INTEGRATED RISK ASSESSMENT AND SCORING IN THE DEPARTMENT OF DEFENSE SOURCE SELECTION PROCESS

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IN THE DEPARTMENT OF DEFENSE

SOURCE SELECTION PROCESS

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To my parents,

who taught me the golden rule,

and, by their example, proved

its eternal value.

PREFACE

This thesis is concerned with developing a procedure whereby Source Selection officials in the Department of Defense are able to quantitatively assess, within the constraints of anticipating unknowns in developmental programs, the technological risks associated with contractor proposals. Recent changes in the DoD Systems Acquisition Life Cycle are investigated to determine what effects these changes may have on the Source Selection process. An initial risk model, developed and applied to the Source Selection activities of a major aircraft system, demonstrates the feasibility of obtaining a cumulative measure of the anticipated technological risks associated with a contractor proposal. The major findings of the initial risk model and a comprehensive Source Selection questionnaire are incorporated in the development of an integrated risk assessment and scoring model. The procedural methodology developed to implement the model provides a systematic approach to incrementally establish the proposal score while achieving maximum utilization and benefit from the detailed evaluation effort. The output of the model provides a relative measure of the overall technological risk associated with each proposal, based upon the net value of the expected positive and negative risk of potential problem areas of varying importance.

I would like to take this opportunity to express my sincere gratitude and appreciation to the members of my advisory committee: Professors Michael R. Edgmand, Hamed K. Eldin, and M. Palmer Terrell, for their personal interest, encouragement, and valued counsel; to Professor Wilson J. Bentley, for his dedicated leadership and support which have been a constant source of inspiration and strength; and particularly to Professor Earl J. Ferguson whose interest, insight, and professional competence resulted in major contributions to the preparation of this thesis. I would also like to thank Professor James E. Shamblin for his encouragement and valued counsel.

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Finally, sincere appreciation is extended to my devoted wife who patiently typed the draft of this manuscript, and whose personal sacrifices were instrumental in the successful completion of this work.

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CHAPTER I

INTRODUCTION

The Department of Defense (DoD) is responsible for research, development, production, and employment of approved systems necessary for the national security. When a new operational requirement is defined, validated, and conditionally approved, one branch of the Armed Forces is assigned responsibility for acquiring a system which will satisfy the specific operational requirement(s). The agency of that branch which is responsible for research and development will be responsible for the system throughout the acquisition life cycle. The systems acquisition life cycle is generally divided into five major phases -- conceptual, validation, full-scale development, production, and deployment. All projects whose R & D costs are expected to exceed $25 million, or whose total projected procurement costs exceed $100 million must be contracted to industry through a competitive process called the Source Selection Process. The Source Selection Process is included in the Validation Phase of the Systems Acquisition Life Cycle.

This study focuses upon the Source Selection Process within the DoD Systems Acquisition Life Cycle. Specifically, the study focuses upon the process used by the Source

Selection Evaluation Board (SSEB) to evaluate and score proposals submitted by contractors in accordance with a Request for Proposal (RFP) document. The purpose of the study is to investigate the problems associated with evaluating and scoring proposals in the SSEB and to determine what effects current DoD management philosophy may have upon the SSEB process. Since the current DoD management philosophy has strongly emphasized the need for increased risk assessment throughout the systems acquisition life cycle, the primary objective of this study is to develop an integrated risk assessment and scoring model for use by the SSEB in the Source Selection process.

Methods of Research

The existing DoD directives and implementing regulations, manuals, and procedures relative to source selection were reviewed. In this effort, particular attention was given to the applicable documents within the United States Air Force (USAF). Since early 1969, the DoD has placed strong emphasis on increased hardware demonstration and proofing prior to a production commitment, with the objectives being greater cost effectiveness and reduction of program risks. The DoD directives and USAF responses relative to this current systems management philosophy were also reviewed. It was this rather intensive review of the current DoD management philosophy and the existing Source

Selection process that prompted the writer to focus on the area of risk assessment within the SSEB function.

An extensive literature search of the Defense Documentation Center (DDC) was conducted to identify current work related to risk analysis and assessment within the Source Selection process. While there is an abundance of literature in the DDC, and elsewhere, covering quantitative tools and techniques for handling uncertainty in real world problems, the writer found nothing that specifically addressed the problems of risk identification and quantitative assessment within the SSEB function. Much is understood and written about tools and techniques such as probability theory, statistical inference, decision theory, utility theory, game theory, simulation, network analysis, and queueing theory--all of which involve estimating and/or assessing the degree and potential impact of uncertainty in real world problems. Yet, those familiar with developmental programs for major defense weapon systems know that it is extremely difficult to structure or model the problems and potential problems associated with major defense systems in such a way as to permit meaningful and useful quantitative assessments using one, or a combination of the tools and techniques mentioned above. This is particularly true when a measure of the over-all program risk, or probability of success, is desired. As mentioned earlier, the primary objective of this study is to develop a model and procedural methodology which will allow the SSEB to obtain a quantitative measure of the over-all program risk associated with anticipated unknowns and simultaneously score the contractor proposal being evaluated.

In order to determine the feasibility of developing an integrated risk assessment and scoring model for use by the SSEB, the writer was accepted as a member of a recent SSEB for a major weapon system of the Air Force. This experience resulted in the development of an initial risk model, the results of which proved that such an approach was both feasible and potentially useful. In addition, the writer prepared and distributed a Source Selection questionnaire for the purpose of:

(1) Assessing the impact of the current DoD management philosophy upon the SSEB process.

(2) Assessing the adequacy of the present scoring system used in the SSEB process.

The questionnaire data was analyzed and evaluated, and the major findings were used in conjunction with the initial risk model to develop an integrated risk assessment/scoring model and the procedural methodology to implement it. This entire study is tailored to source selection activities of the Air Force, and particularly to the Aeronautical Systems Division of the Air Force Systems Command.

Approach

Chapter II briefly discusses the defense R & D program and the systems acquisition life cycle as it existed for a number of years prior to 1969. Chapter III is a summary of the key documents that have resulted in the current DoD management philosophy for defense R & D. Chapter IV briefly describes the Source Selection process and how the process has been adapted to the current DoD management philosophy. In addition, the scoring system used by the SSEB and the Source Selection Advisory Council (SSAC) is discussed in some detail.

Chapter V presents the initial risk model and methodology developed by the writer while serving as a member of a recent SSEB. Chapter VI evaluates the results of the Source Selection Questionnaire and presents the major findings. The questionnaire itself and an analysis of the respondent answers are provided in Appendixes A and B, respectively.

In Chapter VII, three interrelated problems associated with the SSEB function are discussed. The major findings of the Source Selection Questionnaire and a major Air Force study on the Request for Proposal document are compared, and major conclusions are presented relative to them. Chapter VIII is the most important chapter since it attempts to develop an integrated risk assessment/scoring model and procedural methodology that is consistent with the current DoD management philosophy and the major findings and conclusions of Chapters V, VI, and VII. In Chapter IX, a brief conclusion to the study is presented along with recommendations for further study.

CHAPTER II

THE DEFENSE R & D CYCLE

As briefly discussed in Chapter I, this study attempts to develop a methodology and model for integrated risk analysis and scoring in the Source Selection Evaluation Board process within the total Department of Defense (DoD) research and development (R & D) cycle. In order to provide a backdrop of the total environment in which this study fits, a thumbnail sketch of the structure of defense R & D is given. Those familiar with Defense R & D should proceed to Chapter III.

Defense-wide R & D is a major program - Program 6 - in the DoD Five-Year Defense Program. It encompasses research, development, tests, and evaluation (RDT&E), where RDT&E is the title under which Congress appropriates funds for these activities. The weapons acquisition process can be divided into three main phases: concept formulation, contract definition, and acquisition. In concept formulation, the defense managers are responsible for conducting research, exploratory development, and advanced development. It is in this phase that the technological bases of developmental programs are established. Using the scientific knowledge obtained through research, exploratory development attempts to demonstrate technical feasibility and conduct very limited developmental activities to solve specific military problems. Advanced development includes all activities which develop and test hardware on an experimental basis. The advanced development effort must satisfy numerous conditions for a developmental proposal to qualify for the next major phase. Briefly, these conditions are: (1) Mission must be clearly defined, (2) Performance requirements must be identified and defined, (3) The best technical approach must be identified and selected, with emphasis on engineering rather than experimental effort, (4) Trade-off analyses must be accomplished on studies of operational effectiveness, cost, cost-effectiveness, and schedule, and (5) Acceptable and credible cost and schedule estimates must be determined (1, p. 4). When a Service meets these conditions, conditional approval is given for its developmental proposal.

Before proceeding to the contract definition phase, a brief discussion of operational requirements is necessary to understand the fundamental basis for developmental proposals. The need for defense materials is derived from current or anticipated requirements or deficiencies. Once the need is validated by the military service and the Director of Defense Research and Engineering (DDR&E), the development agency (for the Air Force, the Air Force Systems Command) is tasked to perform the activities of the concept formulation phase. If the conditions of this phase are satisfactorily met by the service, its developmental proposal is ready for the contract definition phase. The formal request to proceed into contract definition is in the form of a Program Change Request (PCR) which, if approved, is reflected in the Five-Year Defense Plan. The Service also provides a Technical Development Plan which justifies the PCR by presenting the status of the prerequisite conditions and a detailed plan for the developmental program.

The Contract Definition phase begins when the Secretary of Defense gives conditional approval to proceed with engineering development. All projects whose R & D costs are expected to exceed $25 million, or whose total projected procurement costs exceed $100 million must go through a Contract Definition phase (1, p. 3). In contract definition, the DOD selects and pays certain contractors to submit engineering development proposals in accordance with a key document, The Request for Proposal (RFP). Engineering development encompasses the establishment of firm specifications and those activities required to develop engineered items for use by a Service, but not yet approved for procurement or operation. Systems engineering and system/project management is also included in engineering development. One or more contractors are selected to perform the engineering development in accordance with current DoD policy directives and regulations. It is the Source Selection process of evaluating and selecting contractor proposals submitted in accordance with the RFP that this study is addressed. Therefore, the only R & D projects to which this study is specifically addressed are those that require contract definition; that is, R & D costs are expected to exceed $25 million or projected procurement costs exceed $100 million.

