomplished by the decision maker judging, usually in a pairwise fashion, which criterion is more "important" than the other and specifying how much more important on a nine point scale. This step will result in a priority of criteria, sub-criteria and attributes with each receiving a numerical rating. The priorities of criteria, sub-criteria and attributes of the same level of the hierarchy are positive and sum to one. A "consistency ratio" is calculated to assess how consistent the decision maker was in his pairwise comparisons.

4. Alternatives are then compared by the decision maker, again in a pairwise fashion, with respect to each criteria, sub-criteria or attribute at the level of the hierarchy just above the alternatives. He or she judges which of the two alternatives measures higher on the associated attribute, and specifies, again on a nine point scale, by how much higher. These assessments are conducted either verbally, graphically, or numerically. This step results in a relative score for each alternative with respect to each criteria, sub-criteria, or attribute, with scores being positive and summing to

one. A measure of consistency is again calculated for these comparisons.

5. Judgements are synthesized to determine an overall composite priority for each alternative. The alternative with the highest composite priority is the preferred alternative.

5.2 An Example of the AHP

An example, taken from Saaty (1988), will serve to illustrate the fundamentals of the AHP. The goal of the decision problem is to select the "best" school to attend from among three alternatives: A, B, or C. The decision is to be based upon six criteria: learning (L), friends (F), school life (S), vocational training (V), college preparation (C) and music classes (M). After completing steps 1 and 2, the hierarchical model is depicted below:

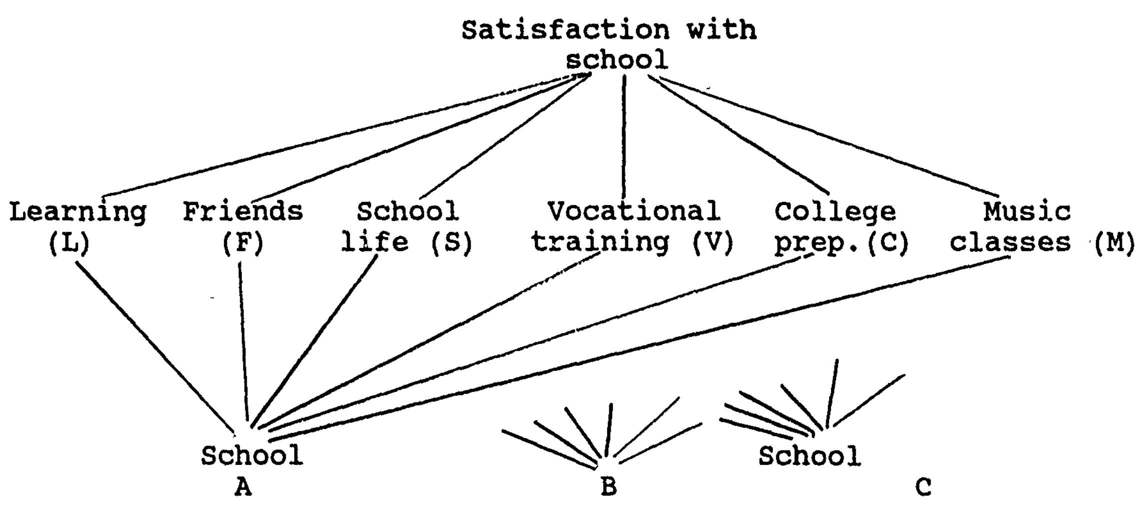


FIGURE 8: Example AHP Model

Step 3 of AHP proceeds with the decision maker comparing the six criteria in a pairwise fashion to determine the relative importance of each. He or she would be asked a series of questions like the following:

> "With respect to the overall goal of satisfaction with the school chosen, which is most important in the decision: Learning or Friends?"

Assuming the decision maker indicated that Learning was more important, he would then be asked:

"Indicate how much more important Learning is than Friends on the scale below:

1. Equally important
2.
3. Weak importance of one over the other.
4.
5. Essential or strong importance.
6.
7. Very strong or demonstrated importance.
8.
9. Absolute importance."

(NOTE: 2, 4, 6, and 8 are simply intermediate values between adjacent scale values.)

Pairwise comparisons would be made for all possible pairs of criteria and the results summarized in a "comparison matrix," like the one below. The entry in the ith row and jth column is the relative importance of criterion i with respect to criterion j according to the above scale. Notice that the matrix is a reciprocal matrix with the entry in the ith row and jth column being the inverse of the entry in the jth row and ith column.

	L	F	S	V	C	M
L	1	4	3	1	3	4
F	1/4	1	7	3	1/5	1
S	1/3	1/7	1	1/5	1/5	1/6
V	1	1/3	5	1	1	1/3
C	1/3	5	5	1	1	3
M	1/4	1	6	3	1/3	1

TABLE 1: Comparison Matrix for Criteria

The relative weighting or importance of for each criteria is determined from the pairwise matrix.[2] In this instance, the weights of the criteria are:

L	F	S	V	C	M
0.32	0.14	0.03	0.13	0.24	0.14

2 These weights or importance values are obtained from the normalized eigenvectors of the pairwise comparison matrix which corresponds to the maximum eigenvalue. The interested reader is referred to Saaty, (1988).

TABLE 2: Relative Weights of the Criteria

A measure of consistency, called the consistency ratio (C.R.) is then calculated.[3] A C.R. of less than 0.10 is considered by Saaty to be acceptable, whereas a C.R. above 0.10 would suggest that the comparisons be reaccomplished. The C.R. for the above comparison matrix is a relatively inconsistent 0.24, implying this decision maker should be asked to reaccomplish these pairwise comparisons

Step 4 compares, again in a pairwise fashion, the alternatives with respect to each of the criteria. These comparisons are summarized in the reciprocal matrices below:

With respect to: Learning

	A	B	C
A	1	1/3	1/2
B	3	1	3
C	2	1/3	1

C.R. = 0.04

With respect to: Friends

	A	B	C
A	1	1	1
B	1	1	1
C	1	1	1

C.R. = 0.00

With respect to: School life

	A	B	C
A	1	5	1
B	1/5	1	1/5
C	1	5	1

C.R. = 0.00

With respect to: Vocational trng.

	A	B	C
A	1	9	7
B	1/9	1	1/5
C	1/7	5	1

C.R. = 0.18

With respect to: College prep.

	A	B	C
A	1	1/2	1
B	2	1	2
C	1	1/2	1

C.R. = 0.00

With respect to: Music classes

	A	B	C
A	1	6	4
B	1/6	1	1/3
C	1/4	3	1

C.R. = 0.04

TABLE 3: Comparison Matrices for Alternatives with Respect to Criteria

The relative scores of each alternative with respect to each criteria are given in the Table 4 below.

School	Learning	Friends	School life	Vocational training	College prep.	Music classes
A	0.16	0.33	0.45	0.77	0.25	0.69
B	0.59	0.33	0.09	0.05	0.50	0.09
C	0.25	0.33	0.46	0.17	0.25	0.22

3 The interested reader is again referred to Saaty (1988) for a detailed discussion of "consistency ratio."

TABLE 4: Relative Scores of the Alternatives with Respect to the Criteria

Step 5 combines the relative scores with the weights of the criteria in a straight forward multiplicative fashion to obtain the composite priority for each alternative. The composite priority for a particular school is obtained by multiplying each score for that school (Table 4) by the corresponding weighting for the criterion (Table 2) and summing the resultant products. For example, the composite priority for school A is:

0.16*0.32 + 0.33*0.14 + 0.45*0.03 + 0.77*0.13 + 0.25*0.24 + 0.69*0.14 = 0.37

The composite priorities for the alternatives are:

School	Composite Priority
A	0.37
B	0.38
C	0.25

TABLE 5: Composite Priorities of Alternatives

Thus, schools B and A are almost equivalently preferred over C by this decision maker.

There is much more to the AHP than has been described here. The above discussion is not intended to be a complete treatise on the AHP, but instead to provide the reader with a "feel" for the "mechanics" of the process. The reader is referred to Saaty (1988) for the details, rationale and theory underlying the AHP.

5.3 Applying the AHP to the Source Selection Case Study

The AHP is well suited for application to the source selection problem. The most appealing feature of the AHP for this problem domain is its capability to incorporate, in a logical, rational and consistent way, the subjective judgements of the decision maker. As Vincze (1990) recently stated in his review of the AHP as embodied in the *EXPERT CHOICE* (1990) software package:

> Initially, the feature that interested this reviewer is that *EXPERT CHOICE's* decision analysis does not require numerically based judgements. EC allows subjective judgement about aspects of a problem for which no scale of measurement exists. Again, quoting from the manual, "*Your* subjective judgements are applied in a systematic way to solve your problems. Expert Choice does not make a choice for you in some mysterious way, but helps you to

make an expert choice based on your knowledge, experience, and preferences." (p. 10)

Other advantages that suggest the application of AHP to the source selection problem are ease of use, readily available and relatively inexpensive software (EXPERT CHOICE (1990), CRITERIUM (1989)), and intuitive appeal. Most importantly though, the current source selection process might be improved through a more systematic, rational and consistent evaluation of alternatives and synthesis of judgements into a priority of alternatives.

In the remainder of this Section we describe the application of the AHP to the case study introduced in Section 2.

In Section 5.1, we described the AHP and the basic process embodied in the following five steps:

1. Analyze the problem components.

2. Specify component relationships.

3. Determine relative importance of each component.

4. Compare alternatives with respect to each criteria.

5. Determine each alternative's composite priority.

It is interesting at this point to investigate the correspondence between the current source selection process and the AHP as embodied in the above five steps. The current source selection process clearly accomplish steps 1 and 2 by defining the areas, items, factors, subfactors, and assessment criteria. In fact

> *the areas, items, factors, subfactors, and assessment criteria clearly defines the hierarchical model of the source selection problem as viewed by the Source Selection Advisory Council and the Source Selection Evaluation Board.*

That is to say, the areas, items, factors, subfactors, and assessment criteria for the case study, as provided in Appendix 1, is *equivalent to the hierarchical model* of Appendix 3.

Step 3 is also addressed in the current source selection process. The Source Selection Advisory Council lists the criteria of importance in the source selection in descending order of importance. This ordinal ranking of criteria is even communicated to the potential contractors. Moreover, the System Program Office often precisely and numerically specifies the relative importance of the criteria. Usually, however, these weights are determined in an ad hoc manner. But,

> *the AHP provides a theoretically based, systematic, intuitively appealing methodology to incorporate and summarize the decision maker's subjective judgements into the required relative weights.*

The comments regarding Step 3 apply equally to Step 4. The AHP assists the decision maker to consistently, systematically, and subjectively judge how well each alternative satisfies the criteria important for the decision problem at hand. In the case of source selection, this evaluation step is performed by the separate "Item Teams" as described in Section 2.

There are two ways of evaluating alternatives in the AHP:

1. pairwise comparisons between alternatives using relative measurement,

2. evaluation of each alternative with respect to each criterion using absolute measurement.

For the fourth step, we used absolute measurement in lieu of pairwise comparisons as discussed above. The color rating scheme is the basis of the absolute measurements used in our AHP model. For each criterion at the lowest level of the hierarchy, pairwise comparisons were initially employed to determine the relative importance of the colors with respect to each of these criteria. This permits item specific meanings for the color ratings. For example, the relative importance of " red" and "blue" will most likely be dramatically different when rating "System Safety" versus "Organizational Structure."

Another advantage of using absolute measurement is that potential of "rank reversal" (described in Section 5.5) is avoided.

Furthermore, regulations governing the source selection process prohibit comparisons between contractors; instead contractor performance is compared against standards established in the Source Selection Plan:

> 2-9a. The SSEB conducts its evaluation by measuring each proposal against objective standards established at the lowest level of subdivision. The SSEB shall not compare proposals against each other. (Air Force Regulation 70-15 (1988), p. 14)

A hierarchical model with the size and complexity of the case study requires many pairwise comparisons. It is possible however, to reduce the number of comparisons required, but the number and time required are still substantial. These time savings can be attained, in large part, by use of absolute versus relative measurement (Liberatore 1989).

For these reasons, absolute measurement is used in Step 4 of our application of the AHP to the case study. The alternatives (potential contractors) were "ranked in reference to standards" (Saaty 1987).

The AHP can perhaps provide the greatest improvement to the current process with Step 5. The current process approaches bona fide decision analysis by structuring the hierarchical model, specifying the relative importance, at least ordinally, of the criteria, and evaluating alternatives against criteria. But, once evaluations of alternatives are completed, the current process reverts to an ad hoc, intuitive means of determining the final ranking. The AHP on the other hand, provides a systematic, logically defensible, and insightful way of synthesizing these evaluations into the corresponding priority of alternatives (contractors).

In Step 5, the color ratings, beginning with each of the lowest level criteria, are synthesized into a final priority of contractors. The rating for each contractor on each criterion was obtained independent of the other contractor's proposal and each contractor was compared only to standards established for the system acquisition. The overall ranking of contractors is obtained through the method illustrated in Section 5.2.

In our application to the case study, we investigated ways to translate the numerical "composite priorities" provided by the AHP back into a traditional color rating. This makes the application of AHP to source selection consistent with established procedures. Moreover, the AHP methodology is almost totally "hidden" from the users, giving the appearance that they are "conducting business as usual." It should be emphasized that

1. *all of the advantages of applying the AHP are retained,*

2. *source selection proceeds as specified in existing regulations, directives and policies, and*

3. *evaluators and decision makers are not confronted with changing to and learning a dramatically different method.*

In this application, the "composite priorities" (numerical ratings) were translated into the colors currently used in evaluation. This was done so the implementation of the AHP would be consistent with the current procedures and appear familiar to the evaluators and decision makers. This was done as follows:

1. For the criterion being evaluated, set all evaluations to "blue." Note the resultant "composite priority" provided by the AHP. This provides the upper limit for the "blue range."

2. Set all evaluations to "green." Note the resultant "composite priority."

3. The midpoint or average of the "composite priorities" obtained in steps 1 and 2 is the lower limit of the "blue range" and the upper limit of the "green range."

4. Repeat steps 1 through 3 for the "green" and "yellow."

As an example, consider the hypothetical results below:

Evaluations all set to:	Resultant "Composite Priority":	Average:	Color Code Range:
Blue	0.51		0.425 - 0.510
		0.425	
Green	0.34		0.230 - 0.425
		0.230	
Yellow	0.12		0.085 - .230
		0.085	
Red	0.05		

TABLE 6: Translation of Priorities to Colors

Thus, a "Composite Priority" of .474 would be translated to a color code of "blue," .383 to "green," .215 to "yellow." A "red" evaluation is required by current regulations to be carried up all higher of the hierarchy.

While translation of the numerical ratings to colors is not necessary for the application of AHP to source selection, we feel it is an area deserving of further research. It is necessary to investigate the theoretical and practical implications of such translation methods. The impact of carrying a "red" evaluation up through all levels of the hierarchy should also be studied.

An added advantage of AHP, and other decision analysis methodologies, in Step 5 is the capability to perform "sensitivity analysis." The decision maker (in this case, the Source Selection Authority) is not expected to accept the highest ranked alternative as *THE DECISION* after "running" the model only once. Instead, the decision maker can now investigate model characteristics to ascertain which have the greatest effect on the decision. For example, the decision maker can perform sensitivity analysis to answer such questions as:

> 1. "Over what range can the importance (weight) for the factor "Manufacturing Technology," vary while leaving the ranking of contractors unchanged?"
>
> 2. "How much must the "Systems Integration" evaluation of Contractor 3 increase before he becomes the preferred contractor?"

This type of analysis adds both insight into the decision problem and confidence in the ultimate decision. If for example, the answer to question 2 above is:

> "Contractor 3, even if he were given the highest rating in the "Systems Integration," would still not be the preferred contractor."

the decision maker need not be concerned about the fact that he may have been unsure about whether Contractor 3 deserved a Yellow or Green rating on Systems Integration.

Appendix 3 provides the complete hierarchical model for the case study. We've assumed that the AHP was carefully and thoughtfully applied to arrive at the relative weights and the evaluations shown here.

5.4 Advantages of the AHP

The proponents of the AHP have argued that it has several important advantages as a decision analysis methodology. These advantages include the following.

> Advantage 1: The AHP has a simple, and intuitively appealing axiomatic foundation that most decision makers readily accept. These Axioms, as simply stated by Harker (1989), are:
>
> > Axiom 1: Given any two alternatives (or criteria), the decision maker is able to provide a pairwise comparison of these alternatives with respect to any criterion on a nine point scale.
> >
> > Axiom 2: When comparing any two alternatives i,j the decision maker never judges one to be infinitely better than the other under any criterion.
> >
> > Axiom 3: One can formulate the decision problem as a hierarchy.
> >
> > Axiom 4: All criteria and alternatives which impact the given decision problem are represented in the

hierarchy. That is, all the decision maker's intuition must be represented in term of criteria and alternatives in the structure and be assigned priorities which are compatible with intuition.

Advantage 2: The AHP easily facilitates, even fosters, subjective judgement. Unlike other quantitative methodologies, subjectivity is explicitly included in the AHP.

Advantage 3: The AHP allows the decision maker to structure a complex decision problem and to sequentially focus attention on small parts of the problem. Thus, the AHP is in keeping with psychological research that suggests the human mind can only consider "7 plus or minus 2" things at a time (the famous "Miller's Law," Miller, (1956)).

Advantage 4: The AHP provides a framework for thinking about, structuring, analyzing, and synthesizing judgements in a complex decision problem. It generates insight into the problem that might not have been discovered, identifies areas of the problem which are unclear in the decision maker's mind, highlights where additional information is required, helps the decision maker be consistent in his judgements and thinking, isolates and resolves areas of disagreement in the group decision making environment. The AHP then allows for a rational and consistent synthesis of the "parts" into an overall composite ranking of the alternatives. As Saaty (1988) stated:

The theory reflects what appears to be an innate method of operation of the human mind. When presented with a multitude of elements, controllable or not, which comprise a complex situation, it aggregates them into groups, according to whether they share certain properties. Our model of this brain function allows a repetition of this process, in that we consider these groups, or rather their identifying common properties, as the elements of a new level in the system...We were influenced by the following observations:

(1) When we watch people participating in the process of structuring and prioritizing a hierarchy, we find that they engage naturally in successive grouping of items within levels and in distinguishing among levels of complexity.