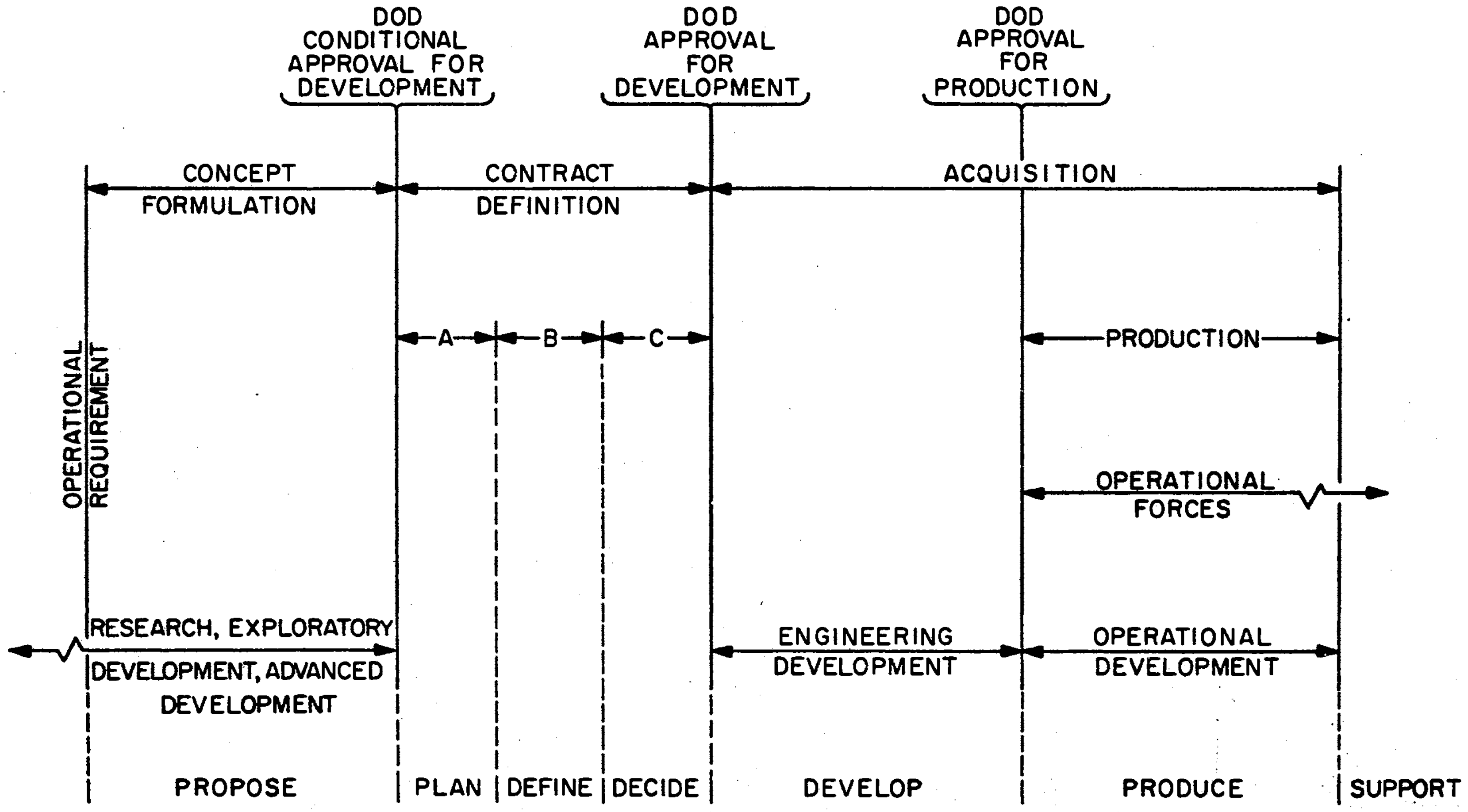
Upon completion of engineering development, the program is reviewed and a decision made as to the acceptability of proceeding into the acquisition phase. If approved, the program enters the acquisition phase and operational development begins. This signifies that the project is approved for full production and deployment and is transferred from the R & D program to another program category of the Five-Year Defense Plan. Operational development encompasses the development, engineering and testing of components, subsystems, and systems approved for production and employment. It will be shown later that the DoD has recently directed that more prototype hardware be developed. It is, therefore, necessary that the Services accomplish more hardware testing and evaluation activities in Engineering Development, rather than Operational Development. Production and issue to field unit follow this testing period. From the above, it is seen that the three major phases of the R & D cycle - concept formulation, contract definition, and acquisition - encompass the five major categories of R & D activity - research, exploratory development, advanced development, engineering development, and operational development. These categories, plus a sixth and final category - management and support - make up the complete defense R & D program. The management and support category involves support and operation of test ranges and laboratories, maintenance and operation of ships, aircraft, and land based support instrumentation, and all other multiusage and general purpose R & D support activities. The support functions of this category apply to all of the other five categories. Dickey has portrayed the defense R & D cycle in Figure 1 (2, p. 12). This presentation best describes those developmental programs which result in a single contractor being awarded the engineering development contract as a result of contract definition. In practice, the DoD has used this general scheme as a guide, departing from it to tailor the management approach to each particular developmental program on a best fit basis.

The overview of the Defense R & D cycle presented above drew heavily from the work of Dickey (2, pp. 5-31). In the past two years, there have been considerable shifts in emphasis by the DoD but fundamentally the R & D cycle remains unchanged.

Contract Definition

The contract definition phase of Figure 1 consists of three subphases; A, B, and C. Phase A is a process which results in the selection of two or more competing contractors for participation in Phase B. The selection is made by evaluating two contractor proposals - one which describes how he will conduct the contract definition in Phase B, and

THE DEFENSE ITEM ACQUISITION PROCESS



Source: Defense Research and Development, edited by Ralph Sanders, Industrial College of the Armed Forces, Washington, D.C., 1968, p. 12.

Figure 1. The Defense Item Acquisition Process

the other which describes a plan for the Acquisition Phase. In Phase B, the contractor prepares and submits a proposal which describes the engineering design approach, system performance, implementation plan, and costs. Phase C consists of a rigorous evaluation and analysis by the Source Selection organization and ends with the selection of a contractor to perform engineering and operational development, and production activities.

CHAPTER III

CURRENT DOD MANAGEMENT PHILOSOPHY

As weapons and equipment have grown in size, complexity, and cost, the DoD has continually sought ways to improve R & D management concepts. Since the end of World War II, increasing emphasis has been placed on a total systems approach. Today, defense managers of large and complex systems are faced with technical and managerial decisions which should take into account factors such as threat, urgency of need, methods of employment, systems concepts, technical feasibility, alternative trade-offs, cost and cost-effectiveness, supportability, reliability, vulnerability, survivability, flexibility, etc. Since each one of these factors can and usually do have a degree of uncertainty associated with them, the defense manager is constantly faced with situations which require courageous and risky decisions. The enormous costs associated with modern defense systems make it essential that maximum utilization and effectiveness of limited national resources is achieved.

Parallel Undocumented Development

Because it was recognized that among other things, the real world does not allow sufficient elimination of technical risk prior to approval for engineering development, the Chairman, Senate Subcommittee on the Judiciary in October, 1968, requested the General Accounting Office (GAO) to evaluate two proposed methods of procurement - Parallel Undocumented Development and Directed Technology Licensing. The Comptroller General presented the GAO report to Congress on July 14, 1969 (3, pp. 1-34). The Parallel Undocumented Development (PUD) proposal, authored by Dean Ralph C. Nash, of George Washington University, was favored by the GAO. The PUD requires that:

> (1) Competitive engagement be sustained through further, more substantive stages of development; (2) Contractor selection be based upon demonstrated performance of hardware; and (3) Most Government-purposed documentation be deferred until the winning contractor is selected (3, p. 14).

The end products of Contract Definition studies are usually a set of performance specification models, technical and management plans, and briefings to source selection officials. These officials are responsible for deciding whether or not to proceed into engineering development, and if so, selecting a single contractor for that phase. The winning contractor is usually the sole source for the follow-on production phase of acquisition. This approach to contract definition is frequently referred to as "paper competition" or "paper studies". The PUD approach to sustain competition through more substantive development introduces a substantial change to the "paper competition" process of the Contract Definition. Specifically, it retains at least two competing contractors throughout the engineering development activity, and requires a significantly different approach than the Phase A, B, C of Contract Definition. The concept that the contractor selection for production will be based upon demonstratable hardware introduces a new dimension into the initial SSEB evaluation, and requires development and testing of full-scale (not necessarily complete) system prototypes during the engineering development. The concept to defer government proposed documentation is basically an attempt to require only that documentation now that will be used now in the evaluation and selection criteria. This so-called minimum documentation concept argues that to require voluminous data on maintainability, reliability, operability, etc. on a system that has not been designed is, for the most part, a waste of time and dollars.

While none of the three basic tenets of PUD - competition in engineering development, full-scale prototype systems, and deferred documentation - are new concepts to R & D management, they are significant departures from the defense R & D management principles and practices of the past fifteen years relative to the Contract Definition and engineering development activities. Figure 2 shows the defense item acquisition process as modified by the PUD approach. The differences can be seen clearly by comparing Figure 1 and Figure 2.