(2) Individuals informed about particular problems may structure it hierarchically somewhat differently, but if their judgements are similar, their overall answers tend to be similar. Also, the process is

robust. In other words, fine distinctions within the hierarchy tend in practice not to be decisive.

(3) In the course of developing the theory we find a mathematically reasonable way to handle judgements. (p. x)

Advantage 5: The AHP is not intended to replace human decision making, but is instead to supplement it. Often the results of AHP are counter-intuitive which should cause the decision maker to reflect on his/her conception of the problem formulation and his/her expressed preferences. This reflection should result in further insight and, ultimately, a "better" decision.

5.5 Disadvantages and Controversies Associated with the AHP

There has recently been an ongoing debate regarding the theoretical soundness, and applicability of the AHP. The most vocal of the opponents is Professor James S. Dyer of the University of Texas. The proponents' camp is led, of course, by Professor Saaty with staunch allies Professors Patrick T. Harker of The Wharton School, University of Pennsylvania, and Luis G. Vargas, a colleague of Professor Saaty at the Joseph M. Katz Graduate School of Business, University of Pennsylvania. The debate is best summarized by the series of articles which recently appeared in *Management Science*. (Winkler (1990), Dyer (1990a, 1990b), Saaty (1990), Harker and Vargas (1990)). We shall attempt to briefly summarize those arguments in this section.

The first criticism posed by Dyer (1990a) regards the axiomatic foundation of AHP. He said:

> *Harker and Vargas claim that the AHP has been criticized because it lacks an axiomatic foundation, but that Saaty (1986) has now provided the necessary axioms to counter this deficiency. The Axioms developed by Saaty (1986) were a significant contribution to the theory of AHP. However, Harker and Vargas miss an important point that can be explained by a comparison of Saaty's axioms with those of expected utility theory...The axioms (of utility theory) have an intuitive meaning that can be subjected to empirical tests, and the preference function is derived from these axioms rather than assumed as a primitive notion...In contrast, the axioms provided by Saaty (1986) fail to be motivated by descriptions of behavior.*
>
> *The appeal of AHP would be strengthened by an effort to link its theoretical basis to that of classical preference theory, and by providing a more fundamental set of axioms descriptive of behavior that allow one to derive the existence of the ratio scale... (pp. 251-252)*

The AHP supporters do not agree with this criticism. The arguments put forth in Harker and Vargas (1990) basically assert that the axiom system for AHP is no less logical, no less descriptive of actual behavior than the axioms of utility theory.

Dyer and others have shown that "rank reversal" can occur in the AHP when an additional alternative, similar to others already included, is added to an AHP model. "Rank reversal" occurs when, for example, the alternatives are ranked A, B, then C initially, but are ranked A, D, C, and B after alternative D has been added. Notice that the relative rankings of alternatives B and C have reversed. Because of this, Dyer concludes that the ranking of alternatives as determined by the AHP are, in essence, arbitrary. He states (Dyer (1990a)):

> *The difficulty can be simply stated as follows: The ranking of alternatives determined by the AHP may be altered by the addition of another alternative for consideration. This characteristic of the methodology has been well known for years and has been discussed in a number of articles by critics and by proponents of the AHP...The real issue, however, is not the phenomenon of rank reversal per se. Rather, rank reversal is a symptom of a much more profound problem with AHP: the rankings provided by the methodology are arbitrary. (p. 252)*

The AHP proponents counter this argument by showing that when using "absolute measurement," instead of "relative measurement," rank reversal cannot occur. "Absolute measurement" does not require the pairwise comparisons of alternatives with respect of each criterion. Instead, each alternative is rated against each criterion after the relative weights of the ratings have been determined. Furthermore, the AHP camp argues that the examples exhibiting rank reversal have added an alternative which is essentially a "copy" of an alternative included in the original model. They contend this creates an artificial example that does not occur in realistic decision problems. Finally, Saaty (1990) contends the reversal is a legitimate phenomenon, truly reflective of the decision process at hand. He states:

> *In a relative measurement the preference for an alternative is determined by all other alternatives. In this sense the alternatives are not independent from each other for the determination of their priorities. This dependence among the alternatives may be reinterpreted as a rescaling of the priorities of the criteria depending on how many alternatives there are. Stated differently, the presence or absence of an alternative in relative measurement introduces additional information regarding the dominance of that alternative with respect to the other alternatives, whatever their number is. This information arises from change in the structure of the decision problem like adding or deleting a variable in a linear programming*

problem. The new optimum must be calculated from the start and would not usually coincide with the previous optimum on some of the variables. The new information in the decision problem is represented by a structural criterion, which instead of being compared with the old criteria from which it is fundamentally different, operates as a transformation on the priorities of those criteria by rescaling them according to the new information. This is not like anything encountered in utility theory. It is new and logical, but certainly not arbitrary. By changing the priorities of the criteria, the collection of old and new alternatives or simply the old collection with a missing alternative may have a new ranking not compatible with the old one. (p. 264)

Dyer concludes with the suggestion

...the actual solution to this problem is relatively simple, and is based on the synthesis of the AHP assessment methodologies with the theory of multiattribute utility theory (MAUT).

At a higher level of abstraction we assume that researchers in "utility theory" and in AHP methodologies are attempting to model the preferences of a decision maker so that the rankings of alternatives produced by these approaches reflect these preferences. Therefore, it seems reasonable to conclude that both fields would benefit from efforts to synthesize these two approaches to the same problem...

We conclude that much more is to be gained from a synthesis of AHP and MAUT than from efforts to maintain them as separate areas of research and application. (pp. 257-258)

Despite the fact that the debate rages on, theoretical progress and successful application of both methodologies continues. From a pragmatic point of view, the true test of the viability of any decision analysis methodology is whether or not it assists the decision maker in structuring, understanding and resolving complex decision problems.

6. Conclusions and Recommendations for Further Research

In this paper, we have investigated the application of two established decision analysis methodologies, Multiattribute Utility Theory and the Analytic Hierarchy Process, to the problem of source selection, an important and recurring problem in the Department of Defense. The scope of our discussion was limited to Air Force systems acquisition projects. Source selection, MAUT, and the AHP were briefly explained. The decision methodologies were then applied to an actual source selection problem, although the evaluations used were fictitious.

It was shown that both decision analysis methodologies can be applied to this important class of problems. We conclude:

1. Both the AHP and MAUT provide a rational, consistent, communicable and logically defensible means of synthesizing the many individual judgements and evaluations into a prioritization of contractors. Moreover, this synthesis is accomplished very efficiently using readily available microcomputers and software.

2. The area, item, factor, and subfactor structure provided in the Source Selection Plan is easily and directly translated into a hierarchical model.

3. Sensitivity analysis results in significantly increased understanding of the problem and its characteristics, insight not currently attainable using the current procedures.

5. The application of MAUT requires extensive assistance of and interaction with a trained, experienced decision analyst, whereas the AHP can be easily used with little training.

We are not the first to come to these or similar conclusions. It is our opinion that the application of decision analysis to source selection holds great promise.

Further research might be directed at the following areas:

1. Development of a user friendly software package which implements decision analysis specifically for the source selection problem domain.

2. Investigation of the applicability of decision analysis to source selection in the other military services.

3. A theoretically sound means of translating composite priorities into the familiar color scheme currently employed.

4. Development of a program to educate acquisition personnel about the benefits and use of decision analysis in source selection.

5. Development of a test program to further assess the efficacy of applying decision analysis to source selection.

6. A more extensive survey of previous applications of the decision analysis to systems acquisition and the benefits obtained.

7. Methods of combining several individual analyses into a single decision.

8. Psychological and behavioral aspects of both individual and group decision making and the implications for employing the decision analysis in source selection.

9. Investigation of the decision analysis methodology employed at Stanford University under the direction of R. A. Howard (c.f. Howard and Matheson (1984), and Tatman (1989)).

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APPENDIX 1: Source Selection Case Study

This Appendix contains information obtained from an actual Air Force Systems Command source selection. Pages 1-2 through 1-7 are pages from Source Selection Plan which provide the areas, items, factors and assessment criteria for this source selection. Note that information which might reveal the identity of the weapon system under consideration has been blacked out. These pages provide the information from which the MAUT and the AHP models were constructed.

The remaining pages of Appendix 1 (pp. 1-8 through 1-28) are the fictitious evaluations of four contractors proposals. Actual evaluations were not provided to us for this case, however this was not critical to this research. Actual evaluations could easily be substituted for the fictitious ones used herein with no significant impact on the application of MAUT or AHP to source selection, the resultant models, or the conclusions and recommendations reached in this study. Also note that not all evaluation matrices are provided. We provide only enough of these to give the reader an understanding of how the decision analysis models are constructed.

[redacted]

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each CR, DR, and MR, including offeror responses and final disposition of each.

6. Lessons Learned: At the conclusion of source selection activities, the administrative group will develop and publish any lessons learned, subject to approval by the chairman of the SSEB, in a single bound document.

V. EVALUATION CRITERIA

A. Introduction:

Using the Government-provided [redacted] Statement of Work (SOW), [redacted] and other provisions in Section L of the RFP, the offerors will propose the program they believe best meets system requirements, demonstrates that the [redacted] concept is technically feasible and reduces program risks to the point acceptable to proceed into the Full Scale Development (FSD) phase of the program. The offerors will also propose the price of the Demonstration/Validation (Dem/Val) effort and their preliminary cost estimates for FSD, production, and Operations and Support (O&S), along with methodology for calculating these estimates.

B. Basis for Award:

The planned selection of four contractors for the Dem/Val phase of the [redacted] Program will be made on the basis of an integrated assessment of the proposals submitted in response to the RFP and the proposed terms and conditions contained within the executed (negotiated) contract. In making this integrated assessment, the following specific areas will be evaluated (listed in descending order of importance):

a. Technical;

b. Supportability;

c. Management Capability; and

d. Cost.

The following assessment criteria (ranked equally) will be used to rate each area of the proposal evaluation:

a. Soundness of Approach;

b. Understanding of the Problem;

c. Compliance with Requirements; and

d. Past Performance.

The Government will review each proposal against the above criteria using both internal and offeror-provided data in the assessment. The evaluation will include an assessment of the risks involved with the design approach proposed and the means proposed to reduce these risks. Throughout the evaluation, the Government will consider "correction potential" when a deficiency is identified in the proposal. Proposals unrealistic in terms of technical, supportability, or schedule commitments, or unrealistically low in cost or price, will be deemed reflective of an inherent lack of technical competence or indicative of a failure to comprehend the complexity and risks of the contract requirements. These conditions may be grounds for rejection of the proposal. The Source Selection Authority will make a determination of the overall value of each proposed system approach judged in terms of its potential to best satisfy the needs of the Government, all factors considered. Subjective judgment on the part of the Government is implicit in the evaluation process. The Government reserves the right to award contracts at other than the lowest proposed Dem/Val price, lowest estimated FSD price, or lowest life cycle cost.

C. Scope of Evaluation:

1. A detailed evaluation will be made of each offeror's proposal to provide information to the SSA for use in source selection. The [redacted] Dem/Val proposal evaluation will include consideration of the areas described below, in order of relative importance. The [redacted] must meet the mission performance requirements, Reliability/Maintainability (R/M) requirements, and must be a producible design. To clearly set the importance of these required features, R/M, Producibility/Quality Engineering, and System Engineering are the highest ranked items under the technical area. The remaining items are equally ranked. Excluding the Cost area, items within the other areas (Supportability and Management Capability) are equally important within their respective areas. All factors (or items which do not have factors) will be measured against specific standards. Each area is rated using all four assessment criteria.

[redacted] a. TECHNICAL AREA.

The quality of the contractor proposed procedures for accomplishing design synthesis and validation during the Dem/Val program phase is of primary importance. The evaluation will focus on a combination of the following elements: (1) weapon system concept and its threat-driven characteristics, (2) the engineering plans for refining the weapon system designs to provide superior combat capability for world-wide deployment based upon evolving operational, reliability, maintainability, and producibility requirements, and (3) the degree to which the proposed engineering planning supports the technologies used in establishing a system configuration. The proposal must demonstrate and convey clearly an understanding of the technical achievements required by the SRD and SOW and the level of effort needed to achieve the required capability. Engineering program planning will be assessed for reasonableness and use of acceptable design practices. The following items and factors will be used in proposal evaluation in the technical area:

- Reliability/Maintainability Item
  - Reliability
  - Maintainability
- Producibility/Quality Engineering Item
  - Producibility in Design
  - Quality in Design
  - Manufacturing Technology
  - Manufacturing Research
- System Engineering Item
  - System Effectiveness
  - Armament Integration
  - Systems Integration
  - Computer Resources
- Flight Systems Item
  - Structures
  - Propulsion
  - Stability and Control
  - Aerodynamics and Performance
  - Flight Equipment and Subsystems
- Avionics Item
  - Communications/Navigation
  - Offensive Functions
  - Defensive Functions
  - Architecture
  - Controls and Displays
  - Observables
- Support Systems Item
  - Life Support/Escape Systems
  - Crew Systems
  - Maintenance Systems
  - Human Factors
  - Training Analysis

[redacted] b. SUPPORTABILITY AREA.

Supportability will be evaluated in terms of the offeror's approach to the [redacted] management, technical, and operations concepts. The approach for assessing the impact on supportability of the design concept will be evaluated by the technical panel. The management and operations aspects of supportability will be evaluated as defined below. The offeror must present evidence of the technical capability, managerial capability and corporate commitment needed to vigorously plan, implement, monitor and control the supportability program required to design, demonstrate and produce an affordable, supportable and effective [redacted] weapon system. The offeror's proposed approach and thoroughness in conducting LCC tradeoff analyses for Dem/Val will also be evaluated in this area. The following items and factors will be used in proposal evaluation in the supportability area:

- <u>Organizational Structure Item</u>
- <u>Management Policies, Practices, and Planning Item</u>
  - ILS Program
  - LCC Program
  - LSA Program
  - Lessons Learned Program
- <u>Supportability Program Implementation Item</u>
  - Influence on Design Process
  - Integration of Supportability Efforts
- <u>Logistics Capabilities Item</u>
  - Definition of Logistics Issues
  - Tools and Techniques for Supportability Evaluation

c. MANAGEMENT CAPABILITY AREA.

The contractor's organizational structure, management plans, and overall program schedule will be evaluated. Consideration will be given to the distribution of responsibility within the organization, supervisory authority over personnel, the location and responsibility of key personnel in the organizational structure, internal review procedures of management activities and decisions, participation of functional organizations in the design process, interface with and management visibility provided to the Government of internal and external organizations, and individual plan schedules and their relationship with total program schedule. The management capability evaluation will include assessment of the following items and factors:

- <u>Program Management Item</u>
  - Configuration Management Planning
  - Data Management
  - Organization
  - Management Control and Information
  - Contingency Planning
  - Contractor Interfaces

- Future Competition Item
- Systems Test Item
- Manufacturing Item
  - Manufacturing Planning
  - Manufacturing Capability
  - Manufacturing Cost Reduction
- Quality Assurance Item
  - Quality System
  - Initial Quality Planning
- System Safety Item
- Training Systems Management Item
- Security Item
  - Personnel/Physical Security and Classification Mgt
  - TEMPEST/COMSEC/OPSEC
  - System Security Engineering Management Program

d. COST AREA.

In the [redacted] Dem/Val phase source selection, the cost panel's objectives are to evaluate the affordability of each offeror's [redacted] system approach/concept for FSD, production, and O&S as well as the methodology used in constructing their estimates. The proposed Dem/Val contract price, although it will be evaluated for reasonableness and consistency by the contracting negotiators and auditors, is of secondary importance. Each offeror shall provide their best cost estimate for FSD, production, and O&S using the format, definitions and ground rules prescribed in the [redacted] Dem/Val Cost Annex. The cost evaluation will be based on an assessment of each offeror's proposed cost, and the government's estimate of most probable total life cycle cost for the planned force structure for each offeror considering:

- Realism: Costs and scope of work are compatible.
- Reasonableness: Acceptable estimating methodology.
- Completeness: Responsiveness in providing all RFP requirements, SOW items, and traceability of estimates.

2. The overall evaluation of each proposal may include on-site inspections and results of pre-award surveys to provide information to the Source Selection Authority regarding offerors current and future capability to perform all aspects of the program. Risk assessment associated with the major

areas of the program will be accomplished. In assessing risk, an independent judgment of the probability of success, the impact of failure, and the alternatives available to meet the requirements will be considered.

VI. ACQUISITION STRATEGY

The overall acquisition strategy follows recommendations approved by the AFSC Business Strategy Panel (BSP) on 6 Aug 84 as refined by the Air Force System Acquisition Review Council (AFSARC) on 13 Nov 84 and the AFSC/ASD Solicitation Review Panel (SRP) on 15 Jan 85. This plan updates and amplifies the strategy discussed in the [redacted] Highlighted program strategy includes:

A. Fixed Price contracts are planned for Dem/Val to limit the government's cost risk in the highly competitive environment which precedes a major downselection, (i.e., selection of an [redacted] FSD contractor).

[redacted]

[redacted]

D. Solicitations will include anticipated funding profiles by fiscal years.

E. Cost reporting sufficient to evaluate Dem/Val contractor's expenditures under the FFP contract will be required.

F. Requirement for explicit planning to assure adequate competition for critical subsystems will be available by the time the [redacted] system enters the production phase (e.g., dual sources, unlimited rights in technical data, etc.).

VII. SCHEDULE OF EVENTS

ASD Business Strategy Panel Convened
ASD Acquisition Management Panel Convened
AFSC Business Strategy Panel Convened
Draft RFP Released
SSA Approves the Source Selection Plan
RFP Released
SSAC Formally Established
Standards Prepared/Approved
Proposals Received - Evaluation Starts
Initial Evaluation Completed
Competitive Range Determination
SSEB Initial Evaluation and Competitive
 Range Briefing to SSAC
Evaluation Completed
Discussions Completed

[redacted]

	Overall Assessment			
Item Summary	G (m)	Y (m)	B (1)	G (h)
	Item	Item	Item	Item
Contractors / Primary Areas	Contractor A	Contractor B	Contractor C	Contractor D
Technical	G	Y	G	B
Support-ability	G	Y	B	G
Management Capability	G	G	B	Y
Cost	Y	G	Y	Y

Assessment. Summary

Contractor A

	Item	Item	Item	Item
Item Summary	G	G	G	Y
Assessment Criteria \ Primary Areas	Technical	Support-ability	Management Capability	Cost
Soundness of Approach	B	G	G	Y
Understanding of Problem	B	B	G	Y
Compliance with Requirement	G	Y	G	G
Past Performance	Y	G	B	Y

Technical Contractor A

Item Summary	G	G	B	G	G	G
	Item	Item	Item	Item	Item	Item
Specific Criteria / Assessment Criteria	Reliability Maintainability	Producibility/ Quality Engin.	System Engineering	Flight Systems	Avionics	Support Systems
Soundness of Approach	G	B	B	B	B	G
Undrestanding of Problem	G	G	B	B	B	B
Compliance with Requirement	G	G	B	G	G	G
Past Performance	Y	G	Y	Y	Y	G

Supportability Contractor A

Specific Criteria / Assessment Criteria	Item: Organizational Structure	Item: Policies Practices Planning	Item: Support Program Implement.	Item: Logistics Capabilities
Item Summary	Y	G	G	B
Soundness of Approach	Y	G	G	B
Understanding of Problem	G	B	B	B
Compliance with Requirement	Y	Y	Y	G
Past Performance	Y	G	G	G

Management Capability
Contractor A

	Item	Item	Item	Item	Item	Item	Item
Item Summary	B	G	G	G	G	G	Y
Specific Criteria / Assessment Criteria	Program Management	Future Competition	Systems Test	Manufact-uring	Quality Assurance	System Safety	Security
Soundness of Approach	B	G	G	G	G	G	Y
Understanding of Problem	G	G	G	B	G	G	Y
Compliance with Requirement	B	G	G	G	G	G	Y
Past Performance	B	G	B	G	B	B	G

Cost Contractor A			
Item Summary	G	Y	Y
	Item	Item	Item
Specific Criteria / Assessment Criteria	Realism	Reasonableness	Completeness
Soundness of Approach	Y	Y	Y
Understanding of Problem	G	Y	Y
Compliance with Requirement	G	G	G
Past Performance	G	Y	Y

Assessment. Summary
Contractor B

Assessment Criteria \ Primary Areas	Technical	Supportability	Management Capability	Cost
Item Summary	Y	Y	G	G
	Item	Item	Item	Item
Soundness of Approach	Y	Y	G	G
Understanding of Problem	Y	G	G	G
Compliance with Requirement	Y	Y	G	G
Past Performance	G	Y	G	Y

Technical Contractor B						
Item Summary	Y	Y	G	G	Y	Y
	Item	Item	Item	Item	Item	Item
Specific Criteria / Assessment Criteria	Reliability Maintainability	Producibility/ Quality Engin.	System Engineering	Flight Systems	Avionics	Support Systems
Soundness of Approach	Y	Y	G	G	Y	Y
Undrestanding of Problem	Y	Y	Y	G	G	Y
Compliance with Requirement	Y	Y	G	Y	Y	Y
Past Performance	G	Y	G	G	Y	G

Supportability

Contractor B

Specific Criteria / Assessment Criteria	Item: Organizational Structure	Item: Policies Practices Planning	Item: Support Program Implement.	Item: Logistics Capabilities
Item Summary	G	Y	Y	Y
Soundness of Approach	G	Y	Y	Y
Understanding of Problem	G	G	G	Y
Compliance with Requirement	G	Y	Y	Y
Past Performance	G	Y	Y	Y

Management Capability
Contractor B

	Item	Item	Item	Item	Item	Item	Item
Item Summary	G	Y	G	G	Y	G	G
Specific Criteria / Assessment Criteria	Program Management	Future Competition	Systems Test	Manufacturing	Quality Assurance	System Safety	Security
Soundness of Approach	G	Y	G	G	Y	G	G
Understanding of Problem	G	G	Y	G	Y	G	G
Compliance with Requirement	G	Y	G	G	Y	G	G
Past Performance	G	Y	Y	G	Y	G	G

	Cost Contractor B		
Item Summary	G	G	G
	Item	Item	Item
Specific Criteria / Assessment Criteria	Realism	Reasonableness	Completeness
Soundness of Approach	Y	G	G
Understanding of Problem	G	G	Y
Compliance with Requirement	G	G	G
Past Performance	Y	Y	G

Assessment. Summary

Contractor C

Primary Areas / Assessment Criteria	Technical	Support-ability	Management Capability	Cost
Item Summary	G	B	B	Y
	Item	Item	Item	Item
Soundness of Approach	G	B	B	Y
Understanding of Problem	G	G	B	G
Compliance with Requirement	G	B	B	Y
Past Performance	G	B	G	Y

Technical Contractor C						
Item Summary	G	Y	G	G	G	B
	Item	Item	Item	Item	Item	Item
Specific Criteria / Assessment Criteria	Reliability Maintainability	Producibility/ Quality Engin.	System Engineering	Flight Systems	Avionics	Support Systems
Soundness of Approach	G	Y	G	G	G	B
Undrestanding of Problem	G	G	G	G	G	G
Compliance with Requirement	G	Y	G	G	G	B
Past Performance	G	Y	G	G	G	B

Supportability Contractor C

Specific Criteria / Assessment Criteria	Item: Organizational Structure	Item: Policies Practices Planning	Item: Support Program Implement.	Item: Logistics Capabilities
Item Summary	G	B	B	B
Soundness of Approach	G	B	B	B
Understanding of Problem	G	G	B	G
Compliance with Requirement	G	B	B	B
Past Performance	G	B	B	B

Management Capability
Contractor C

Specific Criteria / Assessment Criteria	Item	Item	Item	Item	Item	Item	Item
Item Summary	B	G	B	G	B	G	G
	Program Management	Future Competition	Systems Test	Manufact-uring	Quality Assurance	System Safety	Security
Soundness of Approach	B	G	B	B	B	B	G
Understanding of Problem	B	B	B	G	B	G	B
Compliance with Requirement	B	G	B	G	B	Y	B
Past Performance	B	G	B	G	G	G	Y

	Cost Contractor C		
Item Summary	Y	Y	G
	Item	Item	Item
Specific Criteria / Assessment Criteria	Realism	Reason-ableness	Complete-ness
Soundness of Approach	Y	Y	G
Understanding of Problem	G	G	Y
Compliance with Requirement	Y	Y	G
Past Performance	Y	Y	G

Assessment. Summary
Contractor D

Assessment Criteria \ Primary Areas	Technical	Support-ability	Management Capability	Cost
Item Summary	B	G	Y	Y
	Item	Item	Item	Item
Soundness of Approach	B	G	Y	Y
Understanding of Problem	B	G	Y	G
Compliance with Requirement	B	G	Y	Y
Past Performance	G	G	G	Y

Technical Contractor D

Specific Criteria / Assessment Criteria	Item: Reliability Maintainability	Item: Producibility/ Quality Engin.	Item: System Engineering	Item: Flight Systems	Item: Avionics	Item: Support Systems
Item Summary	G	B	B	B	B	B
Soundness of Approach	G	B	B	B	B	G
Undrestanding of Problem	B	B	B	B	B	B
Compliance with Requirement	G	B	B	B	B	G
Past Performance	G	G	G	B	G	G

Supportability
Contractor D

Specific Criteria / Assessment Criteria	Item: Organizational Structure	Item: Policies Practices Planning	Item: Support Program Implement.	Item: Logistics Capabilities
Item Summary	G	G	G	Y
Soundness of Approach	G	G	G	G
Understanding of Problem	G	G	G	Y
Compliance with Requirement	G	G	G	G
Past Performance	G	G	Y	Y

Management Capability
Contractor D

Item Summary	G	Y	Y	Y	Y	Y	G
	Item	Item	Item	Item	Item	Item	Item
Specific Criteria / Assessment Criteria	Program Management	Future Competition	Systems Test	Manufact-uring	Quality Assurance	System Safety	Security
Soundness of Approach	G	Y	Y	Y	Y	Y	G
Understanding of Problem	G	Y	Y	Y	Y	Y	G
Compliance with Requirement	G	Y	Y	Y	Y	Y	Y
Past Performance	G	G	G	Y	G	G	G

Cost

Contractor D

	Item	Item	Item
Item Summary	Y	Y	G
Specific Criteria / Assessment Criteria	Realism	Reason-ableness	Complete-ness
Soundness of Approach	Y	Y	G
Understanding of Problem	G	Y	G
Compliance with Requirement	Y	Y	Y
Past Performance	Y	Y	G

Appendix 2 (MAUT model)

Appendix 2 contains printouts from EXPRESSION TREE, utility values, probability assessments, and a generic decision tree.

I. EXPRESSION TREE Printouts

The TREE EVALUATION printout is the evaluation of the model using expected utility theory. The recommended alternative is Contractor C. Sensitivity analyses (see below) indicate Contractor C is still preferred.

NODE: 1 (Decision) C.E.: 0.858 (Risk Neutral--Increasing)
NODE NAME: SS_DECISION

BRANCH LABEL	BRANCH VALUE	CERTAINTY EQUIVALENT
CONTRACTOR A	0.000	0.810
CONTRACTOR B	0.000	0.722
CONTRACTOR C	0.000	0.858 <---
CONTRACTOR D	0.000	0.775

SENSITIVITY ANALYSIS is a "what if" analysis.

Vary Probability Variable: P_TECHB_A

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.858	CONTRACTOR C
0.06000	0.858	CONTRACTOR C
0.12000	0.858	CONTRACTOR C
0.18000	0.858	CONTRACTOR C
0.24000	0.858	CONTRACTOR C
0.30000	0.858	CONTRACTOR C
0.36000	0.858	CONTRACTOR C
0.42000	0.858	CONTRACTOR C
0.48000	0.858	CONTRACTOR C
0.54000	0.858	CONTRACTOR C

Vary Probability Variable: P_TECHG_A

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.858	CONTRACTOR C
0.07400	0.858	CONTRACTOR C
0.14800	0.858	CONTRACTOR C
0.22200	0.858	CONTRACTOR C
0.29600	0.858	CONTRACTOR C
0.37000	0.858	CONTRACTOR C
0.44400	0.858	CONTRACTOR C
0.51800	0.858	CONTRACTOR C
0.59200	0.858	CONTRACTOR C
0.66600	0.858	CONTRACTOR C
0.74000	0.858	CONTRACTOR C

Vary Probability Variable: P_TECHG_B

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.858	CONTRACTOR C
0.09900	0.858	CONTRACTOR C
0.19800	0.858	CONTRACTOR C
0.29700	0.858	CONTRACTOR C
0.39600	0.858	CONTRACTOR C
0.49500	0.858	CONTRACTOR C
0.59400	0.858	CONTRACTOR C
0.69300	0.858	CONTRACTOR C
0.79200	0.858	CONTRACTOR C
0.89100	0.858	CONTRACTOR C
0.99000	0.858	CONTRACTOR C

Vary Probability Variable: P_TECHB_C

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.849	CONTRACTOR C
0.02900	0.850	CONTRACTOR C
0.05800	0.852	CONTRACTOR C
0.08700	0.854	CONTRACTOR C
0.11600	0.856	CONTRACTOR C
0.14500	0.857	CONTRACTOR C
0.17400	0.859	CONTRACTOR C
0.20300	0.861	CONTRACTOR C
0.23200	0.863	CONTRACTOR C
0.26100	0.864	CONTRACTOR C
0.29000	0.866	CONTRACTOR C

Vary Probability Variable: P_TECHG_C

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.830	CONTRACTOR C
0.08400	0.833	CONTRACTOR C
0.16800	0.836	CONTRACTOR C
0.25200	0.840	CONTRACTOR C
0.33600	0.843	CONTRACTOR C
0.42000	0.847	CONTRACTOR C
0.50400	0.850	CONTRACTOR C
0.58800	0.853	CONTRACTOR C
0.67200	0.857	CONTRACTOR C
0.75600	0.860	CONTRACTOR C
0.84000	0.863	CONTRACTOR C

Vary Probability Variable: P_TECHB_D

PROBABILITY VALUE	CERTAINTY EQUIVALENT [Node 1]	PREFERRED DECISION
0.00000	0.858	CONTRACTOR C
0.09900	0.858	CONTRACTOR C
0.19800	0.858	CONTRACTOR C
0.29700	0.858	CONTRACTOR C
0.39600	0.858	CONTRACTOR C
0.49500	0.858	CONTRACTOR C
0.59400	0.858	CONTRACTOR C
0.69300	0.858	CONTRACTOR C
0.79200	0.858	CONTRACTOR C
0.89100	0.858	CONTRACTOR C
0.99000	0.858	CONTRACTOR C

The TREE SUMMARY printout is a description of each node.

1-D: SS_DECISION

CONTRACTOR A	CONTRACTOR B	CONTRACTOR C	CONTRACTOR D
0.000	0.000	0.000	0.000
2	11	21	31

Note: 1-D is a decision node and is arbitrarily labeled as node 1. There are four contractors (A, B, C, and D) in this source selection decision. The 0.000 indicates that there is no branch value for the decision. The numbers, 2, 11, 21, and 31 indicate the next node.

2-C: TECHNICAL

BLUE	GREEN	YELLOW
1.000	0.950	0.850
3	3	3
0.25000	0.40000	0.35000

Note: 2-C is a chance node and is labeled as node 2. The uncertain variable is for the technical area and has three possible outcomes, namely, blue, green, and yellow. The numbers 1.000, 0.950, and 0.850 indicate the utility values for technical for outcomes of blue, green, and yellow, respectively. The number 3 is the next node. The likelihoods of a blue, green, and yellow are 0.25, 0.40, and 0.35. The following are other chance nodes for contractors A, B, C, and D.

3-C: SUPPORTABILITY

BLUE	GREEN	YELLOW
1.000	0.900	0.500
4	4	4
0.15000	0.55000	0.30000

4-C: MANAGEMENT

BLUE	GREEN	YELLOW
1.000	0.800	0.400
5	5	5
0.40000	0.55000	0.05000

5-C: COST

GREEN	YELLOW
0.650	0.350
41	41
0.35000	0.65000

11-C: TECHNICAL

GREEN	YELLOW
0.950	0.850
12	12
0.50000	0.50000

12-C: SUPPORTABILITY

GREEN	YELLOW
0.900	0.500
13	13
0.30000	0.70000

13-C: MANAGEMENT

GREEN	YELLOW
0.800	0.400
14	14
0.65000	0.35000

14-C: COST

GREEN	YELLOW
0.650	0.350
41	41
0.50000	0.50000

21-C: TECHNICAL

BLUE	GREEN	YELLOW
1.000	0.950	0.850
22	22	22
0.15000	0.70000	0.15000

22-C: SUPPORTABILITY

BLUE	GREEN
1.000	0.900
23	23
0.70000	0.30000

23-C: MANAGEMENT

BLUE	GREEN	YELLOW
1.000	0.800	0.400
24	24	24
0.45000	0.45000	0.10000

24-C: COST

GREEN	YELLOW
0.650	0.350
41	41
0.35000	0.65000

31-C: TECHNICAL

BLUE	GREEN
1.000	0.950
32	32
0.50000	0.50000

32-C: SUPPORTABILITY

GREEN	YELLOW
0.900	0.500
33	33
0.70000	0.30000

33-C: MANAGEMENT

GREEN	YELLOW
0.800	0.400
34	34
0.55000	0.45000

34-C: COST

GREEN	YELLOW
0.650	0.350
41	41
0.30000	0.70000

41-E: KT*TECHNICAL + KS*SUPPORTABILITY + KM*MANAGEMENT + KC*COST

Note: 41-E is the end node and is labeled as 41. This end point represents the following additive utility function:

U(t, s, m, c) = Kt*U(t) + Ks*U(s) + Km*U(m) + Kc*U(c)

The SHOW NODE printout is another way to express nodes in EXPRESSION TREE, see below.

Node Number : 1 Node Type : Decision
Node Name : SS_DECISION Number Of Branches : 4

Branch Label	Branch Value	Nxt
CONTRACTOR A	0.000	2
CONTRACTOR B	0.000	11
CONTRACTOR C	0.000	21
CONTRACTOR D	0.000	31

Node Number : 2 Node Type : Chance
Node Name : TECHNICAL Number Of Branches : 3

Branch Label	Branch Value	Nxt	Branch Probability Expression
BLUE	1.000	3	P_TECHB_A
GREEN	0.950	3	P_TECHG_A
YELLOW	0.850	3	1-P_TECHB_A-P_TECHG_A

Node Number : 3 Node Type : Chance
Node Name : SUPPORTABILITY Number Of Branches : 3

Branch Label	Branch Value	Nxt	Branch Probability Expression
BLUE	1.000	4	.15
GREEN	0.900	4	.55
YELLOW	0.500	4	.3

Node Number : 4 Node Type : Chance
Node Name : MANAGEMENT Number Of Branches : 3

Branch Label	Branch Value	Nxt	Branch Probability Expression
BLUE	1.000	5	.4
GREEN	0.800	5	.55
YELLOW	0.400	5	.05

Node Number : 5 Node Type : Chance
Node Name : COST Number Of Branches : 2

Branch Label	Branch Value	Nxt	Branch Probability Expression
GREEN	0.650	41	.35
YELLOW	0.350	41	.65

Node Number : 41 Node Type : End

END NODE EXPRESSION

KT*TECHNICAL + KS*SUPPORTABILITY + KM*MANAGEMENT + KC*COST

PROBABILITY VARIABLES are expressions for the probabilities for the technical area. These expressions allow the user to conduct sensitivity analyses on the technical area. Listed below are the nominal values. Interpreting, P_TECHB_A is the likelihood of obtaining a technical blue for Contractor A.

P_TECHB_A	= 0.25000	P_TECHG_A	= 0.40000
P_TECHG_B	= 0.50000	P_TECHB_C	= 0.15000
P_TECHG_C	= 0.70000	P_TECHB_D	= 0.50000

PARAMETER VALUES are expressions for scaling or importance weights for the utility function. Once again, expressions enable the user to conduct sensitivity analyses. Listed below are the nominal values. Interpreting, KT is the scaling weight for the technical area.