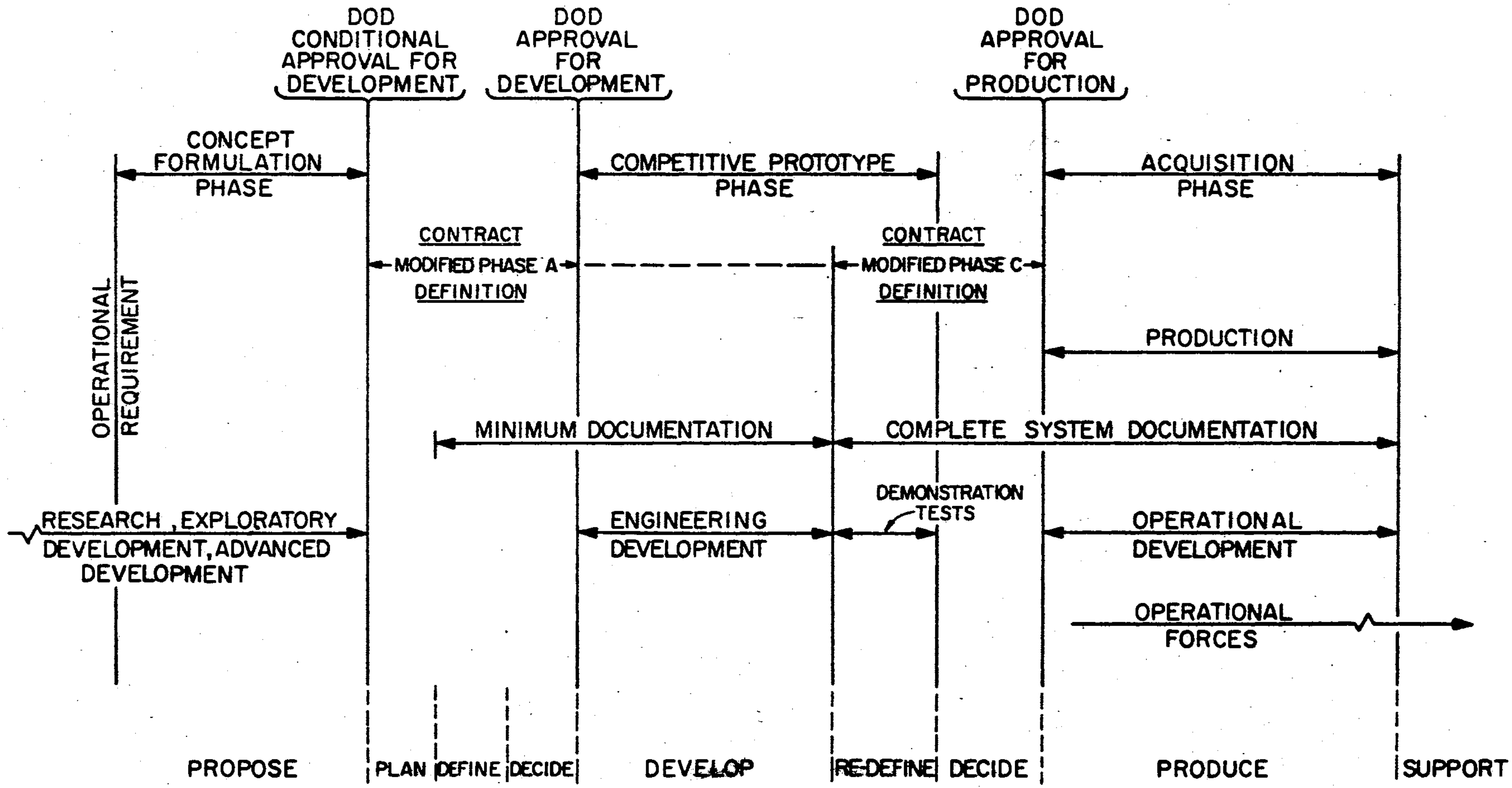


Figure 2. The PUD Defense Item Acquisition Process

Recent DoD Directives

In July, 1969, Mr. Packard, the Deputy Secretary of Defense, directed the Service Secretaries to study ways to improve the weapon systems acquisition process (4). Cost growth in systems acquisition was a major topic of this memorandum, and three factors were identified as major causes of the unacceptable cost growth during systems acquisition. The first factor is over-optimism in cost estimates by both contractors and Military Services. To correct this, greater emphasis on reality will be achieved by making it a major factor in the Source Selection process. This will require improvements in cost estimating and validating capability and insure these improved capabilities are effectively applied by the Source Selection authority. The second factor is the degree of changes made in a system during the operational development and production phase. More emphasis is required to insure that requirements are well established and that "nice" or "desirable" features do not creep in later. No changes to the system configuration are to be approved without full and accurate knowledge of the cost of the change on the total program cost. The third major factor for cost growth is inadequate identification and assessment of technical risks associated with systems. Greater emphasis is needed to insure that the conditions of advanced development are achieved as prerequisite to Contract Definition and full-scale engineering development. In this regard, Deputy Secretary Packard required managers to insure that:

> Areas of high technical risk are identified and fully considered; formal risk analysis on each program is made; and summaries of these are made part of the back-up material for the program (4, p. 2).

Deputy Secretary Packard also stressed the need for increased use of competitive prototyping and the amount of test and evaluation in the acquisition process.

The Air Force response to the Packard memorandum was contained in Air Force Secretary Seaman's letter, with attachment, dated 26 Oct 1969. The attachment, signed by the Air Force Vice Chief of Staff, discusses positive actions the Air Force is taking to improve weapon system acquisition relative to the specific points of the DoD memorandum as well as other actions. In discussing the need for improvements in coping with the problems of technical risk, the Air Force agreed that it must adequately identify and assess the risks associated with major programs and meet the prerequisites of contract definition. The Air Force points out that:

> At the same time, in our efforts to reduce the unknowns and uncertainties in our program, we must remember that technical advancements essential to worthwhile improvements in our operational capabilities must, of necessity, involve a degree of technical risk (5, pp. 4-5).

To eliminate all technical risks in a new system development program would result in an obsolescent and inferior product. Regarding cost estimating and validation, the Air Force and

Rand Corporation currently have over eighty separate cost research projects underway to develop improved methodologies for estimating direct and indirect costs. The Air Force was in agreement with the DoD on every major point in the DoD memorandum of 31 July 1969.

In Dec 1969, Deputy Secretary Packard signed a memorandum to the Service Secretaries which outlined responsibilities in the process of acquiring major weapon systems (6). Figure 3 is a chart which was presented to the Industry Advisory Council meeting on October 10, 1969 and was enclosed in this memorandum, along with definitions of the various activities and decisions. It should be noted that while the names of the major phases have been changed there is great similarity in the descriptions of these new phases to those in Figure 1. The Conceptual Phase is essentially the same as the previous concept formulation phase. The Validation Phase corresponds to the previous Contract Definition Phase, but expands the definition to include provisions for Parallel (Competitive) Prototype Development. The Validation Phase may be interpreted by some to be an extension of the advanced development activities of the Conceptual phase (7). If such were the case, the intent would most likely be to develop, fabricate, and test component or subsystem prototype hardware to determine if the prerequisites for entering engineering development are satisfied. Full-Scale Development and Production Phases

FUNCTIONAL RESPONSIBILITIES IN THE PROCESS OF ACQUIRING MAJOR WEAPON SYSTEMS

RESPONSIBILITIES OF SECDEF AND SERVICE

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SECDEF	X	●	X	●	X	●	X	X
SERVICE	●		●		●		●	●

RESPONSIBILITIES WITHIN OSD

	CONCEPTUAL PHASE	PROGRAM DECISION	VALIDATION PHASE	RATIFICATION DECISION	FULL-SCALE DEVELOPMENT	PRODUCTION DECISION	PRODUCTION	DEPLOYMENT
SECDEF		○		○		○		
DDR&E	⦶	⦶	⦶	⦶	⦶	○	⦶ →	
ASD(I&L)		○		○		⦶	→ ⦶	⦶
ASD(C)	X	○	X	○	X	○	X	X
ASD (SA)	X	○		○		○		

● PRIMARY RESPONSIBILITY

○ SECONDARY RESPONSIBILITY IN OSD

⦶ PRINCIPAL RESPONSIBILITY IN OSD

X MONITORING RESPONSIBILITY

Source: Department of Defense Briefing to the Industry Advisory Council, October 10, 1969.

Figure 3. DoD Acquisition Responsibilities

replace the previous Acquisition Phase. Acquisition Phase previously included Engineering Development, Operational Development, and Production. The Full-Scale Development Phase appears to include the same activities, but with greater emphasis on test and evaluation of the weapon system, including all of the items necessary for its support, prior to approval for production. In the new Production Phase, the weapon system, including training equipment, spares, etc., is produced for operational use. In the Deployment Phase, the system is provided to and used by operational forces. The decision milestones by DoD are essentially the same as in Figure 1. Figure 4 provides summarial comparison of the previous and new processes. It is clear that the primary change has been increased emphasis on the development, testing and evaluation of prototype hardware throughout the development activities, including parallel (competitive) prototype development.

In May 1970, Deputy Secretary of Defense Packard sent a memorandum to the DoD at-large providing further policy guidance on major weapon system acquisition (8). A major portion of this directive was addressed to the need for reducing technical risks in new programs and ways that risk can be minimized. Three approaches for reducing risk in the conceptual phase were given:

(1) Risk Assessment. The first is to make a careful assessment of the technical problems involved and a judgment as to how much effort

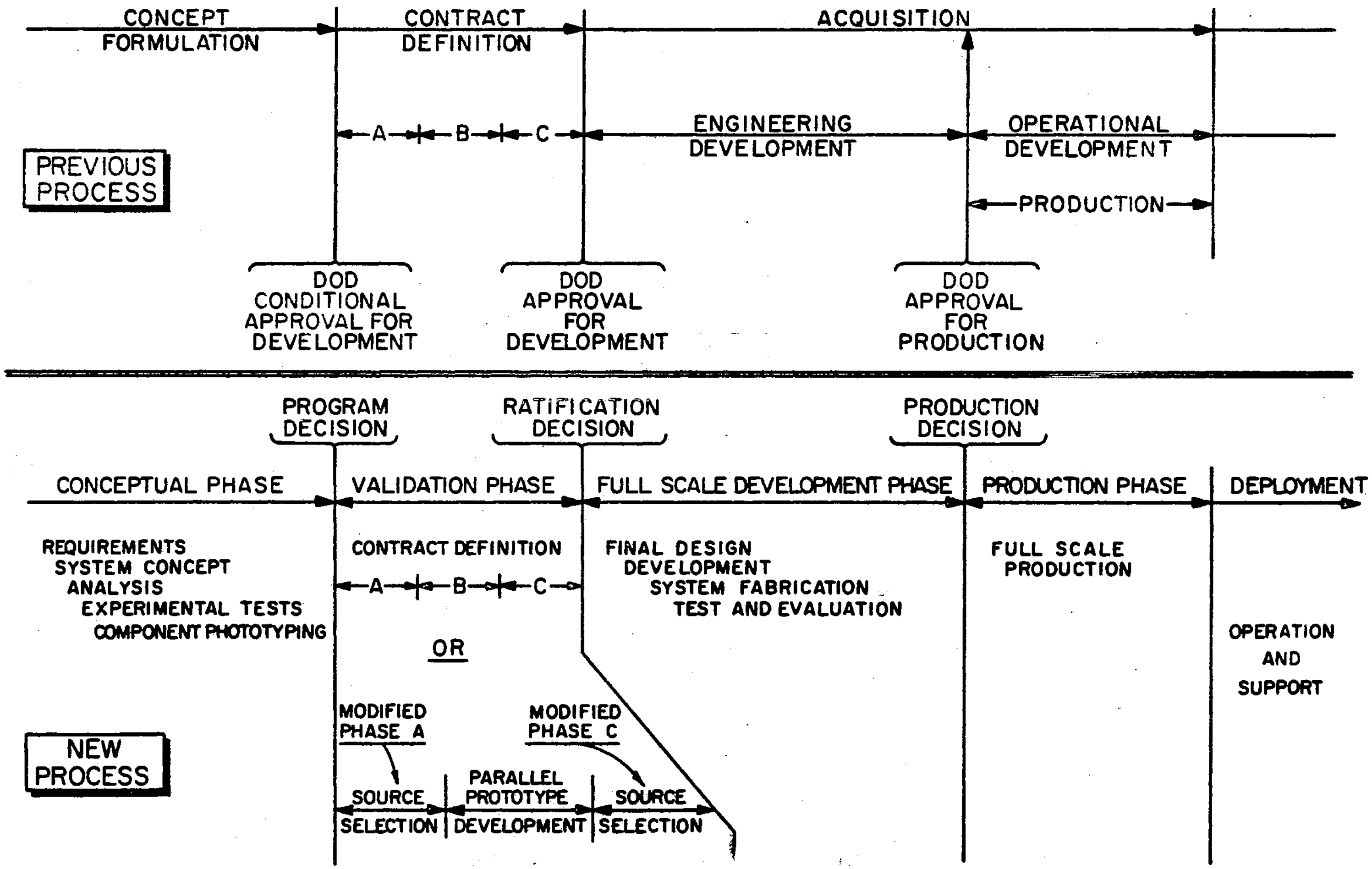


Figure 4. The Defense Item Acquisition Process

is likely to be necessary in finding a solution that is practical. A careful look at the consequence of failure, even of "low risk" program elements, is also critical.

(2) System and Hardware Proofing. The second and only sure way to minimize the technical risk is to do enough actual engineering design and component testing in the conceptual development stage to demonstrate that the technical risks have been eliminated or reduced to a reasonable level. Component or complete system prototyping, or backup development, are examples of this.

(3) Trade-offs (risk avoidance). Since program risk and cost are dependent on practical trade-offs between stated operating requirements and engineering design, trade-offs must be considered not only at the beginning of the program but continually throughout the developmental stages.