KT	= 0.400	KS	= 0.250
KM	= 0.200	KC	= 0.150

II. Utility Values. The following utility values were obtained from individual utility curves for technical, supportability, management, and cost areas. Since blue is the most preferred outcome, the utility of a blue is one or U(blue) = 1, while red is the least preferred outcome, therefore, the U(red) = 0. The utility for a green or a yellow outcome is between the U(blue) and U(green). Utilities represent the risk attitude of a decision maker. In the case study, we assumed the decision maker was risk averse. In fact, we assumed the decision maker became more risk averse as he/she moved from cost to management to supportability to technical. This coincides with importance of the areas, i.e., cost is the least important while technical is the most important. Below, is a listing of utilities.

Technical

U(blue) = 1.00
U(green) = 0.95
U(yellow) = 0.85
U(red) = 0.00

Supportability

U(blue) = 1.00
U(green) = 0.90
U(yellow) = 0.50
U(red) = 0.00

Management

U(blue) = 1.00
U(green) = 0.80
U(yellow) = 0.40
U(red) = 0.00

Cost

U(blue) = 1.00
U(green) = 0.65
U(yellow) = 0.35
U(red) = 0.00

III. Probability Assessments. The probability assessments were obtained at the item level, see Appendix 1. This was accomplished by assuming past performance was three times as important as soundness of approach, understanding the problem, and compliance with requirement. Then, we counted the number of specific colors (blue, green, yellow, and red) and approached the probabilities from a relative frequency stand point rather than a Bayesian view point. In practice, most uncertainties are subjective judgments of a decision maker's belief.

IV. Generic Decision Tree. The generic decision tree represents a graphical display of the source selection case study. The case study was inputted into EXPRESSION TREE, thereby enabling the user to compute the recommended course of action and to ask what if questions. This was accomplished rather painlessly and required the input of 18 nodes. The nodes included one decision node, sixteen chance nodes, and one end node. The decision node is represented as a square and has four contractors or alternatives. The chance nodes are circles and are the uncertainties for technical, supportability, management, and cost areas and have possible outcomes of blue, green, or yellow. The decimals included in the generic decision tree represent the likelihoods of the various outcomes. The diamond is the end node which is an algebraic expression representing an additive utility function. The numbers inside each nodes are labels required for entry into EXPRESSION TREE.

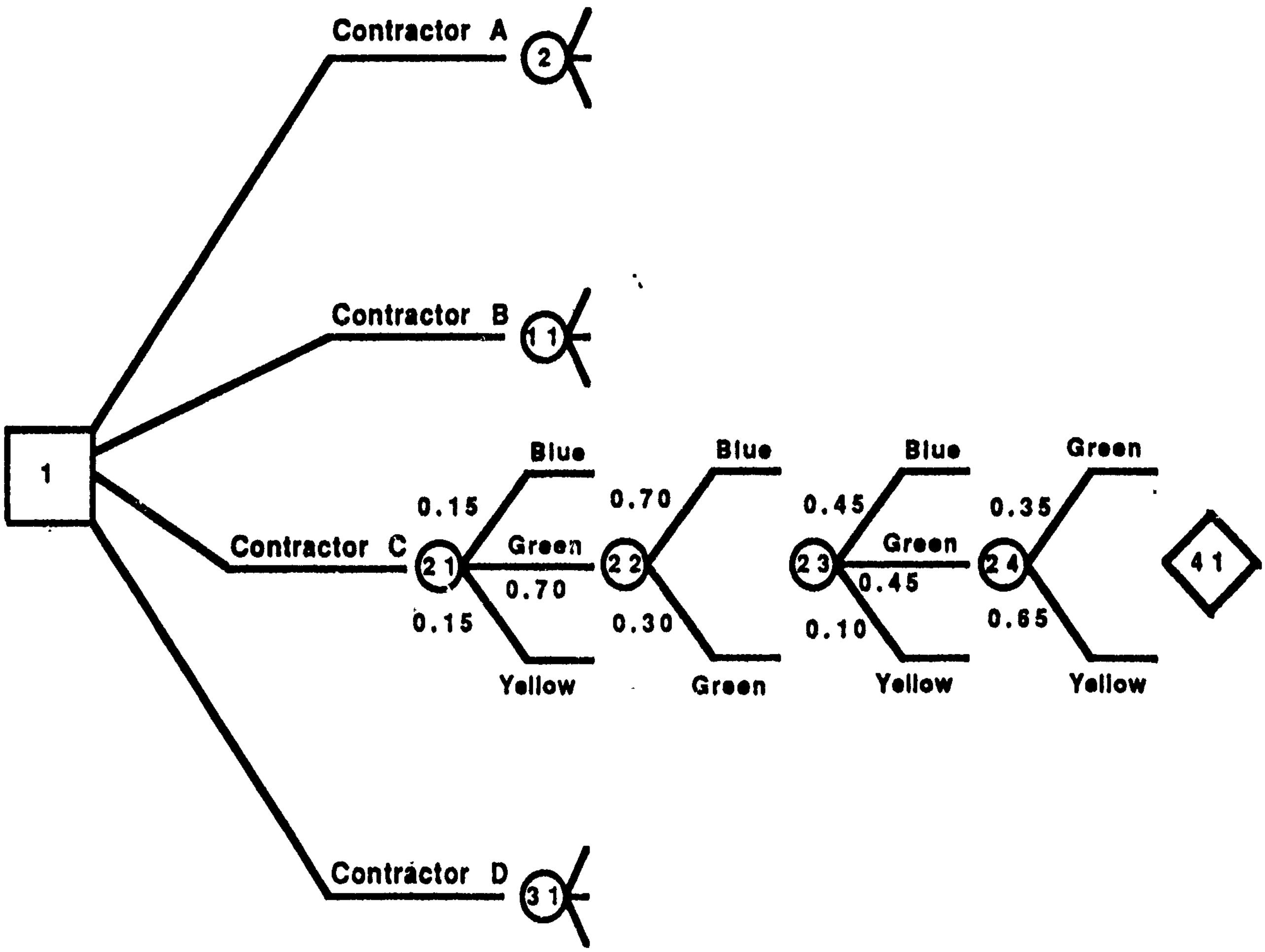

FIGURE 2-1: Generic Decision Tree

APPENDIX 3: AHP Model

This Appendix provides the complete AHP model of the case study. Included in pages 3-2 through 3-27 is the model represented in hierarchical form. Each page provides, at a given level of detail, some portion of the model. Page 3-2 provides the "macro" view of the model showing only the most aggregated level of detail. The remainder of Appendix 1 shows the lower levels of the hierarchy for the "Technical Area." The rest of the model (i.e. the lower levels of the hierarchy for the Supportability, Management Capability, and Cost Areas) are similar but not provided herein.

Pages 3-28 through 3-50 provide the Lotus spreadsheet, in which the AHP calculations for the synthesis of judgements takes place. It is in this spreadsheet that the "absolute measurement" scheme described in Section 5 is implemented using the weights obtained from *EXPERT CHOICE*. Weights were obtained from the *EXPERT CHOICE* package for color ratings with respect to each criterion, and the for each of the areas, items, and factors.

Page 3-50 provides the a summary of the final evaluations.

SS_DECISION

GOAL
L 1.000
G 1.000

TECH	SUPPORT	MANAGE C	COST
L 0.588	L 0.260	L 0.092	L 0.060
G 0.588	G 0.260	G 0.092	G 0.060
-REL/MAIN	-ORGAN ST	-PROG MAN	-REALISM
L 0.074	L 0.078	L 0.212	L 0.327
G 0.044	G 0.020	G 0.019	G 0.020
-PRO/QUAL	-MANAGE P	-FUT COMP	-REASONAB
L 0.044	L 0.135	L 0.106	L 0.413
G 0.026	G 0.035	G 0.010	G 0.025
-SYS ENGR	-SUP IMPL	-SYS TEST	-COMPLETE
L 0.418	L 0.228	L 0.188	L 0.260
G 0.246	G 0.059	G 0.017	G 0.016
-FLY SYS	-LOGISTIC	-MANUFACT	
L 0.166	L 0.559	L 0.324	
G 0.098	G 0.146	G 0.030	
-AVIONICS		-QUAL ASS	
L 0.227		L 0.064	
G 0.134		G 0.006	
-SUPP SYS		-SYS SAFE	
L 0.070		L 0.049	
G 0.041		G 0.004	
		-SECURITY	
		L 0.057	
		G 0.005	

O

TECH		
	L 0.588	G 0.588

O O O

REL/MAIN	PRO/QUAL	SYS ENGR	FLY SYS	AVIONICS	SUPP SYS
L 0.074	L 0.044	L 0.418	L 0.166	L 0.227	L 0.070
G 0.044	G 0.026	G 0.246	G 0.098	G 0.134	G 0.041
-RELIABIL	-PROD DES	-SYS EFFE	-STRUCTUR	-COMM/NAV	-LIFE SUP
L 0.500	L 0.358	L 0.424	L 0.305	L 0.110	L 0.287
G 0.022	G 0.009	G 0.104	G 0.030	G 0.015	G 0.012
-MAINTAIN	-QUAL DES	-ARM INTE	-PROPULSI	-OFF FUNC	-CREW SYS
L 0.500	L 0.085	L 0.095	L 0.135	L 0.120	L 0.347
G 0.022	G 0.002	G 0.023	G 0.013	G 0.016	G 0.014
	-MAN TECH	-SYS INTE	-STAB&CON	-DEF FUNC	-MAIN SYS
	L 0.379	L 0.373	L 0.158	L 0.064	L 0.123
	G 0.010	G 0.092	G 0.015	G 0.009	G 0.005
	-MAN RESE	-COMP RES	-AERO&PER	-ARCHITEC	-HUMAN FA
	L 0.179	L 0.108	L 0.343	L 0.223	L 0.153
	G 0.005	G 0.027	G 0.034	G 0.030	G 0.006
			-FLY EQUI	-CONT&DIS	-TRAIN AN
			L 0.059	L 0.036	L 0.090
			G 0.006	G 0.005	G 0.004
				-OBSERVAB	
				L 0.446	
				G 0.060	

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                    O
                    !
              ______!______
              O   O   O   O
              !
      ________!_____________________
              !              !  !  !  !  !
        __________
       !REL/MAIN!            O  O  O  O  O
       !        !
       ! L 0.074!
       ! G 0.044!
       !________!
            !
      ______!_______
      !            !
  __________   __________
 !RELIABIL!  !MAINTAIN!
 !        !  !        !
 ! L 0.500!  ! L 0.500!
 ! G 0.022!  ! G 0.022!
 !________!  !________!
 !-SOUNDNES  !-SOUNDNES
 !   L 0.250 !   L 0.250
 !   G 0.005 !   G 0.005
 !-UNDERSTA  !-UNDERSTA
 !   L 0.250 !   L 0.250
 !   G 0.005 !   G 0.005
 !-COMPLIAN  !-COMPLIAN
 !   L 0.250 !   L 0.250
 !   G 0.005 !   G 0.005
 !-PAST PER  !-PAST PER
 !   L 0.250 !   L 0.250
 !   G 0.005 !   G 0.005
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                                   !
                              ______________
                              O   O   O   O
                              !
                   ________________________
                   O   O   O   O   O   O
                   !
              _____________________
                   !               !
               __________
              !RELIABIL!           O
              !        !
              ! L 0.500!
              ! G 0.022!
              !________!
                   !
     _____________________________________________
        !              !             !              !
   __________     __________     __________     __________
  !SOUNDNES!     !UNDERSTA!     !COMPLIAN!     !PAST PER!
  !        !     !        !     !        !     !        !
  ! L 0.250!     ! L 0.250!     ! L 0.250!     ! L 0.250!
  ! G 0.005!     ! G 0.005!     ! G 0.005!     ! G 0.005!
  !________!     !________!     !________!     !________!
  !-BLUE         !-BLUE         !-BLUE         !-BLUE
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-GREEN        !-GREEN        !-GREEN        !-GREEN
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-YELLOW       !-YELLOW       !-YELLOW       !-YELLOW
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-RED          !-RED          !-RED          !-RED
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
```

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                          O
                          !
                   O   O   O   O
                       !
     !                 !            !    !    !    !

     O         !PRO/QUAL!           O    O    O    O
               !        !
               ! L 0.044!
               ! G 0.026!
               !________!
                    !
        !               !              !              !

!PROD DES!  !QUAL DES!  !MAN TECH!  !MAN RESE!
!        !  !        !  !        !  !        !
! L 0.358!  ! L 0.085!  ! L 0.379!  ! L 0.179!
! G 0.009!  ! G 0.002!  ! G 0.010!  ! G 0.005!
!________!  !________!  !________!  !________!
!-SOUNDNES  !-SOUNDNES  !-SOUNDNES  !-SOUNDNES
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.001 !   G 0.002 !   G 0.001
!-UNDERSTA  !-UNDERSTA  !-UNDERSTA  !-UNDERSTA
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.001 !   G 0.002 !   G 0.001
!-COMPLIAN  !-COMPLIAN  !-COMPLIAN  !-COMPLIAN
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.001 !   G 0.002 !   G 0.001
!-PAST PER  !-PAST PER  !-PAST PER  !-PAST PER
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.001 !   G 0.002 !   G 0.001
```

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                        O
                        !
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                    O  O  O  O
                        !
       -------------------------------------
       !   !            !            !   !   !

       O   O        !SYS ENGR!       O   O   O
                    !        !
                    ! L 0.413!
                    ! G 0.246!
                    !________!
                        !
     -----------------------------------------------
     !               !               !               !

!SYS EFFE!  !ARM INTE!  !SYS INTE!  !COMP RES!
!        !  !        !  !        !  !        !
! L 0.424!  ! L 0.095!  ! L 0.373!  ! L 0.108!
! G 0.104!  ! G 0.023!  ! G 0.092!  ! G 0.027!
!________!  !________!  !________!  !________!
!-SOUNDNES  !-SOUNDNES  !-SOUNDNES  !-SOUNDNES
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.026  !  G 0.006  !  G 0.023  !  G 0.007
!-UNDERSTA  !-UNDERSTA  !-UNDERSTA  !-UNDERSTA
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.026  !  G 0.006  !  G 0.023  !  G 0.007
!-COMPLIAN  !-COMPLIAN  !-COMPLIAN  !-COMPLIAN
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.026  !  G 0.006  !  G 0.023  !  G 0.007
!-PAST PER  !-PAST PER  !-PAST PER  !-PAST PER
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.026  !  G 0.006  !  G 0.023  !  G 0.007
```

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                                   O
                                   !
                             ______________
                             O   O   O   O
                                   !
             ____________________________________________
             !   !   !             !                 !   !

             O   O   O       !FLY SYS. !             O   O
                             !         !
                             ! L 0.166 !
                             ! G 0.098 !
                             !_________!
                                   !
      _______________________________________________________________
      !              !              !              !              !
 ___________    ___________    ___________    ___________    ___________
!STRUCTUR!     !PROPULSI!     !STAB&CON!     !AERO&PER!     !FLY EQUI!
!        !     !        !     !        !     !        !     !        !
! L 0.305!     ! L 0.135!     ! L 0.158!     ! L 0.343!     ! L 0.059!
! G 0.030!     ! G 0.013!     ! G 0.015!     ! G 0.034!     ! G 0.006!
!________!     !________!     !________!     !________!     !________!
!-SOUNDNES     !-SOUNDNES     !-SOUNDNES     !-SOUNDNES     !-SOUNDNES
!   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
!   G 0.007    !   G 0.003    !   G 0.004    !   G 0.008    !   G 0.001
!-UNDERSTA     !-UNDERSTA     !-UNDERSTA     !-UNDERSTA     !-UNDERSTA
!   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
!   G 0.007    !   G 0.003    !   G 0.004    !   G 0.008    !   G 0.001
!-COMPLIAN     !-COMPLIAN     !-COMPLIAN     !-COMPLIAN     !-COMPLIAN
!   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
!   G 0.007    !   G 0.003    !   G 0.004    !   G 0.008    !   G 0.001
!-PAST PER     !-PAST PER     !-PAST PER     !-PAST PER     !-PAST PER
!   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
!   G 0.007    !   G 0.003    !   G 0.004    !   G 0.008    !   G 0.001
```

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                                                  O
                                                  !
                                            O   O   O   O
                                            !
                      !    !    !    !      !            !

                      O    O    O    O   !AVIONICS!      O
                                         !        !
                                         ! L 0.227!
                                         ! G 0.134!
                                         !________!
                                              !

        !            !            !            !            !            !

!COMM/NAV!  !OFF FUNC!  !DEF FUNC!  !ARCHITEC!  !CONT&DTS!  !OBSERVAB!
!        !  !        !  !        !  !        !  !        !  !        !
! L 0.110!  ! L 0.120!  ! L 0.064!  ! L [illegible]!  ! L 0.036!  ! L 0.446!
! G 0.015!  ! G 0.016!  ! G 0.009!  ! G 0.030!  ! G 0.005!  ! G 0.060!
!________!  !________!  !________!  !________!  !________!  !________!
!-SOUNDNES  !-SOUNDNES  !-SOUNDNES  !-SOUNDNES  !-SOUNDNES  !-SOUNDNES
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.004  !  G 0.004  !  G 0.002  !  G 0.007  !  G 0.001  !  G 0.015
!-UNDERSTA  !-UNDERSTA  !-UNDERSTA  !-UNDERSTA  !-UNDERSTA  !-UNDERSTA
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.004  !  G 0.004  !  G 0.002  !  G 0.007  !  G 0.001  !  G 0.015
!-COMPLIAN  !-COMPLIAN  !-COMPLIAN  !-COMPLIAN  !-COMPLIAN  !-COMPLIAN
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.004  !  G 0.004  !  G 0.002  !  G 0.007     G 0.001  !  G 0.015
!-PAST PER  !-PAST PER  !-PAST PER  !-PAST PER  !-PAST PER  !-PAST PER
!  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250  !  L 0.250
!  G 0.004  !  G 0.004  !  G 0.002  !  G 0.007  !  G 0.001  !  G 0.015
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                                          O
                                          !
                                    ___________
                                    O  O  O  O
                    __________________________
                    !  !  !  !  !           !

                    O  O  O  O  O       !SUPP SYS!
                                        !        !
                                        ! L 0.070!
                                        ! G 0.041!
                                        !________!
                 ___________________________________________
                 !         !         !         !          !
 !LIFE SUP! !CREW SYS! !MAIN SYS! !HUMAN FA! !TRAIN AN!
 !        ! !        ! !        ! !        ! !        !
 ! L 0.287! ! L 0.347! ! L 0.123! ! L 0.153! ! L 0.090!
 ! G 0.012! ! G 0.014! ! G 0.005! ! G 0.006! ! G 0.004!
 !________! !________! !________! !________! !________!
 !-SOUNDNES !-SOUNDNES !-SOUNDNES !-SOUNDNES !-SOUNDNES
 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
 !  G 0.003 !  G 0.004 !  G 0.001 !  G 0.002 !  G 0.001
 !-UNDERSTA !-UNDERSTA !-UNDERSTA !-UNDERSTA !-UNDERSTA
 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
 !  G 0.003 !  G 0.004 !  G 0.001 !  G 0.002 !  G 0.001
 !-COMPLIAN !-COMPLIAN !-COMPLIAN !-COMPLIAN !-COMPLIAN
 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
 !  G 0.003 !  G 0.004 !  G 0.001 !  G 0.002 !  G 0.001
 !-PAST PER !-PAST PER !-PAST PER !-PAST PER !-PAST PER
 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
 !  G 0.003 !  G 0.004 !  G 0.001 !  G 0.002 !  G 0.001
```

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                           O
                           !
          ------------------------------------
          !                !                !    !

          O         ! SUPPORT  !            O    O
                    !          !
                    ! L 0.260  !
                    ! G 0.260  !
                    !__________!
                           !
     --------------------------------------------------
     !                !                !                !

!ORGAN ST!    !MANAGE P!    !SUP TMPL!    !LOGISTIC!
!        !    !        !    !        !    !        !
! L 0.078!    ! L 0.135!    ! L 0.228!    ! L 0.559!
! G 0.020!    ! G 0.035!    ! G 0.059!    ! G 0.146!
!________!    !________!    !________!    !________!
!-SOUNDNES    !-TLS PROG    !-INFLU DP    ! DEF LOGI
!   L 0.250   !   L 0.524   !   L 0.800   !   L 0.200
!   G 0.005   !   G 0.018   !   G 0.048   !   G 0.029
!-UNDERSTA    !-ICC PROG    !-INTL SUP    ! TOOL&TEC
!   L 0.250   !   L 0.271   !   L 0.200   !   L 0.800
!   G 0.005   !   G 0.010   !   G 0.012   !   G 0.116
!-COMPLIAN    !-LSA PROG
!   L 0.250   !   L 0.135
!   G 0.005   !   G 0.005
!-PAST PER    !-LESSONS
!   L 0.250   !   L 0.079
!   G 0.005   !   G 0.002
```

```
                       O
                       !
                 O   O   O   O
                       !
             ----------------------------
                       !        !   !   !

               !ORGAN ST!       O   O   O
               !        !
               ! L 0.078!
               ! G 0.020!
               !________!
                    !
        ---------------------------------------
        !            !            !           !

!SOUNDNES!  !UNDERSTA!  !COMPLTAN!  !PAST PER!
!        !  !        !  !        !  !        !
! L 0.250!  ! L 0.250!  ! L 0.250!  ! L 0.250!
! G 0.005!  ! G 0.005!  ! G 0.005!  ! G 0.005!
!________!  !________!  !________!  !________!
!-BLUE      !-BLUE      !-BLUE      !-BLUE
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.001 !   G 0.001 !   G 0.001 !   G 0.001
!-GREEN     !-GREEN     !-GREEN     !-GREEN
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.001 !   G 0.001 !   G 0.001 !   G 0.001
!-YELLOW    !-YELLOW    !-YELLOW    !-YELLOW
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.001 !   G 0.001 !   G 0.001 !   G 0.001
!-RED       !-RED       !-RED       !-RED
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.001 !   G 0.001 !   G 0.001 !   G 0.001
```

```
                         O
                         !
                     ___________
                     O  O  O  O
                         !
              _______________________________
              !          !          !  !

              O   !MANAGE P!        O  O
                  !        !
                  ! L 0.135!
                  ! G 0.035!
                  !________!
                       !
        _________________________________________
        !          !           !           !
     ________   ________   ________   ________
    !ILS PROG! !LCC PROG! !LSA PROG! !LESSONS !
    !        ! !        ! !        ! !        !
    ! L 0.524! ! L 0.271! ! L 0.135! ! L 0.070!
    ! G 0.018! ! G 0.010! ! G 0.005! ! G 0.002!
    !________! !________! !________! !________!
    !-SOUNDNES !-SOUNDNES !-SOUNDNES !-SOUNDNES
    !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
    !  G 0.005 !  G 0.002 !  G 0.001 !  G 0.001
    !-UNDERSTA !-UNDERSTA !-UNDERSTA !-UNDERSTA
    !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
    !  G 0.005 !  G 0.002 !  G 0.001 !  G 0.001
    !-COMPLIAN !-COMPLIAN !-COMPLIAN !-COMPLIAN
    !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
    !  G 0.005 !  G 0.002 !  G 0.001 !  G 0.001
    !-PAST PER !-PAST PER !-PAST PER !-PAST PER
    !  L 0.250 !  L 0.250 !  L 0.250 !  L 0.250
    !  G 0.005 !  G 0.002 !  G 0.001 !  G 0.001
```

```
                    0
                    !
              _____________
              0   0   0   0
                    !
    ________________!_______________
    !   !           !              !

    0   0      !SUP TMPL!          0
               !        !
               ! L 0.228!
               ! G 0.059!
               !________!
                    !
              ______________
              !            !

      !INFLU DP! !INTE SUP!
      !        ! !        !
      ! L 0.800! ! L 0.200!
      ! G 0.048! ! G 0.012!
      !________! !________!
      !-SOUNDNES !-SOUNDNES
      !  L 0.250 !  L 0.250
      !  G 0.012 !  G 0.003
      !-UNDERSTA !-UNDERSTA
      !  L 0.250 !  L 0.250
      !  G 0.012 !  G 0.003
      !-COMPLIAN !-COMPLIAN
      !  L 0.250 !  L 0.250
      !  G 0.012 !  G 0.003
      !-PAST PER !-PAST PER
      !  L 0.250 !  L 0.250
      !  G 0.012 !  G 0.003
```

```
                          O
                          !
                    O   O   O   O
                          !
 !    !    !              !

 O    O    O        !LOGISTIC!
                    !        !
                    ! L 0.559!
                    ! G 0.146!
                    !________!
                         !
                 ____________________
                 !                  !

         !DEF LOGI!  !TOOL&TEC!
         !        !  !        !
         ! L 0.200!  ! L 0.800!
         ! G 0.029!  ! G 0.116!
         !________!  !________!
         !-SOUNDNES  !-SOUNDNES
         !   L 0.250 !   L 0.250
         !   G 0.007 !   G 0.029
         !-UNDERSTA  !-UNDERSTA
         !   L 0.250 !   L 0.250
         !   G 0.007 !   G 0.029
         !-COMPLIAN  !-COMPLIAN
         !   L 0.250 !   L 0.250
         !   G 0.007 !   G 0.029
         !-PAST PER  !-PAST PER
         !   L 0.250 !   L 0.250
         !   G 0.007 !   G 0.029
```

```
                                   O
                                   !
                  ---------------------------------
                  !  !             !              !
                  O  O         !MANAGE O!         O
                               !        !
                               ! L 0.092!
                               ! G 0.092!
                               !________!
                                   !
  ----------------------------------------------------------------------------------
     !           !           !           !           !           !           !
!PROG MAN!  !FUT COMP!  !SYS TEST!  !MANUFACT!  !QUAL ASS!  !SYS SAFE!  !SECURITY!
!        !  !        !  !        !  !        !  !        !  !        !  !        !
! L 0.212!  ! L 0.106!  ! L 0.188!  ! L 0.324!  ! L 0.064!  ! L 0.049!  ! L 0.057!
! G 0.019!  ! G 0.010!  ! G 0.017!  ! G 0.030!  ! G 0.006!  ! G 0.004!  ! G 0.005!
!________!  !________!  !________!  !________!  !________!  !________!  !________!
!-CONFIGUR  !-SOUNDNES  !-SOUNDNES  !-MAN PLAN  !-QUAL SYS  !-SOUNDNES  !-PER/PHYS
!  L 0.102  !  L 0.250  !  L 0.250  !  L 0.297  !  L 0.800  !  L 0.250  !  L 0.500
!  G 0.002  !  G 0.002  !  G 0.004  !  G 0.009  !  G 0.005  !  G 0.001  !  G 0.003
!-DATA MAN  !-UNDERSTA  !-UNDERSTA  !-MAN CAPA  !-INIT QUA  !-UNDERSTA  !-TEMPEST/
!  L 0.090  !  L 0.250  !  L 0.250  !  L 0.540  !  L 0.200  !  L 0.250  !  L 0.250
!  G 0.002  !  G 0.002  !  G 0.004  !  G 0.016  !  G 0.001  !  G 0.001  !  G 0.001
!-ORGANIZA  !-COMPLIAN  !-COMPLIAN  !-MAN COST              !-COMPLIAN  !-SYS SECU
!  L 0.173  !  L 0.250  !  L 0.250  !  L 0.163              !  L 0.250  !  L 0.250
!  G 0.003  !  G 0.002  !  G 0.004  !  G 0.005              !  G 0.001  !  G 0.001
!-MAN C&T   !-PAST PER  !-PAST PER                          !-PAST PER
!  L 0.138  !  L 0.250  !  L 0.250                          !  L 0.250
!  G 0.003  !  G 0.002  !  G 0.004                          !  G 0.001
!-CONTIN P
!  L 0.278
!  G 0.005
!-CONTRACT
!  L 0.218
!  G 0.004
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                            !         !   !   !   !   !   !
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                    !PROG MAN!        O   O   O   O   O   O
                    !        !
                    ! L 0.212!
                    ! G 0.019!
                    !________!
                        !
   ______________________________________________________________________________
        !            !            !            !            !            !
   __________   __________   __________   __________   __________   __________
  !CONFIGUR!   !DATA MAN!   !ORGANIZA!   !MAN C&I !   !CONTIN P!   !CONTRACT!
  !        !   !        !   !        !   !        !   !        !   !        !
  ! L 0.102!   ! L 0.090!   ! L 0.173!   ! L 0.138!   ! L 0.278!   ! L 0.218!
  ! G 0.002!   ! G 0.002!   ! G 0.003!   ! G 0.003!   ! G 0.005!   ! G 0.004!
  !________!   !________!   !________!   !________!   !________!   !________!
  !-SOUNDNES   !-SOUNDNES   !-SOUNDNES   !-SOUNDNES   !-SOUNDNES   !-SOUNDNES
  !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250
  !  G 0.000   !  G 0.000   !  G 0.001   !  G 0.001   !  G 0.001   !  G 0.001
  !-UNDERSTA   !-UNDERSTA   !-UNDERSTA   !-UNDERSTA   !-UNDERSTA   !-UNDERSTA
  !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250
  !  G 0.000   !  G 0.000   !  G 0.001   !  G 0.001   !  G 0.001   !  G 0.001
  !-COMPLIAN   !-COMPLIAN   !-COMPLIAN   !-COMPLIAN   !-COMPLIAN   !-COMPLIAN
  !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250
  !  G 0.000   !  G 0.000   !  G 0.001   !  G 0.001   !  G 0.001   !  G 0.001
  !-PAST PER   !-PAST PER   !-PAST PER   !-PAST PER   !-PAST PER   !-PAST PER
  !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250   !  L 0.250
  !  G 0.000   !  G 0.000   !  G 0.001   !  G 0.001   !  G 0.001   !  G 0.001
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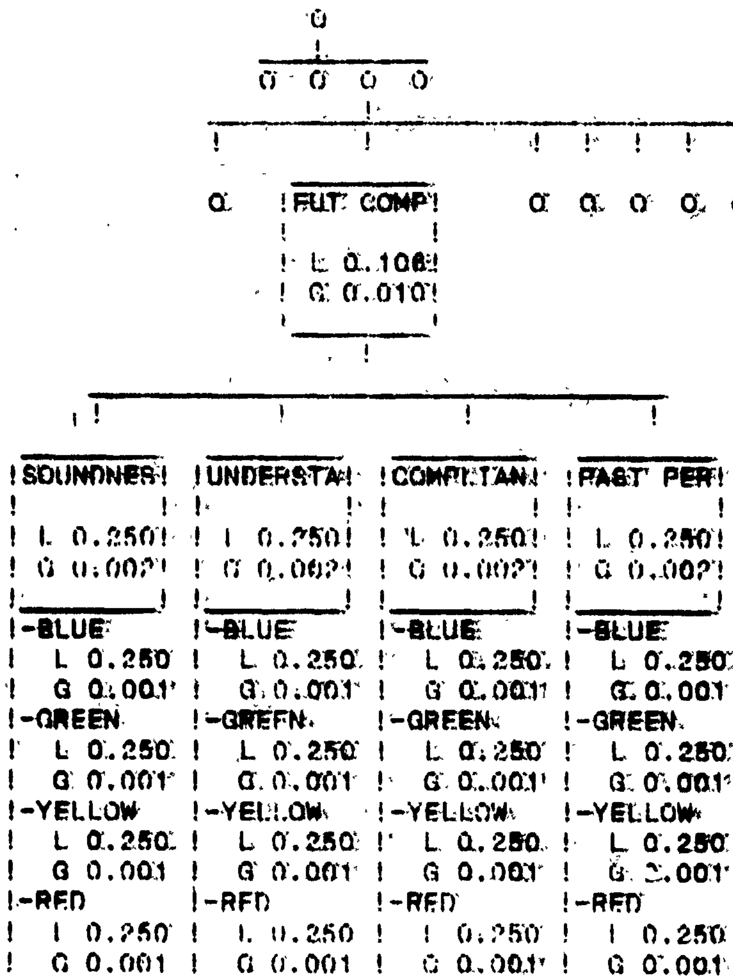
FUT COMP
L 0.108
G 0.010
SOUNDNES
UNDERSTA
COMPETAN
FAST PER
L 0.250
G 0.002
BLUE
GREEN
YELLOW
RED
L 0.250
G 0.001

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       !    !               !               !    !    !    !

       O    O         !SYS TEST!            O    O    O    O
                      !        !
                      ! L 0.188!
                      ! G 0.017!
                      !________!
                          !
      ___________________________________________
      !              !              !              !

!SOUNDNES!    !UNDERSTA!    !COMPLIAN!    !PAST PER!
!        !    !        !    !        !    !        !
! L 0.250!    ! L 0.250!    ! L 0.250!    ! L 0.250!
! G 0.004!    ! G 0.004!    ! G 0.004!    ! G 0.004!
!________!    !________!    !________!    !________!
!-BLUE        !-BLUE        !-BLUE        !-BLUE
!  L 0.250    !  L 0.250    !  L 0.250    !  L 0.250
!  G 0.001    !  G 0.001    !  G 0.001    !  G 0.001
!-GREEN       !-GREEN       !-GREEN       !-GREEN
!  L 0.250    !  L 0.250    !  L 0.250    !  L 0.250
!  G 0.001    !  G 0.001    !  G 0.001    !  G 0.001
!-YELLOW      !-YELLOW      !-YELLOW      !-YELLOW
!  L 0.250    !  L 0.250    !  L 0.250    !  L 0.250
!  G 0.001    !  G 0.001    !  G 0.001    !  G 0.001
!-RED         !-RED         !-RED         !-RED
!  L 0.250    !  L 0.250    !  L 0.250    !  L 0.250
!  G 0.001    !  G 0.001    !  G 0.001    !  G 0.001
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 !   !   !          !             !   !   !
 O   O   O     !MANUFACT!         O   O   O
               !        !
               ! L 0.324!
               ! G 0.030!
               !________!
                    !
        ---------------------------------
        !           !                   !
 !MAN PLAN!  !MAN CAPA!  !MAN COST!
 !        !  !        !  !        !
 ! L 0.297!  ! L 0.540!  ! L 0.163!
 ! G 0.009!  ! G 0.016!  ! G 0.005!
 !________!  !________!  !________!
 !-SOUNDNES  !-SOUNDNES  !-SOUNDNES
 !  L 0.250  !  L 0.250  !  L 0.250
 !  G 0.002  !  G 0.004  !  G 0.001
 !-UNDERSTA  !-UNDERSTA  !-UNDERSTA
 !  L 0.250  !  L 0.250  !  L 0.250
 !  G 0.002  !  G 0.004  !  G 0.001
 !-COMPLTAN  !-COMPLTAN  !-COMPLTAN
 !  L 0.250  !  L 0.250  !  L 0.250
 !  G 0.002  !  G 0.004  !  G 0.001
 !-PAST PER  !-PAST PER  !-PAST PER
 !  L 0.250  !  L 0.250  !  L 0.250
 !  G 0.002  !  G 0.004  !  G 0.001
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 !  !  !  !         !            !  !

 O  O  O  O     !QUAL ASS!       O  O
                !        !
                ! L 0.064!
                ! G 0.006!
                !________!
                    !
               ____________
               !          !

          !QUAL SYS! !INIT QUA!
          !        ! !        !
          ! L 0.800! ! L 0.200!
          ! G 0.005! ! G 0.001!
          !________! !________!
          !-SOUNDNES !-SOUNDNES
          !   L 0.250 !   L 0.250
          !   G 0.001 !   G 0.000
          !-UNDERSTA !-UNDERSTA
          !   L 0.250 !   L 0.250
          !   G 0.001 !   G 0.000
          !-COMPLIAN !-COMPLIAN
          !   L 0.250 !   L 0.250
          !   G 0.001 !   G 0.000
          !-PAST PER !-PAST PER
          !   L 0.250 !   L 0.250
          !   G 0.001 !   G 0.000
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   _____________________________________
   !   !   !   !   !            !         !

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                             !SYS SAFE!
                             !        !
                             ! L 0.049!
                             ! G 0.004!
                             !________!
                                  !
        _____________________________________________
        !              !              !              !
   ___________   ___________   ___________   ___________
   !SOUNDNES!    !UNDERSTA!    !COMPLIAN!    !PAST PER!
   !        !    !        !    !        !    !        !
   ! L 0.250!    ! L 0.250!    ! L 0.250!    ! L 0.250!
   ! G 0.001!    ! G 0.001!    ! G 0.001!    ! G 0.001!
   !________!    !________!    !________!    !________!
   !-BLUE        !-BLUE        !-BLUE        !-BLUE
   !   L 0.250   !   L 0.250   !   L 0.250   !   L 0.250