Regarding Full-Scale Development, the memorandum stated that:

> Even though risk has been adequately addressed during the conceptual development stages, full-scale development will uncover technical and engineering problems that need to be solved. Procedures shall be established in the development program by which these problems will be continually addressed in view of possible trade-offs with stated operating requirements, cost, and operational readiness date.

The requirement for "formal risk analysis" that Mr. Packard directed in his 31 July 1969 DoD memorandum and referred to in his 28 May 1970 memorandum was the primary factor that prompted the initiation of this study effort -- the development of a methodology and model for integrated risk analysis and scoring in the Source Selection Evaluation Board Process.

The Air Force Systems Command is currently preparing a guide for management in the systems acquisition life cycle. This guide reflects the current DoD management philosophy and will, when approved, replace Part One of AFSCM 375-4. The major emphasis of the guide is on cost effectiveness and reduction of risk through demonstration and hardware proofing prior to a production commitment. The five major phases of the systems acquisition life cycle, shown in Figure 4, are described in detail in this guide so as to "... provide a frame of reference and management philosophy from which system program personnel <u>may</u> select appropriate ideas to help achieve program objectives" (9, p. 2).

Figures 5, 6, 7, and 8 are taken from the draft of the above mentioned guide and portray the activities that may be applied to a particular developmental program. The main purpose of including these figures in this report is to show where, in the over-all systems acquisition life cycle, the specific activities which are directly related to the process developed in this report are accomplished. The specific portion of the system acquisition life cycle <u>directly</u> involved in this study are block 21 of Figure 5 and blocks 28 and 29 of Figure 6. In block 21, the work statement, RFP,