   !   G 0.000   !   G 0.000   !   G 0.000   !   G 0.000
   !-GREEN       !-GREEN       !-GREEN       !-GREEN
   !   L 0.250   !   L 0.250   !   L 0.250   !   L 0.250
   !   G 0.000   !   G 0.000   !   G 0.000   !   G 0.000
   !-YELLOW      !-YELLOW      !-YELLOW      !-YELLOW
   !   L 0.250   !   L 0.250   !   L 0.250   !   L 0.250
   !   G 0.000   !   G 0.000   !   G 0.000   !   G 0.000
   !-RED         !-RED         !-RED         !-RED
   !   L 0.250   !   L 0.250   !   L 0.250   !   L 0.250
   !   G 0.000   !   G 0.000   !   G 0.000   !   G 0.000
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  ______________________________
  ! ! ! ! ! !           !
                      _________
  O O O O O O         !SECURITY!
                      !        !
                      ! L 0.057!
                      ! G 0.005!
                      !________!
                          !
              ______________________
              !           !          !
         __________  __________  __________
         !PER/PHYS!  !TEMPEST/!  !SYS SECU!
         !        !  !        !  !        !
         ! L 0.500!  ! L 0.250!  ! L 0.250!
         ! G 0.003!  ! G 0.001!  ! G 0.001!
         !________!  !________!  !________!
         !-SOUNDNES  !-SOUNDNES  !-SOUNDNES
         !   L 0.250 !   L 0.250 !   L 0.250
         !   G 0.001 !   G 0.000 !   G 0.000
         !-UNDERSTA  !-UNDERSTA  !-UNDERSTA
         !   L 0.250 !   L 0.250 !   L 0.250
         !   G 0.001 !   G 0.000 !   G 0.000
         !-COMPLIAN  !-COMPLIAN  !-COMPLIAN
         !   L 0.250 !   L 0.250 !   L 0.250
         !   G 0.001 !   G 0.000 !   G 0.000
         !-PAST PER  !-PAST PER  !-PAST PER
         !   L 0.250 !   L 0.250 !   L 0.250
         !   G 0.001 !   G 0.000 !   G 0.000
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     !    !    !          !

     O    O    O      !COST     !
                      !         !
                      ! L 0.060!
                      ! G 0.060!
                      !_________!
                           !
          _____________________________
          !                !           !

    !REALISM  !  !REASONAB!  !COMPLETE!
    !         !  !        !  !        !
    ! L 0.327!   ! L 0.413!  ! L 0.260!
    ! G 0.020!   ! G 0.025!  ! G 0.016!
    !_________!  !________!  !________!
    !-SOUNDNES   !-SOUNDNES  !-SOUNDNES
    !  L 0.250   !  L 0.250  !  L 0.250
    !  G 0.005   !  G 0.006  !  G 0.004
    !-UNDERSTA   !-UNDERSTA  !-UNDERSTA
    !  L 0.250   !  L 0.250  !  L 0.250
    !  G 0.005   !  G 0.006  !  G 0.004
    !-COMPLIAN   !-COMPLIAN  !-COMPLIAN
    !  L 0.250   !  L 0.250  !  L 0.250
    !  G 0.005   !  G 0.006  !  G 0.004
    !-PAST PER   !-PAST PER  !-PAST PER
    !  L 0.250   !  L 0.250  !  L 0.250
    !  G 0.005   !  G 0.006  !  G 0.004
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                             !          !  !
                      ___________
                     !REALISM   !      O  O
                     !          !
                     ! L 0.327  !
                     ! G 0.020  !
                     !__________!
                          !
      ___________________________________________________
      !                !                !               !
 ___________      ___________      ___________     ___________
!SOUNDNES!       !UNDERSTA!       !COMPLIAN!      !PAST PER!
!        !       !        !       !        !      !        !
! L 0.250!       ! L 0.250!       ! L 0.250!      ! L 0.250!
! G 0.005!       ! G 0.005!       ! G 0.005!      ! G 0.005!
!________!       !________!       !________!      !________!
!-BLUE           !-BLUE           !-BLUE          !-BLUE
!   L 0.250      !   L 0.250      !   L 0.250     !   L 0.250
!   G 0.001      !   G 0.001      !   G 0.001     !   G 0.001
!-GREEN          !-GREEN          !-GREEN         !-GREEN
!   L 0.250      !   L 0.250      !   L 0.250     !   L 0.250
!   G 0.001      !   G 0.001      !   G 0.001     !   G 0.001
!-YELLOW         !-YELLOW         !-YELLOW        !-YELLOW
!   L 0.250      !   L 0.250      !   L 0.250     !   L 0.250
!   G 0.001      !   G 0.001      !   G 0.001     !   G 0.001
!-RED            !-RED            !-RED           !-RED
!   L 0.250      !   L 0.250      !   L 0.250     !   L 0.250
!   G 0.001      !   G 0.001      !   G 0.001     !   G 0.001
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              O   O   O   O
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              -----------------------
              !         !           !
              O    !REASONAB!       O
                   !        !
                   ! L 0.413!
                   ! G 0.025!
                   !________!
                        !
        ----------------------------------------
        !            !            !            !
!SOUNDNES!  !UNDERSTA!  !COMPLIAN!  !PAST PER!
!        !  !        !  !        !  !        !
! L 0.250!  ! L 0.250!  ! L 0.250!  ! L 0.250!
! G 0.006!  ! G 0.006!  ! G 0.006!  ! G 0.006!
!________!  !________!  !________!  !________!
!-BLUE      !-BLUE      !-BLUE      !-BLUE
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.002 !   G 0.002 !   G 0.002
!-GREEN     !-GREEN     !-GREEN     !-GREEN
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.002 !   G 0.002 !   G 0.002
!-YELLOW    !-YELLOW    !-YELLOW    !-YELLOW
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.002 !   G 0.002 !   G 0.002
!-RED       !-RED       !-RED       !-RED
!   L 0.250 !   L 0.250 !   L 0.250 !   L 0.250
!   G 0.002 !   G 0.002 !   G 0.002 !   G 0.002
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            O   O   O   O
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          !   !         !
                      __________
          O   O       !COMPLETE!
                      !        !
                      ! L 0.260!
                      ! G 0.016!
                      !________!
                          !
      ________________________________________
      !              !              !              !
  __________     __________     __________     __________
  !SOUNDNES!     !UNDERSTA!     !COMPL TAN!    !PAST PER!
  !        !     !        !     !        !     !        !
  ! L 0.250!     ! L 0.250!     ! L 0.250!     ! L 0.250!
  ! G 0.004!     ! G 0.004!     ! G 0.004!     ! G 0.004!
  !________!     !________!     !________!     !________!
  !-BLUE         !-BLUE         !-BLUE         !-BLUE
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-GREEN        !-GREEN        !-GREEN        !-GREEN
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-YELLOW       !-YELLOW       !-YELLOW       !-YELLOW
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
  !-RED          !-RED          !-RED          !-RED
  !   L 0.250    !   L 0.250    !   L 0.250    !   L 0.250
  !   G 0.001    !   G 0.001    !   G 0.001    !   G 0.001
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SOURCE SELECTION RATINGS OF CONTRACTORS A THROUGH D
FOR THE SOURCE SELECTION PROCESS

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
TECHNICAL AREA						0.588		
Reliability/Maintainability Item						0.074		
Reliability						0.5		
Soundness of Approach						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN	1		1	1	0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Understanding of Problem						0.25		
	BLUE				1	0.4	0.0021756	TECH
	GREEN	1		1		0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Compliance with Requirement						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN	1		1	1	0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Past Performance						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN		1	1	1	0.3	0.0016317	TECH
	YELLOW	1				0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Maintainability						0.5		
Soundness of Approach						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN	1		1	1	0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Understanding of Problem						0.25		
	BLUE				1	0.4	0.0021756	TECH
	GREEN	1		1		0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Compliance with Requirement						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN	1		1	1	0.3	0.0016317	TECH
	YELLOW		1			0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Past Performance						0.25		
	BLUE					0.4	0.0021756	TECH
	GREEN		1	1	1	0.3	0.0016317	TECH
	YELLOW	1				0.2	0.0010878	TECH
	RED					0.1	0.0005439	TECH
Producibility/Quality Engineering						0.044		
Producibility in Design						0.358		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000926217	TECH
	GREEN					0.3	0.000694663	TECH
	YELLOW		1	1		0.2	0.000463108	TECH
	RED					0.1	0.000231554	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Understanding of Problem						0.25		
	BLUE				1	0.4	0.000926217	TECH
	GREEN	1		1		0.3	0.000694663	TECH
	YELLOW		1			0.2	0.000463108	TECH
	RED					0.1	0.000231554	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000926217	TECH
	GREEN	1				0.3	0.000694663	TECH
	YELLOW		1	1		0.2	0.000463108	TECH
	RED					0.1	0.000231554	TECH
Past Performance						0.25		
	BLUE					0.4	0.000926217	TECH
	GREEN	1			1	0.3	0.000694663	TECH
	YELLOW		1	1		0.2	0.000463108	TECH
	RED					0.1	0.000231554	TECH
Quality in Design						0.085		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000219912	TECH
	GREEN					0.3	0.000164934	TECH
	YELLOW		1	1		0.2	0.000109956	TECH
	RED					0.1	0.000054978	TECH
Understanding of Problem						0.25		
	BLUE				1	0.4	0.000219912	TECH
	GREEN	1		1		0.3	0.000164934	TECH
	YELLOW		1			0.2	0.000109956	TECH
	RED					0.1	0.000054978	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000219912	TECH
	GREEN	1				0.3	0.000164934	TECH
	YELLOW		1	1		0.2	0.000109956	TECH
	RED					0.1	0.000054978	TECH
Past Performance						0.25		
	BLUE					0.4	0.000219912	TECH
	GREEN	1			1	0.3	0.000164934	TECH
	YELLOW		1	1		0.2	0.000109956	TECH
	RED					0.1	0.000054978	TECH
Manufacturing Technology						0.379		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000980548	TECH
	GREEN					0.3	0.000735411	TECH
	YELLOW		1	1		0.2	0.000490274	TECH
	RED					0.1	0.000245137	TECH
Understanding of Problem						0.25		
	BLUE				1	0.4	0.000980548	TECH
	GREEN	1		1		0.3	0.000735411	TECH
	YELLOW		1			0.2	0.000490274	TECH
	RED					0.1	0.000245137	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000980548	TECH
	GREEN	1				0.3	0.000735411	TECH
	YELLOW		1	1		0.2	0.000490274	TECH
	RED					0.1	0.000245137	TECH
Past Performance						0.25		
	BLUE					0.4	0.000980548	TECH
	GREEN	1			1	0.3	0.000735411	TECH
	YELLOW		1	1		0.2	0.000490274	TECH
	RED					0.1	0.000245137	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Manufacturing Research						0.178		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000460521	TECH
	GREEN					0.3	0.000345391	TECH
	YELLOW		1	1		0.2	0.000230260	TECH
	RED					0.1	0.000115130	TECH
Understanding of Problem						0.25		
	BLUE				1	0.4	0.000460521	TECH
	GREEN	1		1		0.3	0.000345391	TECH
	YELLOW		1			0.2	0.000230260	TECH
	RED					0.1	0.000115130	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000460521	TECH
	GREEN	1				0.3	0.000345391	TECH
	YELLOW		1	1		0.2	0.000230260	TECH
	RED					0.1	0.000115130	TECH
Past Performance						0.25		
	BLUE					0.4	0.000460521	TECH
	GREEN	1			1	0.3	0.000345391	TECH
	YELLOW		1	1		0.2	0.000230260	TECH
	RED					0.1	0.000115130	TECH
System Engineering Item						0.418		
System Effectiveness						0.424		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.010421241	TECH
	GREEN		1	1		0.3	0.007815931	TECH
	YELLOW					0.2	0.005210620	TECH
	RED					0.1	0.002605310	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.010421241	TECH
	GREEN			1		0.3	0.007815931	TECH
	YELLOW		1			0.2	0.005210620	TECH
	RED					0.1	0.002605310	TECH
Compliance with Requirement						0.25		
	BLUE	1			1	0.4	0.010421241	TECH
	GREEN		1	1		0.3	0.007815931	TECH
	YELLOW					0.2	0.005210620	TECH
	RED					0.1	0.002605310	TECH
Past Performance						0.25		
	BLUE					0.4	0.010421241	TECH
	GREEN		1	1	1	0.3	0.007815931	TECH
	YELLOW	1				0.2	0.005210620	TECH
	RED					0.1	0.002605310	TECH
Armament Integration						0.095		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.002334948	TECH
	GREEN		1	1		0.3	0.001751211	TECH
	YELLOW					0.2	0.001167474	TECH
	RED					0.1	0.000583737	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.002334948	TECH
	GREEN			1		0.3	0.001751211	TECH
	YELLOW		1			0.2	0.001167474	TECH
	RED					0.1	0.000583737	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE	1			1	0.4	0.002334948	TECH
	GREEN		1	1		0.3	0.001751211	TECH
	YELLOW					0.2	0.001167474	TECH
	RED					0.1	0.000583737	TECH
Past Performance						0.25		
	BLUE					0.4	0.002334948	TECH
	GREEN		1	1	1	0.3	0.001751211	TECH
	YELLOW	1				0.2	0.001167474	TECH
	RED					0.1	0.000583737	TECH
Systems Integration						0.373		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.009167743	TECH
	GREEN		1	1		0.3	0.006875807	TECH
	YELLOW					0.2	0.004583871	TECH
	RED					0.1	0.002291935	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.009167743	TECH
	GREEN			1		0.3	0.006875807	TECH
	YELLOW		1			0.2	0.004583871	TECH
	RED					0.1	0.002291935	TECH
Compliance with Requirement						0.25		
	BLUE	1			1	0.4	0.009167743	TECH
	GREEN		1	1		0.3	0.006875807	TECH
	YELLOW					0.2	0.004583871	TECH
	RED					0.1	0.002291935	TECH
Past Performance						0.25		
	BLUE					0.4	0.009167743	TECH
	GREEN		1	1	1	0.3	0.006875807	TECH
	YELLOW	1				0.2	0.004583871	TECH
	RED					0.1	0.002291935	TECH
Computer Resources						0.108		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.002654467	TECH
	GREEN		1	1		0.3	0.001990850	TECH
	YELLOW					0.2	0.001327233	TECH
	RED					0.1	0.000663616	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.002654467	TECH
	GREEN			1		0.3	0.001990850	TECH
	YELLOW		1			0.2	0.001327233	TECH
	RED					0.1	0.000663616	TECH
Compliance with Requirement						0.25		
	BLUE	1			1	0.4	0.002654467	TECH
	GREEN		1	1		0.3	0.001990850	TECH
	YELLOW					0.2	0.001327233	TECH
	RED					0.1	0.000663616	TECH
Past Performance						0.25		
	BLUE					0.4	0.002654467	TECH
	GREEN		1	1	1	0.3	0.001990850	TECH
	YELLOW	1				0.2	0.001327233	TECH
	RED					0.1	0.000663616	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Flight Systems Item						0.166		
Structures						0.305		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.002977044	TECH
	GREEN		1	1		0.3	0.002232783	TECH
	YELLOW					0.2	0.001488522	TECH
	RED					0.1	0.000744261	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.002977044	TECH
	GREEN		1	1		0.3	0.002232783	TECH
	YELLOW					0.2	0.001488522	TECH
	RED					0.1	0.000744261	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.002977044	TECH
	GREEN	1		1		0.3	0.002232783	TECH
	YELLOW		1			0.2	0.001488522	TECH
	RED					0.1	0.000744261	TECH
Past Performance						0.25		
	BLUE				1	0.4	0.002977044	TECH
	GREEN		1	1		0.3	0.002232783	TECH
	YELLOW	1				0.2	0.001488522	TECH
	RED					0.1	0.000744261	TECH
Propulsion						0.135		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.001317708	TECH
	GREEN		1	1		0.3	0.000988281	TECH
	YELLOW					0.2	0.000658854	TECH
	RED					0.1	0.000329427	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001317708	TECH
	GREEN		1	1		0.3	0.000988281	TECH
	YELLOW					0.2	0.000658854	TECH
	RED					0.1	0.000329427	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.001317708	TECH
	GREEN	1		1		0.3	0.000988281	TECH
	YELLOW		1			0.2	0.000658854	TECH
	RED					0.1	0.000329427	TECH