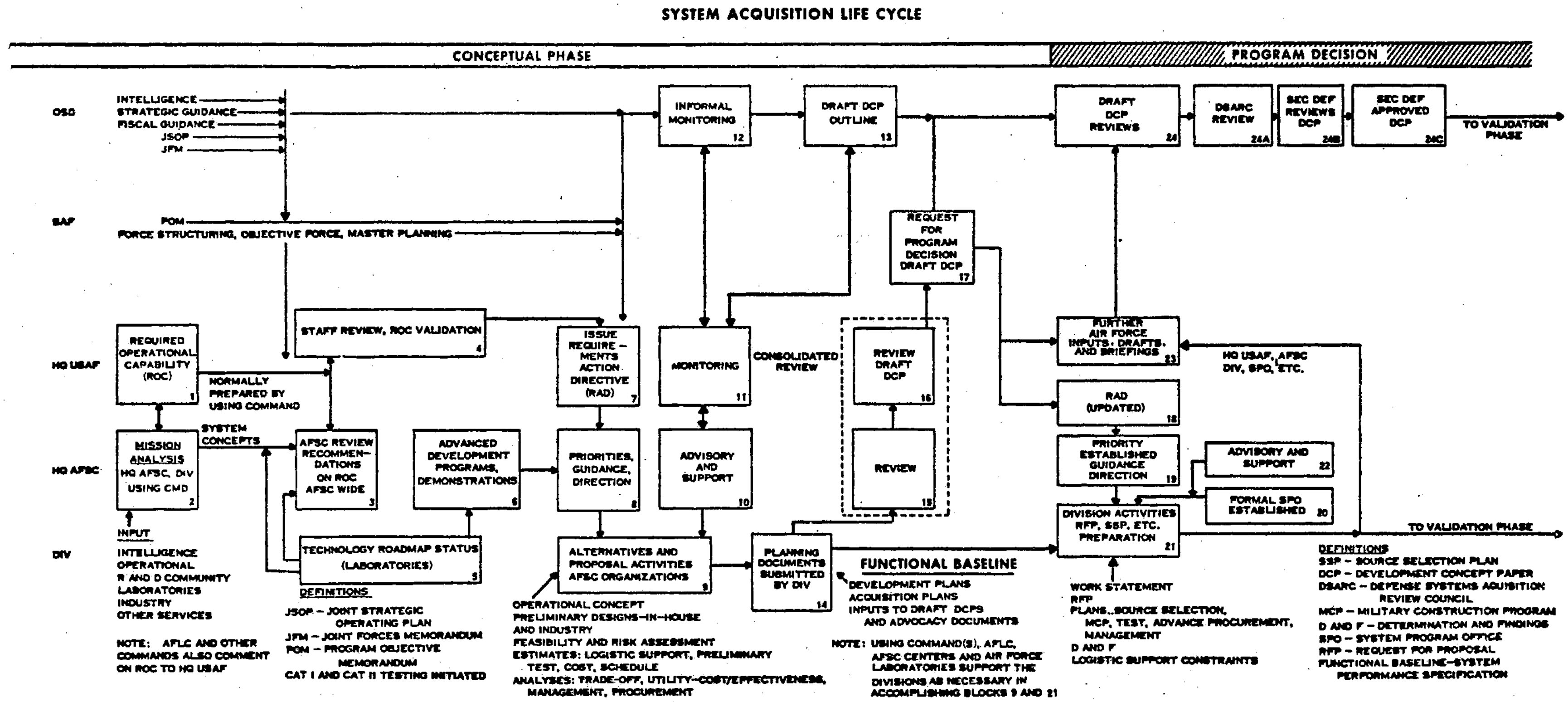


Figure 5. Acquisition Process for Conceptual Phase

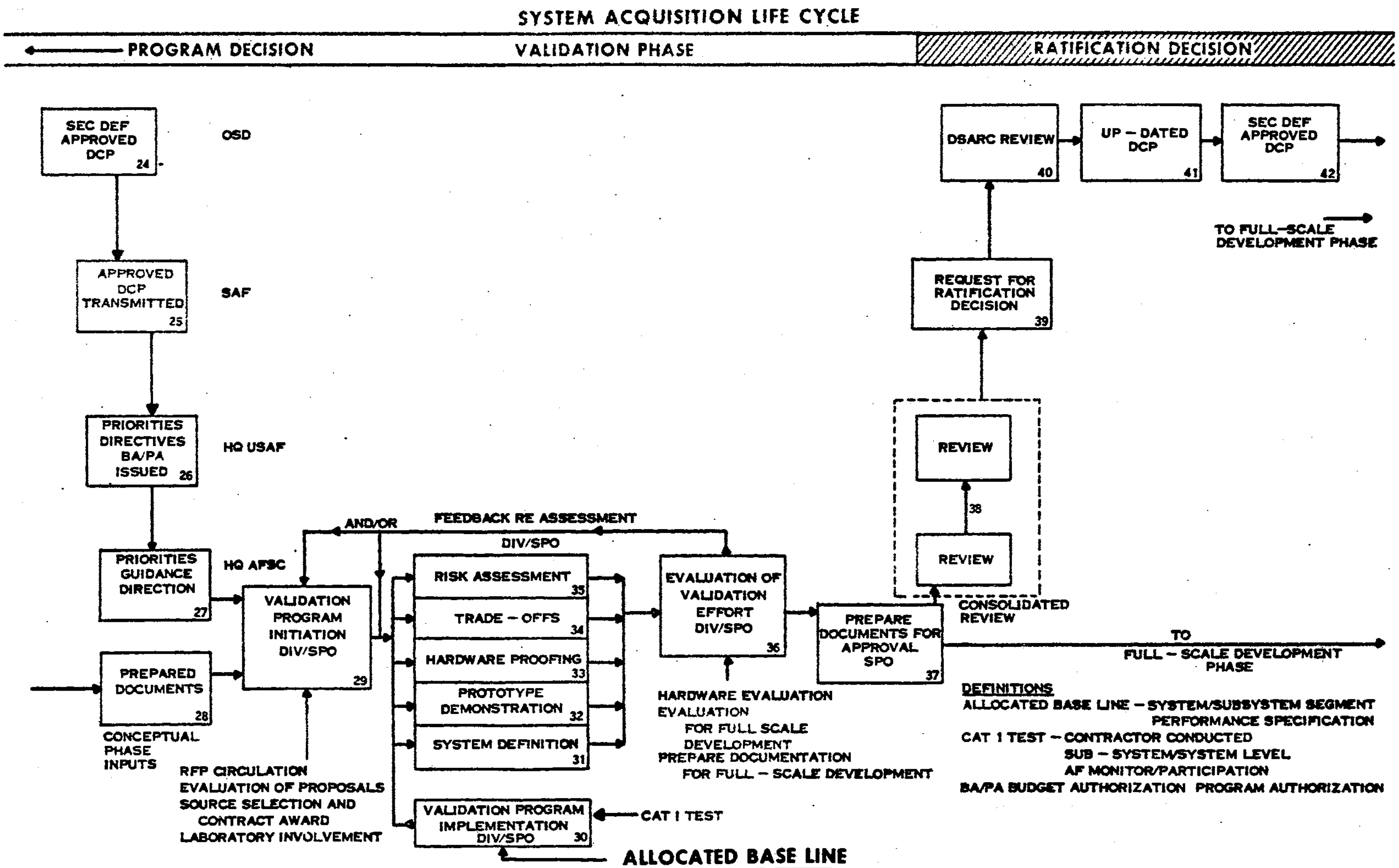


Figure 6. Acquisition Process for Validation Phase

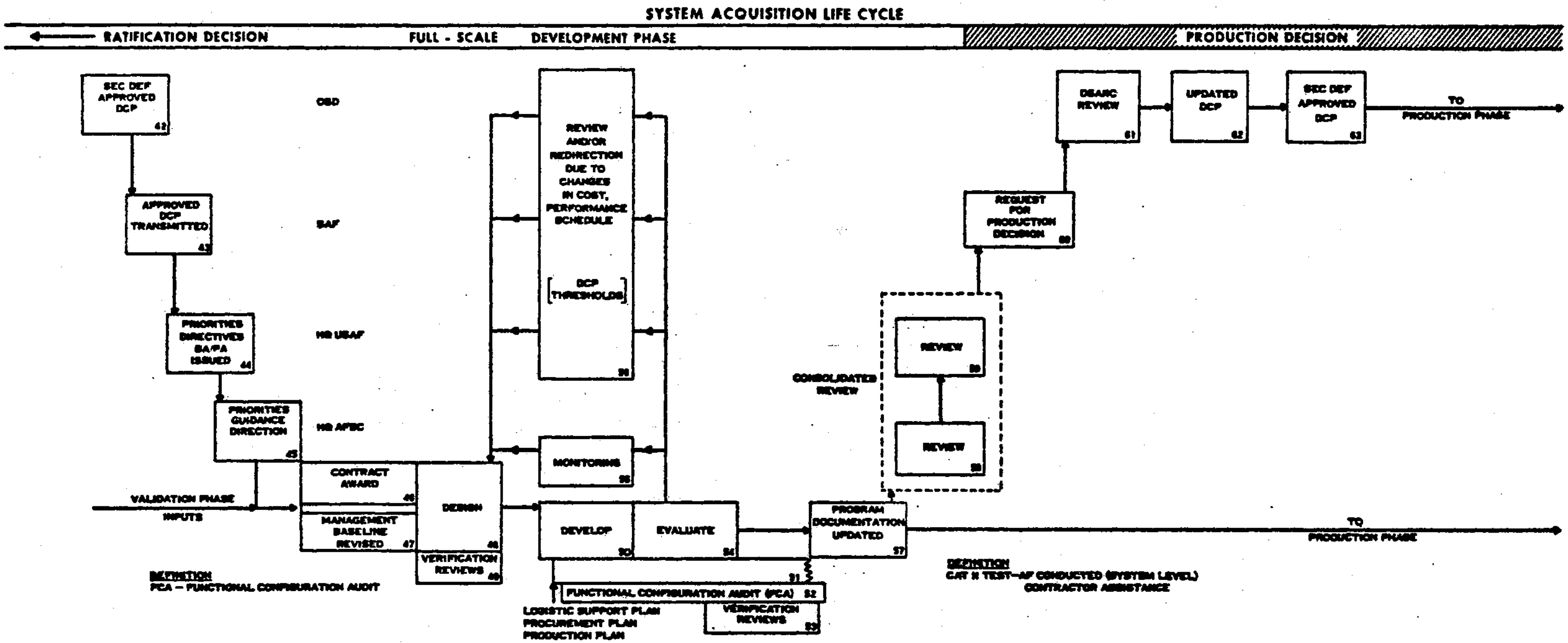


Figure 7. Acquisition Process for Full-Scale Development

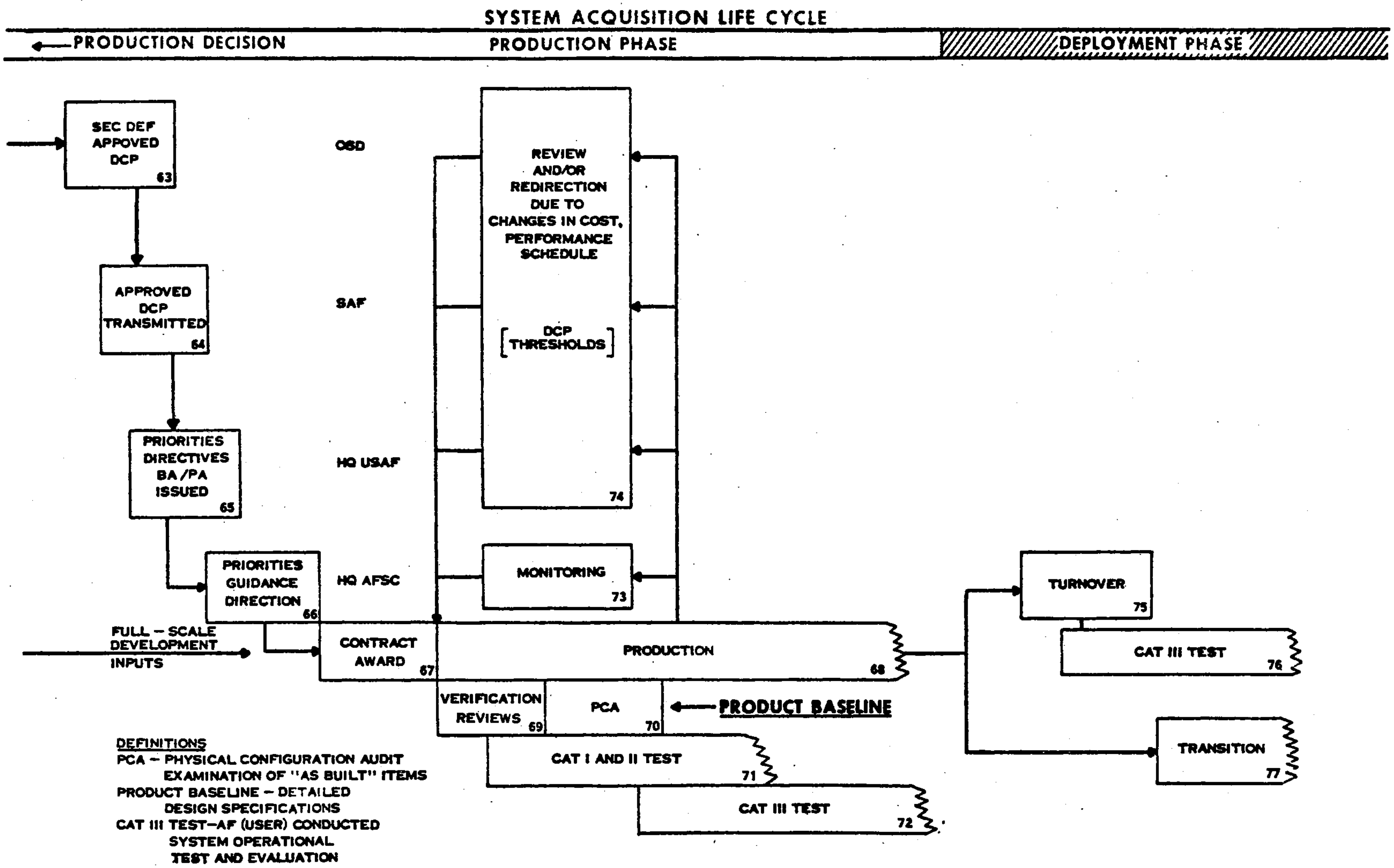


Figure 8. Acquisition Process for Production Phase

logistics considerations, and various plans such as source selection, test, procurement, and management are prepared. In block 28, the requirements baseline documentation prepared in the Conceptual Phase may be revised or supplemented as required for the Validation Phase. Block 29 encompasses the majority of actions that are involved in this study. The over-all objective of the Validation Phase is to determine whether to proceed into Full-Scale Development. The goal of the Validation Phase is to establish firm and realistic performance specifications (allocated baseline), which meet operational requirements. The RFP is distributed to potential or participating contractors for their response. The resulting contractor proposals are then evaluated and a contractor source is selected. Quite specifically, it is the process of evaluating contractor proposals that is the primary subject of this study effort.

Summary

In its continuing quest to develop improved and innovative management principles and practices, the DoD has, since 1968, taken a penetrating and critical look at the weapon systems acquisition process. The two documents that appear to be most significant relative to current DoD management philosophy are:

(1) The proposal for Parallel Undocumented Development

(2) The 31 July 69 memorandum by Deputy Secretary

of Defense Packard entitled "Improvement in Weapon Systems Acquisition."

These and subsequent policy directives have required or encouraged several changes to current weapon systems management practices. The most notable changes are:

(1) Competition be extended throughout engineering development.

(2) Increased use of hardware prototyping and contractor selection based upon demonstrated hardware performance.

(3) Selective requirements for government documentation.

(4) Attempts to reduce cost growth through technical risk analysis and evaluation in every stage of development.

While the R & D regulations and manuals of all military services will be appropriately changed to reflect and implement current DoD management philosophy discussed in this chapter, only those of the Air Force relative to the Source Selection process will be of interest to this study.

CHAPTER IV

THE SOURCE SELECTION PROCESS

The purpose of this chapter is to briefly describe the Source Selection process used in the Department of Defense. Primary emphasis will be on that portion of the Source Selection process which deals directly with the evaluation of contractor proposals submitted on a competitive basis. The Air Force regulations, manuals, and procedures will be used to describe the process but the reader should understand that each military service has corresponding and similar documents to implement the Source Selection process. It is not the intent of this study to provide an in-depth understanding of all the activities involved in the total Source Selection process. The following selected references will provide the interested reader a rather detailed (though Air Force oriented) explanation of the Source Selection process in its entirety (1) (3) (4) (5) (6) (8) (9) (10) (11) (12) (13) (14) (15) (16) (17) (18) (19).

There are numerous activities that take place in the Conceptual Phase that directly or indirectly affect a Source Selection. Broadly speaking, the process may begin with when a using command submits a Required Operational Capability (ROC) and the Headquarters USAF responds with one or more Requirements Action Directive (RAD). Following that, more specific guidance is provided in the RAD and directs appropriate documentation in the form of a Concept Formulation Package or a Preliminary Technical Development Plan (PTDP). This plan, along with the Advanced Procurement Plan and other documentation as appropriate, is forwarded to Headquarters USAF in support of a request to initiate the Contract Definition Phase (referred to as the Validation Phase in current documents). Hq. USAF then issues a Systems Management Directive (SMD) which, among other things, authorizes the establishment of a System Program Office (SPO) and may designate or delegate the Source Selection Authority (SSA). The SPO then prepares the Selection Plan and submits it to the SSA for approval. It should be noted here that upon issuance of the RAD, system management procedures/techniques are normally directed and a System Program Director (SPD) and a System Program Office (SPO) cadre are established. It is at this point in the Conceptual Phase that efforts toward preparing a Selection Plan commence.

Source Selection Procedures

The prime objectives of the Source Selection process, as outlined in AFR 70-15, are:

> ... impartial, equitable, and comprehensive evaluations of competitors and their proposals to insure selection of that source which will provide optimum satisfaction of the government's basic objectives including the required performance and schedule at the best cost (13).

Source Selection actually begins with the preparation of the Selection Plan. This plan relates decisions that will dictate the major course of future source selection activity. Because of this, the Selection Plan must be consistent with the PTDP and other program documentation. It must be completely staffed by Air Force Systems Command (AFSC) and coordinated with all major commands which will participate in the source selection. Briefly, the Selection Plan should include:

(1) System Performance Criteria

(2) Source List Screening Criteria

(3) Evaluation Criteria

(4) Source Selection Organization

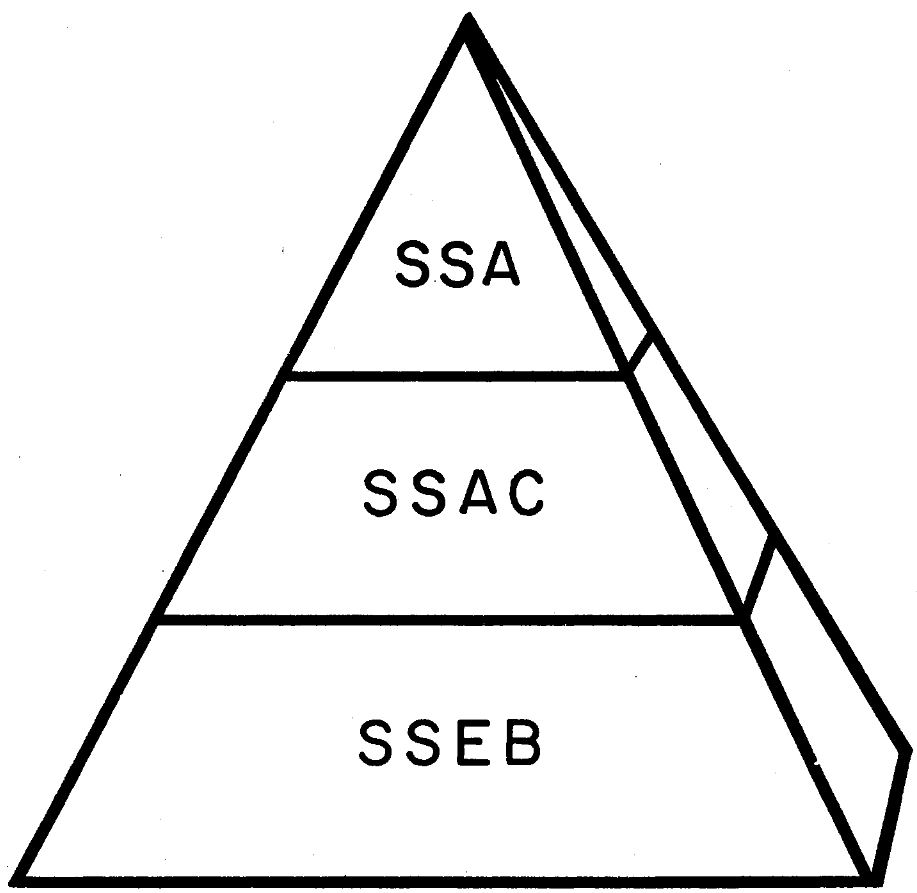
(5) Evaluation Technique

(6) Schedule of Events

(7) Procurement Plan Summary.