Past Performance						0.25		
	BLUE				1	0.4	0.001317708	TECH
	GREEN		1	1		0.3	0.000988281	TECH
	YELLOW	1				0.2	0.000658854	TECH
	RED					0.1	0.000329427	TECH
Stability and Control						0.158		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.001542206	TECH
	GREEN		1	1		0.3	0.001156654	TECH
	YELLOW					0.2	0.000771103	TECH
	RED					0.1	0.000385551	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001542206	TECH
	GREEN		1	1		0.3	0.001156654	TECH
	YELLOW					0.2	0.000771103	TECH
	RED					0.1	0.000385551	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.001542206	TECH
	GREEN	1		1		0.3	0.001156654	TECH
	YELLOW		1			0.2	0.000771103	TECH
	RED					0.1	0.000385551	TECH
Past Performance						0.25		
	BLUE				1	0.4	0.001542206	TECH
	GREEN		1	1		0.3	0.001156654	TECH
	YELLOW	1				0.2	0.000771103	TECH
	RED					0.1	0.000385551	TECH
Aerodynamics and Performance						0.343		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.003347954	TECH
	GREEN		1	1		0.3	0.002510965	TECH
	YELLOW					0.2	0.001673977	TECH
	RED					0.1	0.000836988	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.003347954	TECH
	GREEN		1	1		0.3	0.002510965	TECH
	YELLOW					0.2	0.001673977	TECH
	RED					0.1	0.000836988	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.003347954	TECH
	GREEN	1		1		0.3	0.002510965	TECH
	YELLOW		1			0.2	0.001673977	TECH
	RED					0.1	0.000836988	TECH
Past Performance						0.25		
	BLUE				1	0.4	0.003347954	TECH
	GREEN		1	1		0.3	0.002510965	TECH
	YELLOW	1				0.2	0.001673977	TECH
	RED					0.1	0.000836988	TECH
Flight Equipment and Subsystems						0.059		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000575887	TECH
	GREEN		1	1		0.3	0.000431915	TECH
	YELLOW					0.2	0.000287943	TECH
	RED					0.1	0.000143971	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000575887	TECH
	GREEN		1	1		0.3	0.000431915	TECH
	YELLOW					0.2	0.000287943	TECH
	RED					0.1	0.000143971	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000575887	TECH
	GREEN	1		1		0.3	0.000431915	TECH
	YELLOW		1			0.2	0.000287943	TECH
	RED					0.1	0.000143971	TECH
Past Performance						0.25		
	BLUE				1	0.4	0.000575887	TECH
	GREEN		1	1		0.3	0.000431915	TECH
	YELLOW	1				0.2	0.000287943	TECH
	RED					0.1	0.000143971	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Avionics Item						0.227		
Communications/Navigation						0.11		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.001468236	TECH
	GREEN			1		0.3	0.001101177	TECH
	YELLOW		1			0.2	0.000734118	TECH
	RED					0.1	0.000367059	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001468236	TECH
	GREEN		1	1		0.3	0.001101177	TECH
	YELLOW					0.2	0.000734118	TECH
	RED					0.1	0.000367059	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.001468236	TECH
	GREEN	1		1		0.3	0.001101177	TECH
	YELLOW		1			0.2	0.000734118	TECH
	RED					0.1	0.000367059	TECH
Past Performance						0.25		
	BLUE					0.4	0.001468236	TECH
	GREEN			1	1	0.3	0.001101177	TECH
	YELLOW	1	1			0.2	0.000734118	TECH
	RED					0.1	0.000367059	TECH
Offensive Functions						0.121		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.001615059	TECH
	GREEN			1		0.3	0.001211294	TECH
	YELLOW		1			0.2	0.000807529	TECH
	RED					0.1	0.000403764	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001615059	TECH
	GREEN		1	1		0.3	0.001211294	TECH
	YELLOW					0.2	0.000807529	TECH
	RED					0.1	0.000403764	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.001615059	TECH
	GREEN	1		1		0.3	0.001211294	TECH
	YELLOW		1			0.2	0.000807529	TECH
	RED					0.1	0.000403764	TECH
Past Performance						0.25		
	BLUE					0.4	0.001615059	TECH
	GREEN			1	1	0.3	0.001211294	TECH
	YELLOW	1	1			0.2	0.000807529	TECH
	RED					0.1	0.000403764	TECH
Defensive Functions						0.064		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000854246	TECH
	GREEN			1		0.3	0.000640684	TECH
	YELLOW		1			0.2	0.000427123	TECH
	RED					0.1	0.000213561	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000854246	TECH
	GREEN		1	1		0.3	0.000640684	TECH
	YELLOW					0.2	0.000427123	TECH
	RED					0.1	0.000213561	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000854246	TECH
	GREEN	1		1		0.3	0.000640684	TECH
	YELLOW		1			0.2	0.000427123	TECH
	RED					0.1	0.000213561	TECH
Past Performance						0.25		
	BLUE					0.4	0.000854246	TECH
	GREEN			1	1	0.3	0.000640684	TECH
	YELLOW	1	1			0.2	0.000427123	TECH
	RED					0.1	0.000213561	TECH
Architecture						0.223		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.002976514	TECH
	GREEN			1		0.3	0.002232386	TECH
	YELLOW		1			0.2	0.001488257	TECH
	RED					0.1	0.000744128	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.002976514	TECH
	GREEN		1	1		0.3	0.002232386	TECH
	YELLOW					0.2	0.001488257	TECH
	RED					0.1	0.000744128	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.002976514	TECH
	GREEN	1		1		0.3	0.002232386	TECH
	YELLOW		1			0.2	0.001488257	TECH
	RED					0.1	0.000744128	TECH
Past Performance						0.25		
	BLUE					0.4	0.002976514	TECH
	GREEN			1	1	0.3	0.002232386	TECH
	YELLOW	1	1			0.2	0.001488257	TECH
	RED					0.1	0.000744128	TECH
Controls and Displays						0.036		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.000480513	TECH
	GREEN			1		0.3	0.000360385	TECH
	YELLOW		1			0.2	0.000240256	TECH
	RED					0.1	0.000120128	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000480513	TECH
	GREEN		1	1		0.3	0.000360385	TECH
	YELLOW					0.2	0.000240256	TECH
	RED					0.1	0.000120128	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.000480513	TECH
	GREEN	1		1		0.3	0.000360385	TECH
	YELLOW		1			0.2	0.000240256	TECH
	RED					0.1	0.000120128	TECH
Past Performance						0.25		
	BLUE					0.4	0.000480513	TECH
	GREEN			1	1	0.3	0.000360385	TECH
	YELLOW	1	1			0.2	0.000240256	TECH
	RED					0.1	0.000120128	TECH

CRITERA	RATING LEVELS	A	[illegible]	[illegible]	D	WEIGHTS	CUMMULATIVE WEIGHTINGS	AREA
Observables						0.446		
Soundness of Approach						0.25		
	BLUE	1			1	0.4	0.005953029	TECH
	GREEN			1		0.3	0.004464772	TECH
	YELLOW		1			0.2	0.002976514	TECH
	RED					0.1	0.001488257	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.005953029	TECH
	GREEN		1	1		0.3	0.004464772	TECH
	YELLOW					0.2	0.002976514	TECH
	RED					0.1	0.001488257	TECH
Compliance with Requirement						0.25		
	BLUE				1	0.4	0.005953029	TECH
	GREEN	1		1		0.3	0.004464772	TECH
	YELLOW		1			0.2	0.002976514	TECH
	RED					0.1	0.001488257	TECH
Past Performance						0.25		
	BLUE					0.4	0.005953029	TECH
	GREEN			1	1	0.3	0.004464772	TECH
	YELLOW	1	1			0.2	0.002976514	TECH
	RED					0.1	0.001488257	TECH
Support Systems Item						0.071		
Life Support/Escape Systems						0.287		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.001198167	TECH
	GREEN	1			1	0.3	0.000898625	TECH
	YELLOW		1			0.2	0.000599083	TECH
	RED					0.1	0.000299541	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001198167	TECH
	GREEN			1		0.3	0.000898625	TECH
	YELLOW		1			0.2	0.000599083	TECH
	RED					0.1	0.000299541	TECH
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.001198167	TECH
	GREEN	1			1	0.3	0.000898625	TECH
	YELLOW		1			0.2	0.000599083	TECH
	RED					0.1	0.000299541	TECH
Past Performance						0.25		
	BLUE			1		0.4	0.001198167	TECH
	GREEN	1	1		1	0.3	0.000898625	TECH
	YELLOW					0.2	0.000599083	TECH
	RED					0.1	0.000299541	TECH
Crew Systems						0.347		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.001448655	TECH
	GREEN	1			1	0.3	0.001086491	TECH
	YELLOW		1			0.2	0.000724327	TECH
	RED					0.1	0.000362163	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.001448655	TECH
	GREEN			1		0.3	0.001086491	TECH
	YELLOW		1			0.2	0.000724327	TECH
	RED					0.1	0.000362163	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.001448655	TECH
	GREEN	1			1	0.3	0.001086491	TECH
	YELLOW		1			0.2	0.000724327	TECH
	RED					0.1	0.000362163	TECH
Past Performance						0.25		
	BLUE			1		0.4	0.001448655	TECH
	GREEN	1	1		1	0.3	0.001086491	TECH
	YELLOW					0.2	0.000724327	TECH
	RED					0.1	0.000362163	TECH
Maintenance Systems						0.123		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.000513500	TECH
	GREEN	1			1	0.3	0.000385125	TECH
	YELLOW		1			0.2	0.000256750	TECH
	RED					0.1	0.000128375	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000513500	TECH
	GREEN			1		0.3	0.000385125	TECH
	YELLOW		1			0.2	0.000256750	TECH
	RED					0.1	0.000128375	TECH
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.000513500	TECH
	GREEN	1			1	0.3	0.000385125	TECH
	YELLOW		1			0.2	0.000256750	TECH
	RED					0.1	0.000128375	TECH
Past Performance						0.25		
	BLUE			1		0.4	0.000513500	TECH
	GREEN	1	1		1	0.3	0.000385125	TECH
	YELLOW					0.2	0.000256750	TECH
	RED					0.1	0.000128375	TECH
Human Factors						0.153		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.000638744	TECH
	GREEN	1			1	0.3	0.000479058	TECH
	YELLOW		1			0.2	0.000319372	TECH
	RED					0.1	0.000159686	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000638744	TECH
	GREEN			1		0.3	0.000479058	TECH
	YELLOW		1			0.2	0.000319372	TECH
	RED					0.1	0.000159686	TECH
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.000638744	TECH
	GREEN	1			1	0.3	0.000479058	TECH
	YELLOW		1			0.2	0.000319372	TECH
	RED					0.1	0.000159686	TECH
Past Performance						0.25		
	BLUE			1		0.4	0.000638744	TECH
	GREEN	1	1		1	0.3	0.000479058	TECH
	YELLOW					0.2	0.000319372	TECH
	RED					0.1	0.000159686	TECH

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Training Analysis						0.09		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.000375732	TECH
	GREEN	1			1	0.3	0.000281799	TECH
	YELLOW		1			0.2	0.000187866	TECH
	RED					0.1	0.000093933	TECH
Understanding of Problem						0.25		
	BLUE	1			1	0.4	0.000375732	TECH
	GREEN			1		0.3	0.000281799	TECH
	YELLOW		1			0.2	0.000187866	TECH
	RED					0.1	0.000093933	TECH
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.000375732	TECH
	GREEN	1			1	0.3	0.000281799	TECH
	YELLOW		1			0.2	0.000187866	TECH
	RED					0.1	0.000093933	TECH
Past Performance						0.25		
	BLUE			1		0.4	0.000375732	TECH
	GREEN	1	1		1	0.3	0.000281799	TECH
	YELLOW					0.2	0.000187866	TECH
	RED					0.1	0.000093933	TECH
SUPPORTABILITY AREA						0.26		
Organizational Structure Item						0.078		
Soundness of Approach						0.25		
	BLUE					0.4	0.002028	SUPP
	GREEN		1	1	1	0.3	0.001521	SUPP
	YELLOW	1				0.2	0.001014	SUPP
	RED					0.1	0.000507	SUPP
Understanding of Problem						0.25		
	BLUE					0.4	0.002028	SUPP
	GREEN	1	1	1	1	0.3	0.001521	SUPP
	YELLOW					0.2	0.001014	SUPP
	RED					0.1	0.000507	SUPP
Compliance with Requirement						0.25		
	BLUE					0.4	0.002028	SUPP
	GREEN		1	1	1	0.3	0.001521	SUPP
	YELLOW	1				0.2	0.001014	SUPP
	RED					0.1	0.000507	SUPP
Past Performance						0.25		
	BLUE					0.4	0.002028	SUPP
	GREEN		1	1	1	0.3	0.001521	SUPP
	YELLOW	1				0.2	0.001014	SUPP
	RED					0.1	0.000507	SUPP
Management Policies, Practices, and Planning Item						0.135		
ILS Program						0.524		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.00183924	SUPP
	GREEN	1			1	0.3	0.00137943	SUPP
	YELLOW		1			0.2	0.00091962	SUPP
	RED					0.1	0.00045981	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.00183924	SUPP
	GREEN		1	1	1	0.3	0.00137943	SUPP
	YELLOW					0.2	0.00091962	SUPP
	RED					0.1	0.00045981	SUPP

CRITERA	RATING LEVELS	A	B	C	D	WEIGHT	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.00183924	SUPP
	GREEN				1	0.3	0.00137943	SUPP
	YELLOW	1	1			0.2	0.00091962	SUPP
	RED					0.1	0.00045981	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.00183924	SUPP
	GREEN	1			1	0.3	0.00137943	SUPP
	YELLOW		1			0.2	0.00091962	SUPP
	RED					0.1	0.00045981	SUPP
LCC Program						0.271		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.00095121	SUPP
	GREEN	1			1	0.3	0.000713407	SUPP
	YELLOW		1			0.2	0.000475605	SUPP
	RED					0.1	0.000237802	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.00095121	SUPP
	GREEN		1	1	1	0.3	0.000713407	SUPP
	YELLOW					0.2	0.000475605	SUPP
	RED					0.1	0.000237802	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.00095121	SUPP
	GREEN				1	0.3	0.000713407	SUPP
	YELLOW	1	1			0.2	0.000475605	SUPP
	RED					0.1	0.000237802	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.00095121	SUPP
	GREEN	1			1	0.3	0.000713407	SUPP
	YELLOW		1			0.2	0.000475605	SUPP
	RED					0.1	0.000237802	SUPP
LSA Program						0.135		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.00047385	SUPP
	GREEN	1			1	0.3	0.000355387	SUPP
	YELLOW		1			0.2	0.000236925	SUPP
	RED					0.1	0.000118462	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.00047385	SUPP
	GREEN		1	1	1	0.3	0.000355387	SUPP
	YELLOW					0.2	0.000236925	SUPP
	RED					0.1	0.000118462	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.00047385	SUPP
	GREEN				1	0.3	0.000355387	SUPP
	YELLOW	1	1			0.2	0.000236925	SUPP
	RED					0.1	0.000118462	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.00047385	SUPP
	GREEN	1			1	0.3	0.000355387	SUPP
	YELLOW		1			0.2	0.000236925	SUPP
	RED					0.1	0.000118462	SUPP

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTING	AREA
Lessons Learned Program						0.07		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.0002457	SUPP
	GREEN	1			1	0.3	0.000184275	SUPP
	YELLOW		1			0.2	0.00012285	SUPP
	RED					0.1	0.000061425	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.0002457	SUPP
	GREEN		1	1	1	0.3	0.000184275	SUPP
	YELLOW					0.2	0.00012285	SUPP
	RED					0.1	0.000061425	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0002457	SUPP
	GREEN				1	0.3	0.000184275	SUPP
	YELLOW	1	1			0.2	0.00012285	SUPP
	RED					0.1	0.000061425	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.0002457	SUPP
	GREEN	1			1	0.3	0.000184275	SUPP
	YELLOW		1			0.2	0.00012285	SUPP
	RED					0.1	0.000061425	SUPP
Supportability Program Implementation Item						0.228		
Influence on Design Process						0.8		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.0047424	SUPP
	GREEN	1			1	0.3	0.0035568	SUPP
	YELLOW		1			0.2	0.0023712	SUPP
	RED					0.1	0.0011856	SUPP
Understanding of Problem						0.25		
	BLUE	1		1		0.4	0.0047424	SUPP
	GREEN		1		1	0.3	0.0035568	SUPP
	YELLOW					0.2	0.0023712	SUPP
	RED					0.1	0.0011856	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0047424	SUPP
	GREEN				1	0.3	0.0035568	SUPP
	YELLOW	1	1			0.2	0.0023712	SUPP
	RED					0.1	0.0011856	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.0047424	SUPP
	GREEN	1				0.3	0.0035568	SUPP
	YELLOW		1		1	0.2	0.0023712	SUPP
	RED					0.1	0.0011856	SUPP
Integration of Supportability Efforts						0.2		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.0011856	SUPP
	GREEN	1			1	0.3	0.0008892	SUPP
	YELLOW		1			0.2	0.0005928	SUPP
	RED					0.1	0.0002964	SUPP
Understanding of Problem						0.25		
	BLUE	1		1		0.4	0.0011856	SUPP
	GREEN		1		1	0.3	0.0008892	SUPP
	YELLOW					0.2	0.0005928	SUPP
	RED					0.1	0.0002964	SUPP

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0011856	SUPP
	GREEN				1	0.3	0.0008892	SUPP
	YELLOW	1	1			0.2	0.0005926	SUPP
	RED					0.1	0.0002964	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.0011856	SUPP
	GREEN	1				0.3	0.0008892	SUPP
	YELLOW		1		1	0.2	0.0005928	SUPP
	RED					0.1	0.0002964	SUPP
Logistics Capabilities Item						0.559		
Definition of Logistics Issues						0.2		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.0029068	SUPP
	GREEN				1	0.3	0.0021801	SUPP
	YELLOW		1			0.2	0.0014534	SUPP
	RED					0.1	0.0007267	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.0029068	SUPP
	GREEN			1		0.3	0.0021801	SUPP
	YELLOW		1		1	0.2	0.0014534	SUPP
	RED					0.1	0.0007267	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0029068	SUPP
	GREEN	1			1	0.3	0.0021801	SUPP
	YELLOW		1			0.2	0.0014534	SUPP