After the Selection Plan is prepared and approved by the SSA, the Source Selection Advisory Council (SSAC) is established and the Source Selection Evaluation Board (SSEB) is organized. At this point, the three organizational elements unique to and created specifically for a source selection are established; i.e., the SSA, the SSAC, and the SSEB. Figure 9 pictures the Source Selection decision pyramid (20, p. 54). The specific responsibilities of each of these organizational elements will be summarized later. Normally, the director of the System Program office will be the chairman of the SSEB.

THE DECISION PYRAMID



Source: Aeronautical Systems Division Manual, "The Source Selection Process," 15 June 1969, p. 54.

Figure 9. The Decision Pyramid

The next major activities are the preparation of the Request for Proposal (RFP) document by the SPO and the establishment of the evaluation criteria by the SSAC. When approved by the SSAC, the Request for Proposal document is distributed to qualified contractors who then respond with their proposals. It is essential that the RFP and the evaluation criteria be consistent, for it is upon these that an objective and equitable evaluation and ultimate source selection depend.

Upon receipt of proposals from competing contractors, the SSEB begins the evaluation process. Evaluation teams examine each proposal in detail, evaluate and score them in accordance with the evaluation criteria and plan. Reports by the evaluation teams are summarized, with sufficient narrative to defend the scores given. Although cost data submitted by contractors is not scored, the following actions relative to cost are required by the SSEB:

(1) Insure the comparability of costs

(2) Insure that costs relate to the proposed items of work

(3) Assess cost risk

(4) Assist the SSAC in the analyses of the total cost to the government.

The SSEB evaluation of the costs are the cost basis for SPO negotiations with the contractors.

After completion of the SSEB evaluation report, it is presented to the SSAC in writing and by oral briefing. The

SSAC prepares a Proposed Analysis Report for the SSA. The SSAC analysis includes application of weights to the areas and items scored in the SSEB evaluation report. A Proposal Analysis Report consists of three parts:

(1) Summary of the Source Selection authority, procedures used in the evaluation and significant conclusions.

(2) Summary of each proposal's major strengths, weaknesses, and risks to the government.

(3) Analysis and advice that includes facts considered and the collective judgment of the SSAC based upon its experience and knowledge in military operations, procurement, technology, logistics, etc.

During the SSEB evaluation, certain deficiencies in the proposals may be found; that is, elements of the proposal may not satisfy stated requirements in the RFP. These deficiencies if written up by the evaluator as a separate Deficiency Report (DR), will be reflected in the evaluation report in both a narrative and quantitative score form. The evaluator must report in the SSEB evaluation whether he considers the deficiency as an overlooked detail, easily correctable, or whether the required corrective action will create high risks and impact schedules and costs. The Deficiency Reports will be provided to the SPO negotiating team to use in fact finding with the contractors.

Negotiations for contract commitments can begin when the SSEB Deficiency Reports, cost and other pre-negotiation data are available to the SPO negotiating team. Careful attention to and compliance with the Armed Services Procurement Regulations are required throughout negotiations with those contractors qualified for consideration. The SSAC evaluation and analysis will therefore encompass the summarized Deficiency Reports and the SPO negotiation results (evidenced by definitive contracts), along with the SSEB evaluation report to evaluate and analyze. The SSAC uses these analyses to support its collective judgments and advice included in Part 3 of the Proposal Analysis Report to the SSA.

When the SSA is the Air Force Chief of Staff or higher (the Secretary of Defense may retain SSA), the Air Force Systems Command (AFSC) will submit the original Selection Plan to the Headquarters USAF office of primary responsibility for coordination with various Air Staff offices. The Selection Plan will then be forwarded to the SSA for approval. After the Selection Plan is approved, the process described in this chapter takes place, the final briefing by the SSAC is given to the commanders of AFSC, AFLC, the using command(s), and the Air Force Council. These commanders will submit comments and advice on the source selection and the Air Force Council may modify the action taken by the SSAC, notifying the SSAC of such action. The SSA then has complete information upon which to base the selection decision. This information includes the SSEB evaluation report, SSAC proposal analysis report, contract provisions, cost data, Hq USAF and major commanders advice. To this the SSA may obtain any advice he deems necessary and appropriate. When selection of the contractor(s) is made, the source selection ends.

Figure 10 provides a summary of the key responsibilities of three organizational elements peculiar to the Source Selection Process.

SSEB Evaluation Process

The Source Selection Evaluation Board (SSEB) must develop an Evaluation Plan to conduct a detailed analysis and evaluation of each contractor proposal. The Evaluation Plan usually encompasses the following functional areas:

(1) Scientific and Technical

(2) Operational

(3) Logistics

(4) Management

(5) Cost to the Government.

In addition, the SSEB is required to conduct negotiations with each contractor to arrive at mutually agreeable definitive contract. Figure 11 shows a typical SSEB organization structure to accomplish the above functions. On some programs, another area, cost-effectiveness, is added to the organizational structure and evaluation process. The technical, operational, logistics, and management areas are scored numerically in the evaluation process, while the