	RED					0.1	0.0007267	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.0029068	SUPP
	GREEN	1				0.3	0.0021801	SUPP
	YELLOW		1		1	0.2	0.0014534	SUPP
	RED					0.1	0.0007267	SUPP
Tools and Techniques for Supportability Evaluation						0.8		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.0116272	SUPP
	GREEN				1	0.3	0.0087204	SUPP
	YELLOW		1			0.2	0.0058136	SUPP
	RED					0.1	0.0029068	SUPP
Understanding of Problem						0.25		
	BLUE	1				0.4	0.0116272	SUPP
	GREEN			1		0.3	0.0087204	SUPP
	YELLOW		1		1	0.2	0.0058136	SUPP
	RED					0.1	0.0029068	SUPP
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0116272	SUPP
	GREEN	1			1	0.3	0.0087204	SUPP
	YELLOW		1			0.2	0.0058136	SUPP
	RED					0.1	0.0029068	SUPP
Past Performance						0.25		
	BLUE			1		0.4	0.0116272	SUPP
	GREEN	1				0.3	0.0087204	SUPP
	YELLOW		1		1	0.2	0.0058136	SUPP
	RED					0.1	0.0029068	SUPP

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
MANAGEMENT CAPABILITY AREA						0.092		
Program Management Item						0.212		
Configuration Management Planning						0.102		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000198940	MAN
	GREEN		1		1	0.3	0.000149205	MAN
	YELLOW					0.2	0.000099470	MAN
	RED					0.1	0.000049735	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.000198940	MAN
	GREEN	1	1		1	0.3	0.000149205	MAN
	YELLOW					0.2	0.000099470	MAN
	RED					0.1	0.000049735	MAN
Compliance with Requirements						0.25		
	BLUE	1		1		0.4	0.000198940	MAN
	GREEN		1		1	0.3	0.000149205	MAN
	YELLOW					0.2	0.000099470	MAN
	RED					0.1	0.000049735	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000198940	MAN
	GREEN				1	0.3	0.000149205	MAN
	YELLOW					0.2	0.000099470	MAN
	RED					0.1	0.000049735	MAN
Data Management						0.091		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000177486	MAN
	GREEN		1		1	0.3	0.000133114	MAN
	YELLOW					0.2	0.000088743	MAN
	RED					0.1	0.000044371	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.000177486	MAN
	GREEN	1	1		1	0.3	0.000133114	MAN
	YELLOW					0.2	0.000088743	MAN
	RED					0.1	0.000044371	MAN
Compliance with Requirements						0.25		
	BLUE	1		1		0.4	0.000177486	MAN
	GREEN		1		1	0.3	0.000133114	MAN
	YELLOW					0.2	0.000088743	MAN
	RED					0.1	0.000044371	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000177486	MAN
	GREEN		1		1	0.3	0.000133114	MAN
	YELLOW					0.2	0.000088743	MAN
	RED					0.1	0.000044371	MAN
Organization						0.173		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000337419	MAN
	GREEN		1		1	0.3	0.000253064	MAN
	YELLOW					0.2	0.000168709	MAN
	RED					0.1	0.000084354	MAN
Understanding of Problem						[illegible]		
	BLUE			1		0.4	0.000337419	MAN
	GREEN	1	1		1	0.3	0.000253064	MAN
	YELLOW					0.2	0.000168709	MAN
	RED					0.1	0.000084354	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE	1		1		0.4	0.000337419	MAN
	GREEN		1		1	0.3	0.000253064	MAN
	YELLOW					0.2	0.000168709	MAN
	RED					0.1	0.000084354	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000337419	MAN
	GREEN		1		1	0.3	0.000253064	MAN
	YELLOW					0.2	0.000168709	MAN
	RED					0.1	0.000084354	MAN
Management Control and Information						0.138		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000269155	MAN
	GREEN		1		1	0.3	0.000201866	MAN
	YELLOW					0.2	0.000134577	MAN
	RED					0.1	0.000067288	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.000269155	MAN
	GREEN	1	1		1	0.3	0.000201866	MAN
	YELLOW					0.2	0.000134577	MAN
	RED					0.1	0.000067288	MAN
Compliance with Requirement						0.25		
	BLUE	1		1		0.4	0.000269155	MAN
	GREEN		1		1	0.3	0.000201866	MAN
	YELLOW					0.2	0.000134577	MAN
	RED					0.1	0.000067288	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000269155	MAN
	GREEN		1		1	0.3	0.000201866	MAN
	YELLOW					0.2	0.000134577	MAN
	RED					0.1	0.000067288	MAN
Contingency Planning						0.278		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000542211	MAN
	GREEN		1		1	0.3	0.000406658	MAN
	YELLOW					0.2	0.000271105	MAN
	RED					0.1	0.000135552	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.000542211	MAN
	GREEN	1	1		1	0.3	0.000406658	MAN
	YELLOW					0.2	0.000271105	MAN
	RED					0.1	0.000135552	MAN
Compliance with Requirement						0.25		
	BLUE	1		1		0.4	0.000542211	MAN
	GREEN		1		1	0.3	0.000406658	MAN
	YELLOW					0.2	0.000271105	MAN
	RED					0.1	0.000135552	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000542211	MAN
	GREEN		1		1	0.3	0.000406658	MAN
	YELLOW					0.2	0.000271105	MAN
	RED					0.1	0.000135552	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Contractor Interfaces						0.218		
Soundness of Approach						0.25		
	BLUE	1		1		0.4	0.000425187	MAN
	GREEN		1		1	0.3	0.000318890	MAN
	YELLOW					0.2	0.000212593	MAN
	RED					0.1	0.000106296	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.000425187	MAN
	GREEN	1	1		1	0.3	0.000318890	MAN
	YELLOW					0.2	0.000212593	MAN
	RED					0.1	0.000106296	MAN
Compliance with Requirement						0.25		
	BLUE	1		1		0.4	0.000425187	MAN
	GREEN		1		1	0.3	0.000318890	MAN
	YELLOW					0.2	0.000212593	MAN
	RED					0.1	0.000106296	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.000425187	MAN
	GREEN		1		1	0.3	0.000318890	MAN
	YELLOW					0.2	0.000212593	MAN
	RED					0.1	0.000106296	MAN
Future Competition Item						0.106		
Soundness of Approach						0.25		
	BLUE					0.4	0.0009752	MAN
	GREEN	1		1		0.3	0.0007314	MAN
	YELLOW		1		1	0.2	0.0004876	MAN
	RED					0.1	0.0002438	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.0009752	MAN
	GREEN	1	1			0.3	0.0007314	MAN
	YELLOW				1	0.2	0.0004876	MAN
	RED					0.1	0.0002438	MAN
Compliance with Requirement						0.25		
	BLUE					0.4	0.0009752	MAN
	GREEN	1		1		0.3	0.0007314	MAN
	YELLOW		1		1	0.2	0.0004876	MAN
	RED					0.1	0.0002438	MAN
Past Performance						0.25		
	BLUE					0.4	0.0009752	MAN
	GREEN	1		1	1	0.3	0.0007314	MAN
	YELLOW		1			0.2	0.0004876	MAN
	RED					0.1	0.0002438	MAN
Systems Test Item						0.108		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.0017296	MAN
	GREEN	1	1			0.3	0.0012972	MAN
	YELLOW				1	0.2	0.0008648	MAN
	RED					0.1	0.0004324	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.0017296	MAN
	GREEN	1				0.3	0.0012972	MAN
	YELLOW		1		1	0.2	0.0008648	MAN
	RED					0.1	0.0004324	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0017296	MAN
	GREEN	1	1			0.3	0.0012972	MAN
	YELLOW				1	0.2	0.0008648	MAN
	RED					0.1	0.0004324	MAN
Past Performance						0.25		
	BLUE	1		1		0.4	0.0017296	MAN
	GREEN				1	0.3	0.0012972	MAN
	YELLOW		1			0.2	0.0008648	MAN
	RED					0.1	0.0004324	MAN
Manufacturing Item						0.324		
Manufacturing Planning						0.297		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.000885297	MAN
	GREEN	1	1			0.3	0.000663973	MAN
	YELLOW				1	0.2	0.000442648	MAN
	RED					0.1	0.000221324	MAN
Understanding of Problem						0.25		
	BLUE	1				0.4	0.000885297	MAN
	GREEN		1	1		0.3	0.000663973	MAN
	YELLOW				1	0.2	0.000442648	MAN
	RED					0.1	0.000221324	MAN
Compliance with Requirement						0.25		
	BLUE					0.4	0.000885297	MAN
	GREEN	1	1	1		0.3	0.000663973	MAN
	YELLOW				1	0.2	0.000442648	MAN
	RED					0.1	0.000221324	MAN
Past Performance						0.25		
	BLUE					0.4	0.000885297	MAN
	GREEN	1	1	1		0.3	0.000663973	MAN
	YELLOW				1	0.2	0.000442648	MAN
	RED					0.1	0.000221324	MAN
Manufacturing Capability						0.54		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.001609632	MAN
	GREEN	1	1			0.3	0.001207224	MAN
	YELLOW				1	0.2	0.000804816	MAN
	RED					0.1	0.000402408	MAN
Understanding of Problem						0.25		
	BLUE	1				0.4	0.001609632	MAN
	GREEN		1	1		0.3	0.001207224	MAN
	YELLOW				1	0.2	0.000804816	MAN
	RED					0.1	0.000402408	MAN
Compliance with Requirement						0.25		
	BLUE					0.4	0.001609632	MAN
	GREEN	1	1	1		0.3	0.001207224	MAN
	YELLOW				1	0.2	0.000804816	MAN
	RED					0.1	0.000402408	MAN
Past Performance						0.25		
	BLUE					0.4	0.001609632	MAN
	GREEN	1	1	1		0.3	0.001207224	MAN
	YELLOW				1	0.2	0.000804816	MAN
	RED					0.1	0.000402408	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Manufacturing Cost Reduction						0.163		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.000485870	MAN
	GREEN	1	1			0.3	0.000364402	MAN
	YELLOW				1	0.2	0.000242935	MAN
	RED					0.1	0.000121467	MAN
Understanding of Problem						0.25		
	BLUE	1				0.4	0.000485870	MAN
	GREEN		1	1		0.3	0.000364402	MAN
	YELLOW				1	0.2	0.000242935	MAN
	RED					0.1	0.000121467	MAN
Compliance with Requirement						0.25		
	BLUE					0.4	0.000485870	MAN
	GREEN	1	1	1		0.3	0.000364402	MAN
	YELLOW				1	0.2	0.000242935	MAN
	RED					0.1	0.000121467	MAN
Past Performance						0.25		
	BLUE					0.4	0.000485870	MAN
	GREEN	1	1	1		0.3	0.000364402	MAN
	YELLOW				1	0.2	0.000242935	MAN
	RED					0.1	0.000121467	MAN
Quality Assurance Item						0.064		
Quality System						0.8		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.00047104	MAN
	GREEN	1				0.3	0.00035328	MAN
	YELLOW		1		1	0.2	0.00023552	MAN
	RED					0.1	0.00011776	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.00047104	MAN
	GREEN	1				0.3	0.00035328	MAN
	YELLOW		1		1	0.2	0.00023552	MAN
	RED					0.1	0.00011776	MAN
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.00047104	MAN
	GREEN	1				0.3	0.00035328	MAN
	YELLOW		1		1	0.2	0.00023552	MAN
	RED					0.1	0.00011776	MAN
Past Performance						0.25		
	BLUE	1				0.4	0.00047104	MAN
	GREEN			1	1	0.3	0.00035328	MAN
	YELLOW		1			0.2	0.00023552	MAN
	RED					0.1	0.00011776	MAN
Initial Quality Planning						0.2		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.00011776	MAN
	GREEN	1				0.3	0.00008832	MAN
	YELLOW		1		1	0.2	0.00005888	MAN
	RED					0.1	0.00002944	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.00011776	MAN
	GREEN	1				0.3	0.00008832	MAN
	YELLOW		1		1	0.2	0.00005888	MAN
	RED					0.1	0.00002944	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.00011776	MAN
	GREEN	1				0.3	0.00008832	MAN
	YELLOW		1		1	0.2	0.00005888	MAN
	RED					0.1	0.00002944	MAN
Past Performance						0.25		
	BLUE	1				0.4	0.00011776	MAN
	GREEN			1	1	0.3	0.00008832	MAN
	YELLOW		1			0.2	0.00005888	MAN
	RED					0.1	0.00002944	MAN
System Saftey Item						0.049		
Soundness of Approach						0.25		
	BLUE			1		0.4	0.0004508	MAN
	GREEN	1	1			0.3	0.0003381	MAN
	YELLOW				1	0.2	0.0002254	MAN
	RED					0.1	0.0001127	MAN
Understanding of Problem						0.25		
	BLUE					0.4	0.0004508	MAN
	GREEN	1	1	1		0.3	0.0003381	MAN
	YELLOW				1	0.2	0.0002254	MAN
	RED					[illegible]	0.0001127	MAN
Compliance with Requirement						[illegible]		
	BLUE					[illegible]	0.0004508	MAN
	GREEN	1	1			[illegible]	0.0003381	MAN
	YELLOW			1	1	[illegible]	0.0002254	MAN
	RED					[illegible]	0.0001127	MAN
Past Performance						0.25		
	BLUE	1				0.4	0.0004508	MAN
	GREEN		1	1	1	[illegible]	0.0003381	MAN
	YELLOW					0.2	0.0002254	MAN
	RED					0.1	0.0001127	MAN
Security Item						0.057		
Personnel/Physical Security and Classification Mgt						0.5		
Soundness of Approach						0.25		
	BLUE					0.4	0.0002622	MAN
	GREEN		1	1	1	0.3	0.00019665	MAN
	YELLOW	1				0.2	0.0001311	MAN
	RED					0.1	0.00006555	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.0002622	MAN
	GREEN		1		1	0.3	0.00019665	MAN
	YELLOW	1				0.2	0.0001311	MAN
	RED					0.1	0.00006555	MAN
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0002622	MAN
	GREEN		1			0.3	0.00019665	MAN
	YELLOW	1			1	0.2	0.0001311	MAN
	RED					0.1	0.00006555	MAN
Past Performance						0.25		
	BLUE					0.4	0.0002622	MAN
	GREEN	1	1		1	0.3	0.00019665	MAN
	YELLOW			1		0.2	0.0001311	MAN
	RED					0.1	0.00006555	MAN

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
TEMPEST/COMSEC/OPSEC						0.25		
Soundness of Approach						0.25		
	BLUE					0.4	0.0001311	MAN
	GREEN		1	1	1	0.3	0.000098325	MAN
	YELLOW	1				0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.0001311	MAN
	GREEN		1		1	0.3	0.000098325	MAN
	YELLOW	1				0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0001311	MAN
	GREEN		1			0.3	0.000098325	MAN
	YELLOW	1			1	0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Past Performance						0.25		
	BLUE					0.4	0.0001311	MAN
	GREEN	1	1		1	0.3	0.000098325	MAN
	YELLOW			1		0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
System Security Engineering Management Program						0.25		
Soundness of Approach						0.25		
	BLUE					0.4	0.0001311	MAN
	GREEN		1	1	1	0.3	0.000098325	MAN
	YELLOW	1				0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Understanding of Problem						0.25		
	BLUE			1		0.4	0.0001311	MAN
	GREEN		1		1	0.3	0.000098325	MAN
	YELLOW	1				0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Compliance with Requirement						0.25		
	BLUE			1		0.4	0.0001311	MAN
	GREEN		1			0.3	0.000098325	MAN
	YELLOW	1			1	0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
Past Performance						0.25		
	BLUE					0.4	0.0001311	MAN
	GREEN	1	1		1	0.3	0.000098325	MAN
	YELLOW			1		0.2	0.00006555	MAN
	RED					0.1	0.000032775	MAN
COST AREA						0.06		
Realism: Costs and scope of work are compatible						0.327		
Soundness of Approach						0.25		
	BLUE					0.4	0.001962	COST
	GREEN					0.3	0.0014715	COST
	YELLOW	1	1	1	1	0.2	0.000981	COST
	RED					0.1	0.0004905	COST
Understanding of Problem						0.25		
	BLUE					0.4	0.001962	COST
	GREEN	1	1	1	1	0.3	0.0014715	COST
	YELLOW					0.2	0.000981	COST
	RED					0.1	0.0004905	COST

CRITERA	RATING LEVELS	A	B	C	D	WEIGHTS	CUMULATIVE WEIGHTINGS	AREA
Compliance with Requirement						0.25		
	BLUE					0.4	0.001962	COST
	GREEN	1	1			0.3	0.0014715	COST
	YELLOW			1	1	0.2	0.000981	COST
	RED					0.1	0.0004905	COST
Past Performance						0.25		
	BLUE					0.4	0.001962	COST
	GREEN	1				0.3	0.0014715	COST
	YELLOW		1	1	1	0.2	0.000981	COST
	RED					0.1	0.0004905	COST
Reasonableness: Acceptable estimating methodology						0.413		
Soundness of Approach						0.25		
	BLUE					0.4	0.002478	COST
	GREEN		1			0.3	0.0018585	COST
	YELLOW	1		1	1	0.2	0.001239	COST
	RED					0.1	0.0006195	COST
Understanding of Problem						0.25		
	BLUE					0.4	0.002478	COST
	GREEN		1	1		0.3	0.0018585	COST
	YELLOW	1			1	0.2	0.001239	COST
	RED					0.1	0.0006195	COST
Compliance with Requirement						0.25		
	BLUE					0.4	0.002478	COST
	GREEN	1	1			0.3	0.0018585	COST
	YELLOW			1	1	[illegible]	0.001239	COST
	RED					[illegible]	0.0006195	COST
Past Performance						0.25		
	BLUE					0.4	0.002478	COST
	GREEN					0.3	0.0018585	COST
	YELLOW	1	1	1	1	0.2	0.001239	COST
	RED					0.1	0.0006195	COST
Completeness: Responsiveness in providing all RFP requirements, SOW items, and traceability of estimates						0.25		
Soundness of Approach						0.25		
	BLUE					0.4	0.00156	COST
	GREEN		1	1	1	0.3	0.00117	COST
	YELLOW	1				0.2	0.00078	COST
	RED					0.1	0.00039	COST
Understanding of Problem						0.25		
	BLUE					0.4	0.00156	COST
	GREEN				1	0.3	0.00117	COST
	YELLOW	1	1	1		0.2	0.00078	COST
	RED					0.1	0.00039	COST
Compliance with Requirement						0.25		
	BLUE					0.4	0.00156	COST
	GREEN	1	1	1		0.3	0.00117	COST
	YELLOW				1	0.2	0.00078	COST
	RED					0.1	0.00039	COST
Past Performance						0.25		
	BLUE					0.4	0.00156	COST
	GREEN		1	1	1	0.3	0.00117	COST
	YELLOW	1				0.2	0.00078	COST
	RED					0.1	0.00039	COST

* * * SUMMARY OF CONTRACTOR RAW SCORES * * *

CONTRACTORS:	A	B	C	D
TECHNICAL	0.19506	0.14882	0.17758	0.21867
SUPPORTABILITY	0.08374	0.05638	0.09746	0.06925
MANAGEMENT CAPABILITY	0.03010	0.02541	0.03284	0.02167
COST	0.01448	0.01600	0.01428	0.01366
RAW SCORE	0.32340	0.24663	0.32217	0.32326
RENORM SCORE	0.26607	0.20291	0.26505	0.26595

TOTAL
1.2154797

* * * SUMMARY OF CONTRACTOR COLOR RATINGS * * *

CONTRACTORS:	A	B	C	D
TECHNICAL	GREEN	GREEN	GREEN	BLUE
SUPPORTABILITY	GREEN	YELLOW	BLUE	GREEN
MANAGEMENT CAPABILITY	GREEN	GREEN	BLUE	YELLOW
COST	YELLOW	GREEN	YELLOW	YELLOW
TOTAL:	GREEN	YELLOW	GREEN	GREEN