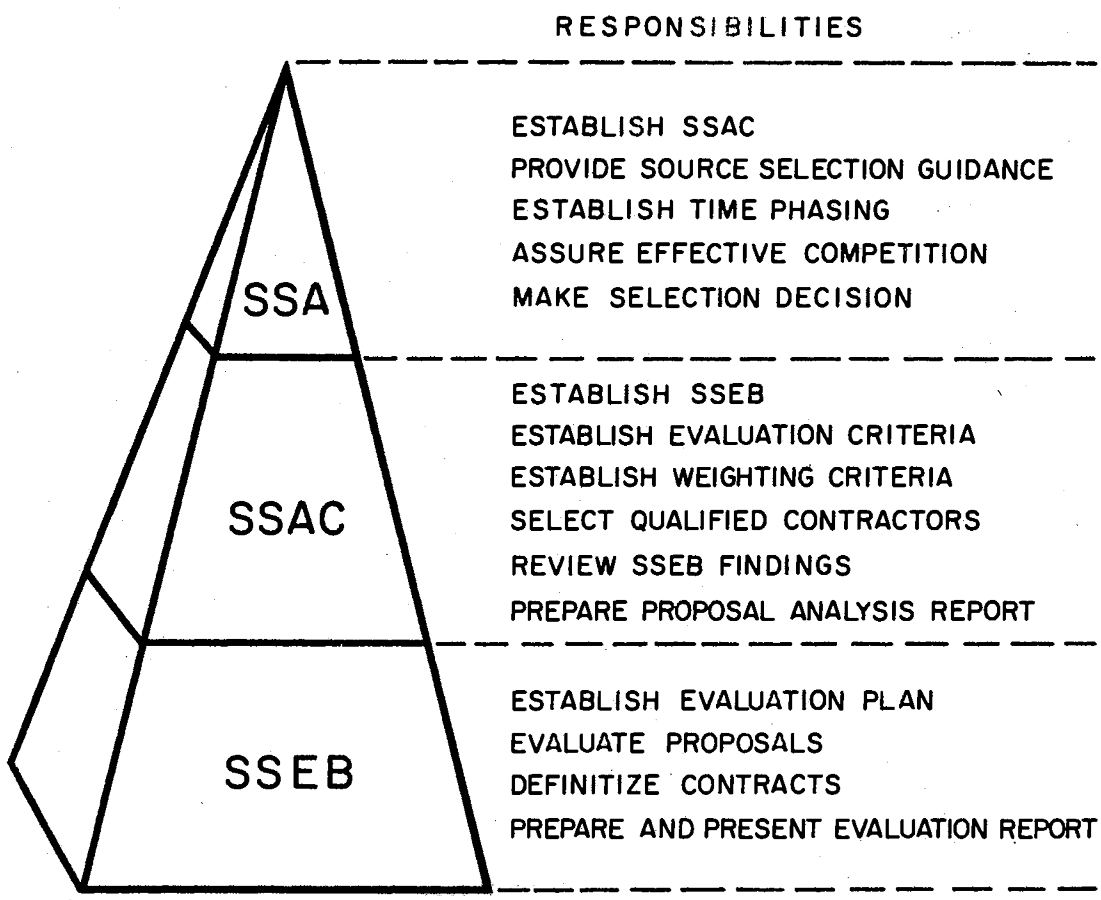


Figure 10. Source Selection Organizational Responsibilities

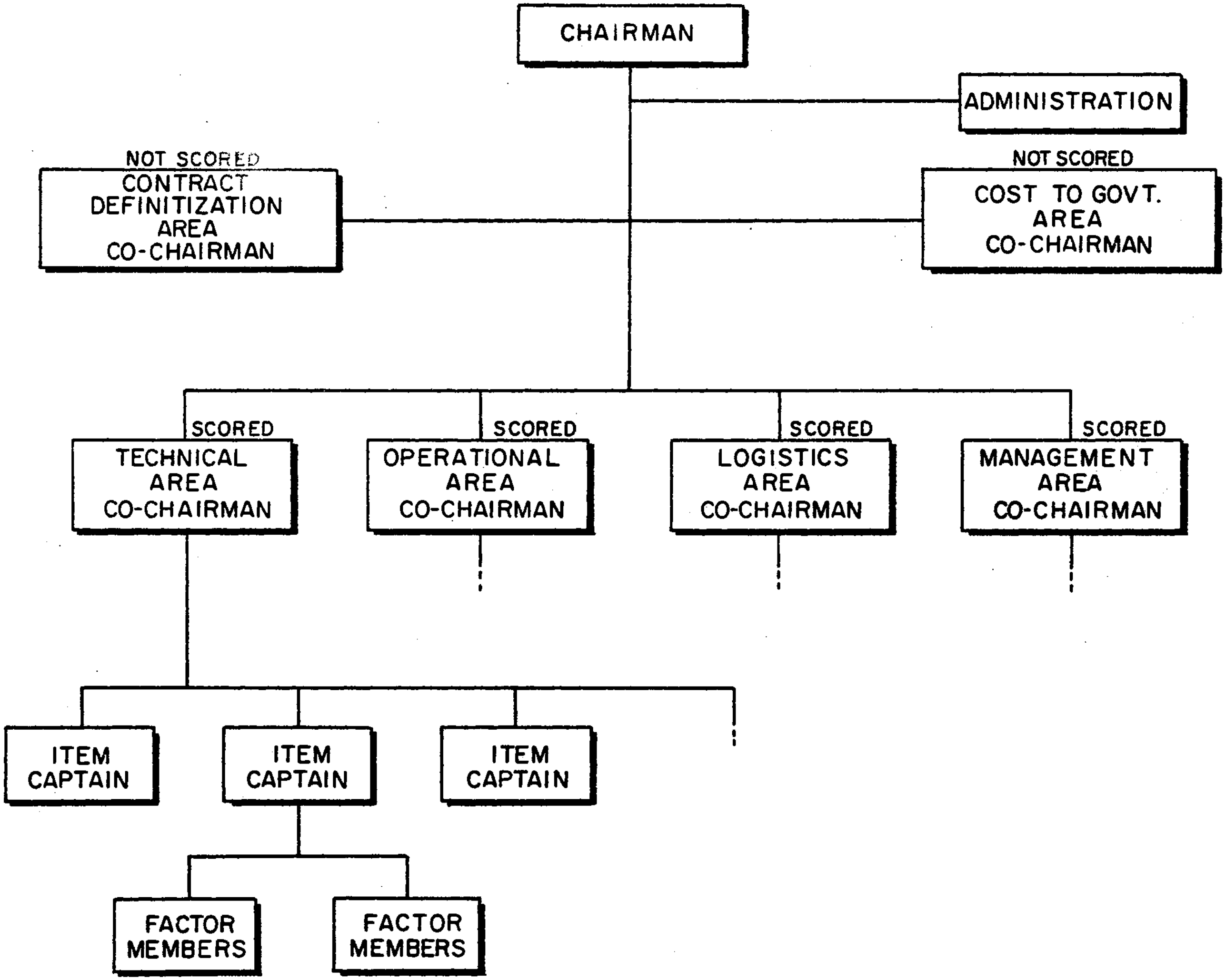


Figure 11. SSEB Organization

remaining areas receive only qualitative evaluation and assessment. Figure 12 shows how the evaluation criteria is married to the SSEB organizational structure and evaluation process. Each factor member performs a detailed analysis and evaluation of each contractor proposal in his factor. He then prepares a narrative report to support the rating assigned. The item captain then integrates the factor write-ups and ratings, summarizes the findings, and assigns a numerical score at the item level. The area co-chairman then integrates narrative write-ups at the item level and prepares an area summary for the SSEB evaluation report, which includes the item level scores.

Evaluation criteria are established to provide the details for implementing and executing the evaluation plan. Standards are derived from the requirements in the RFP and are used to evaluate how well the proposal approaches meet or exceed the RFP requirements. Conversely, they can be used to determine the difference between what the RFP specified as an acceptable minimum and what the proposal offers. The primary objective of using standards is to allow evaluators to rate or score a company proposal objectively upon its own merits or demerits relative to some established norm or minimum acceptable level, rather than rating or scoring proposals against each other. Every effort is made to establish standards quantitatively to insure consistency by evaluators. When standards are

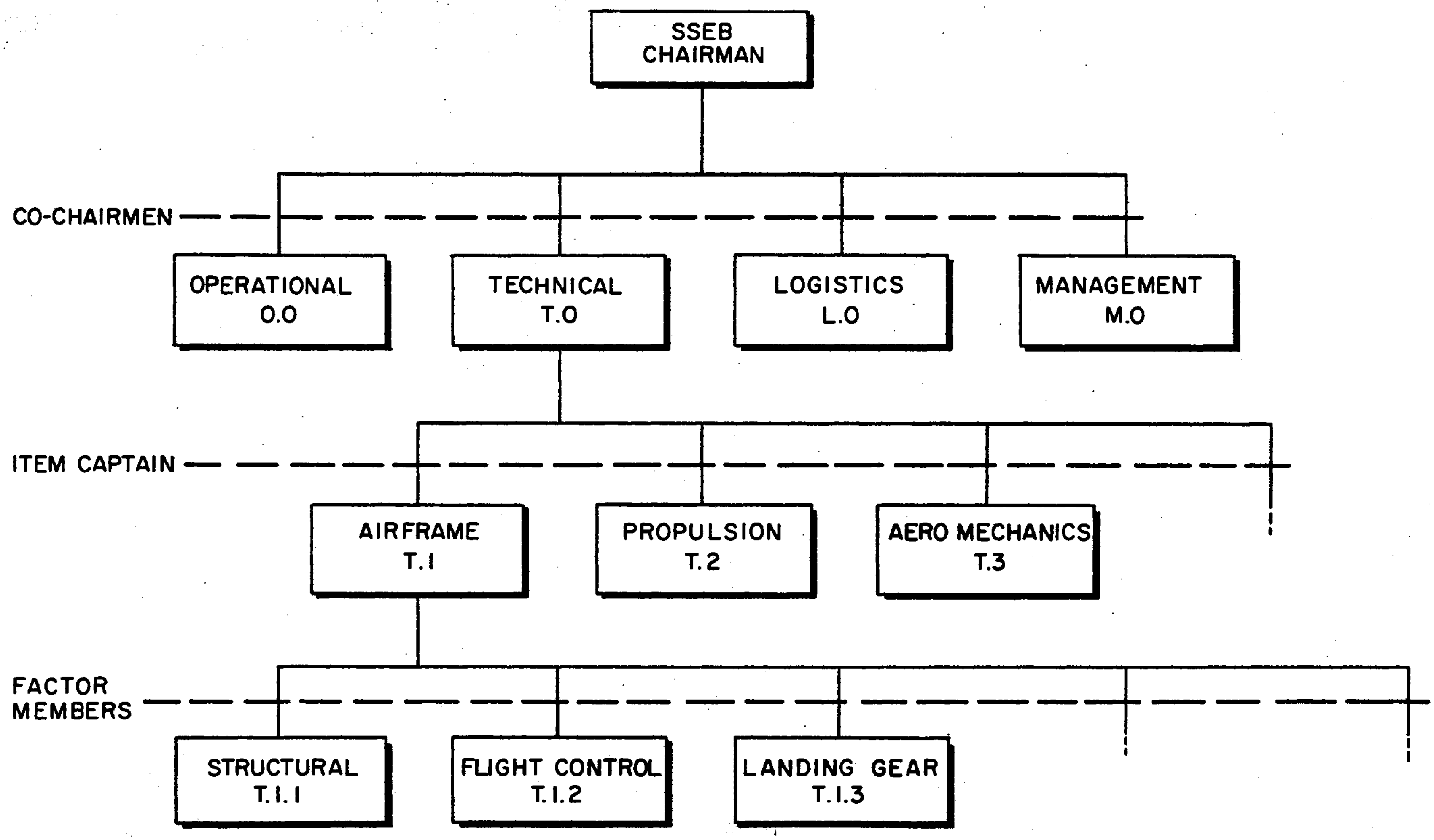


Figure 12. SSEB Organization (Example)

expressed qualitatively, care must be taken to achieve understandability and uniformity of interpretation by evaluators.

Evaluation Techniques

The evaluator at the factor level, equipped with the knowledge of what he is to evaluate, what the RFP requires, and what is minimum acceptable, carefully studies a proposal and compares it with the appropriate standards. The factor level evaluator then develops a quantitative assessment of how well the contractor proposal met the minimum requirements of the system, prepares an analysis in narrative form which includes significant strengths, weaknesses, end risks, and selects one of three symbols which are used to rate the proposal in that factor. The three symbols used for factor rating are as follows:

+ signifies proposal exceeded minimum requirements

✓ signifies proposal met minimum requirements

− signifies proposal failed to meet minimum requirements.

When each factor level evaluator has completed his analysis and evaluation for a contractor proposal, the Item Captain will determine the numerical designator to be assigned for his item as follows:

Exceptional	10 9	Rare solution of exceptional quality
Exceeds Standard	8 7 6	Exceeds minimum acceptable requirements by offering some unique device, process, etc.
Meets Standard	5	Meets all minimum acceptable requirements but does not exceed them
Below Standard	4 3 2 1	Fails to meet minimum acceptable requirements. Evaluator must state degree of impact of deficiency and corrective action.
Unacceptable	0	Totally unacceptable

The numerical score for each item will be supported by a narrative write-up which summarizes the factor level write-ups and includes the significant strengths, weaknesses, and risks. It should be noted that proposals which fail to meet minimum requirements of the standards for one reason or another are, by definition, considered to be deficient. A deficiency is defined as "... an element of the company's proposal, which, when compared to the standard for that element, fails to meet the minimum requirements of the standard ..." (20, p. 181). The individual evaluator will prepare a Deficiency Report (DR) on all deficiencies found. He is required to assess the impact of the uncorrected deficiency upon the system and estimate the degree of corrective action required to correct the deficiency. His over-all evaluation of the deficiency will be reflected in the narrative and numerical rating of the proposal. When the DR's are answered by a company, the DR's will be summarized and given to the Contract Definitization Group and the SSAC. The company answers to DR's will not be reflected in the basic SSEB evaluation ratings and numerical scores.

The Area Co-Chairman then prepares a narrative summary of all the items in his area. These area summaries along with the item level numerical scores where applicable, are included in the over-all SSEB evaluation report and presented to the SSAC.

It is obvious when reading the RFP and Evaluation Criteria that all areas, and items within areas, are not of equal importance to the system requirements and effectiveness. For this reason, some weighting criteria must be established to assure that relative importance is considered in the evaluation and selection process. The item weighting function is restricted to the SSAC and precautions are taken to insure that SSEB evaluators are not appraised of the weighting criteria to be used. While there is no required methodology for establishing the weighting criteria, the suggested method is basically to:

(1) Determine the relative importance of each evaluation criteria item to the Source Selection action as a whole.

(2) From a total of 1000 points, assign to each item the number of points consistent with its relative importance. Care must be exercised to account for cumulative or

collective impacts of a particular item or items on the system as a whole.

Upon receipt of the SSEB evaluation report, apply the following formula to each item to obtain the weighed score.

$$\frac{\text{Maximum Weighted Score X SSEB Raw Item Score}}{10} =$$

Weighted Item Score.

The Sum of the Weighted Item Scores will constitute the over-all proposal score. This over-all score, along with other information, such as cost data, summary of deficiency reports, definitive contract, etc., will be used by the SSAC in preparing its report to the SSA.

CHAPTER V

INITIAL APPROACH TO RISK ASSESSMENT

Introduction

Recently a Source Selection was conducted on a major weapon system developmental program to which the current DoD management policies and principles discussed in Chapter III were applied, including the minimum documentation approach and the parallel prototype hardware development and testing concept. The Contract Definition/Source Selection process used on this program was a modified single phase effort tailored to the new DoD management concepts. In order to study ways to improve the capability to assess technical risks in the SSEB process, and to investigate the effects of current DoD management philosophy on the existing source selection evaluation process, the writer was accepted as a member of the SSEB for this developmental program. The name of the developmental program will not be mentioned in this study. The specific objectives of participating in the SSEB for this particular program were to:

(1) Develop and implement a model for assessing the impact of technical risks associated with contractor proposals.

(2) Obtain data which would permit an objective

evaluation of the effects of the current DoD management philosophy on the SSEB/SSAC evaluation process.

(3) Obtain data which would permit an objective evaluation of the current SSEB scoring system.

The first objective was accomplished by improvising a model and method to assess the over-all technical risk associated with each proposal. The model was quite limited in scope, and the implementation was substantially handicapped by the fact that it was not integrated into the SSEB evaluation process. The second and third objectives, discussed in Chapter VI, were accomplished primarily by preparing a comprehensive questionnaire and distributing it to Aeronautical Systems Division personnel experienced in The Source Selection process.

Participation as a member of the SSEB afforded a unique and valuable opportunity to observe the Source Selection process at the working level. Considerable insight was afforded through discussions with individual evaluators experienced in the SSEB activities. The writer was particularly impressed by the high level of dedication to and interest in professional performance by individual evaluators. With few exceptions, the evaluators displayed broad understanding of the Source Selection process and were quite candid and objective in discussions about the strengths and weaknesses of the SSEB evaluation process.

Current SSEB Risk Identification

A search of current publications and literature, and informal discussions with AFSC and Headquarters USAF personnel indicated that there is a lack of established methodologies for formal risk analysis Air Force wide. In fact, nothing was found in the form of official guidance within the DoD relative to what a formal risk analysis on developmental programs should include or provide other than in broad qualitative generalities. The Interim AFSC Pamphlet XX discusses risk assessment in considerably more detail than any of the existing official documents. In this management guide, risk assessment is defined as

> ... the process of estimating or judgementally determining the degree of probability that a specific interplay of performance, schedule and cost as an objective, will not be attained along the planned course of action. . . . Risk assessment in the Validation Phase should result in identifying and ordering the single and combined elements of risk which will constitute the greatest and most important uncertainties in the Full-Scale Development Phase" (9, pp. 37-38).

In any discussion of new developmental programs, it is vital to understand that risk is inherent in the process. The very nature of research and development involves uncertainties relative to the probability of success or failure. The only way to completely avoid developmental risks is to eliminate developmental programs, which would - in the writer's opinion - rapidly increase the probability of ultimate failure of the entire society. Those involved in defense R & D should clearly recognize that if there are no anticipated uncertainties identifiable, the developmental program should be suspected of being unworthy of R & D and national resources. In addition, those involved in defense R & D should recognize that on developmental programs for complex weapon systems, one can expect to encounter completely unanticipated problems during full-scale development and integration of the weapon system hardware. The key to improved program management is to recognize that undertainties are inherent and to continually identify and assess the anticipated and unanticipated unknowns throughout each phase of the acquisition life cycle. The primary purpose of risk assessment is to systematically identify and evaluate problems or potential problems involving uncertainty so as to reduce the level of risk to an acceptable level.

Within ASD it has been standard practice that the SSEB evaluation report narratively summarize the significant strengths, weaknesses, and risks of each contractor proposal. This narrative summary is derived basically from the factor level write-ups, which are detailed narratives of the analyses in each factor and sub-factor (15, pp. 12, 17). Included in the factor write-up is a summary of the strengths, weaknesses, and risks of that proposal. The major strengths, weaknesses, and risks for each proposal are then summarized at the item and area levels (20, pp. 196-206). It is the individual factor level evaluator who must initially decide what problem area should be classified as a weakness, and what should be classified as a risk. It is important to recognize that any method of risk identification and assessment in the SSEB will be dependent upon technical expertise and measured judgment by the evaluators. However, there does appear to be a need for improved guidance and guidelines relative to risk assessment criteria, objectives, and methodology.

A problem area identified by factor evaluators as a risk is narratively assessed in the same manner as are weaknesses. The evaluator uses his specialized knowledge and experience to judge the impact of the problem area in his factor. Quantitative techniques used by evaluators to measure the impact of risks vary with the standards available and the individual evaluator's knowledge. The risks are then categorized according to the degree of impact as high risk, moderate risk, or low risk. There is no official guidance or criteria established to assist evaluators in determining what constitutes a high, moderate, or low risk.

Current SSEB Rating/Scoring Techniques

Once the individual factor evaluators identify and assess what they consider to be strengths, weaknesses, and risks, a symbol is assigned to the proposal for that factor. As mentioned earlier, the symbol, which constitutes the factor rating, consists of one of the following marks:

+ exceeds minimum requirements

√ meets minimum requirements

− fails to meet minimum requirements.

Therefore, the over-all evaluation and assessment, which includes those problem areas identified as risks, is included in the narrative analysis and assigned one of the above ratings. The method(s) used to reach a decision as to what rating to assign is not specified and, therefore, varies among individual evaluators.

When the evaluation and rating of all factors and subfactors in an item are completed, the Item Captain summarizes the factor narratives, evaluates the ratings based upon proposal strengths, weaknesses, and risks, and assigns a numerical score to the item. Again, this single numerical score reflects an over-all evaluation of all factor narratives, including all strengths, weaknesses, and risks combined. As in the case of the Factor evaluators, there is no guidance which establishes a method, or methods to go about combining the factor ratings, so as to come up with a single numerical score for that item. As would be expected, there is wide variance in the methods used by Item Captains to derive the item score.

Area Co-Chairmen summarize item level write-ups, with primary emphasis on the significant strengths, weaknesses, and risks. These narrative highlights, along with the scores from the item level evaluations, provide additional back-up as necessary to defend the scores and narrative analyses of the SSEB report.

The SSAC then applies predetermined weighting criteria to the raw scores presented by the SSEB, as discussed in

Chapter IV. The significant strengths, weaknesses, and risks for each proposal are briefed in a similar manner throughout the Source Selection process up to and including the SSA.

Initial Risk Model Terms Explained

As a member of the SSEB on the developmental program discussed in the introduction to this chapter, it was necessary to improvise a procedure and model to evaluate the total risk associated with each contractor proposal. The terms used in the initial risk model were tailored to the Source Selection scope of interest. Specifically, the terms used were meant to apply to the primary areas of concern in evaluating proposals for hardware prototypes under the current DoD management philosophy discussed in Chapter III.

Risk Element - Any problem or potential problem associated with a contractor's engineering data (technical response to RFP) that creates a substantial degree of uncertainty relative to the proposed weapon system design meeting minimum operational requirements.

Risk Points - A quantitative measure used to represent the over-all degree of risk associated with a particular risk element. The more risk points a risk element has, the greater the over-all risk associated with it.

Sub-System - A major assembly of parts joined together to perform a specific key function necessary to the performance of the weapon system. For example, the aircraft in total is the weapon system. The aircraft engine, engine inlets, accessory drive and exhaust make up the propulsion sub-system. The electrical power, distribution, and switching make up the electrical sub-system, etc.

Critical Component - A part or particular group of parts within a sub-system which, by nature of its materials, design and/or fabrication, is essential for minimum acceptable performance of the sub-system. A critical component may directly affect the performance of other sub-systems and always, though indirectly, affects the performance of the over-all weapon system.

Minor Component - A part or particular group of parts within a sub-system which, by nature of its design and fabrication, affects only the performance level of the sub-system of which it is a part. Minor components are generally those parts which are supportive in nature to the primary functions of the sub-system, and for which a number of alternative solutions may exist.

Early Stage Development - Refers to a portion of the weapons system hardware that is in the developmental stages and has not been proven technically feasible. Use of this hardware on the weapon system as proposed depends upon successful testing to prove technical feasibility, final design configuration, fabrication and qualification testing in time and within proposed cost estimates.

Advanced Stage Development - Refers to a portion of the weapon system hardware that is in the developmental stages and has already been proven technically feasible. Use of this hardware on the weapon system as proposed depends upon final design configuration, fabrication, and qualification testing in time and within proposed cost estimates.

Major Re-Design - Refers to a significant portion of the weapon system hardware which must undergo extensive re-design in order to meet minimum technical design requirements of the weapon system. Major re-design is usually applied to situations that may require:

(1) Complete re-design of sub-system.

(2) A re-design effort on a particular sub-system which requires one or more other sub-systems to be re-designed.

(3) Any extensive re-design that may substantially change the basic design configuration of the proposed weapon system, such as wing and fuselage size, contral, surfaces, weights, structural integrity, etc.

Minor Re-Design - Refers to a portion of the weapon system hardware which must undergo re-design in order to meet minimum technical design requirements of the weapon system. Minor re-design is applicable to situations where the re-design is essential, but creates no serious interface problems in the basic aircraft design configuration. In addition, the re-design effort does not cause extensive re-design of the sub-system involved, nor does it cause re-design effort of any other sub-system.

Ground Rules for Initial Risk Model

Ground rules were established to purposefully limit the scope and depth of the initial risk analysis. This was necessary since the SSEB evaluation plan was geared to the evaluation/rating/scoring process described above, and time did not permit deviations from that plan by SSEB members other than the writer. The ground rules used were as follows:

(1) Primary emphasis was focused on technical and operations areas since these two areas provided the overwhelming majority of unique risks by contractor.

(2) A risk element was used as the basic parameter of the model and variable risk points were used to represent an over-all measure of risk associated with a particular risk element.

(3) Because of a significant lack of standardization in identifying risks, each sub-factor, factor, and item level narrative write-up was studied to determine whether or not a particular weakness should be included as a risk element. In a very few cases, the risks included in factors write-ups were not included as risk elements.

(4) When a particular risk was written up in several different factors and the effect of

that particular risk was the same in each factor, particular caution was used so as not to assess the impact of this risk element at double or triple its actual impact. For example, if the landing gear design did not meet specifications for rough field operations, it may be written up in both a technical and operations factor as a high risk of not being able to meet a particular operational requirement. This risk element would be included in the technical or operations factor, but not both.

(5) Every problem or potential problem (large or small) identified as a risk element was incorporated into the risk model. This insured that small but cummulatively important risk elements were not completely overlooked or overshadowed by the more obvious and important big risk elements.

(6) Risk assessment was limited to evaluating the impact of risk elements on the operational requirements of the system only. No attempt was made to assess the impact of risk elements on program schedules or cost estimates.

(7) No attempt was made to determine the

likelihood (probability) of success or failure of any particular risk element.

Ground rules number 6 and 7 were intentionally very restrictive in nature since it was infeasible to attempt more in the "first cut" at developing a risk assessment methodology and model for use in the SSEB evaluation process.

Risk Criteria for Initial Model

It was necessary to establish some criteria upon which to construct a risk model. Three independent characteristics common to any particular risk element were selected as the basis for evaluating its impact, or potential impact on the weapon system performance requirements:

(A) The nature of the risk element

(B) The corrective action upon which the risk element is dependent.

(C) The weapon system performance objective affected by the risk element.

The following paragraphs discuss these characteristics in some detail. It will be helpful to refer to Figure 14 in following the development of the risk model. In the initial risk analysis model discussed later, these characteristics will be referred to as characteristic A, B, and C according to the Alpha designators used above.

(A) The nature of the risk element was established by determining what specific hardware was involved in the technical problem area. In other words, since each technical problem identified as a risk element is related to some portion of the weapon system hardware, it is necessary to determine the nature of the risk element in terms of the extent of hardware affected. This was accomplished by dividing the weapon system hardware into three categories -- sub-system, critical component, minor component -- and then classifying the nature of the risk element by one of these three categories.

B. The corrective action upon which the risk element is dependent was intended as a measure of the degree of uncertainty, degree of difficulty, and level of effort required to correct the actual or potential problem. It is obvious that to accurately combine uncertainty, difficulty, and level of effort into a single parameter would require a systematic and rather involved evaluation and manipulation of several variables. Since time did not permit this type approach in the initial risk model, four categories were established to suffice as a broad measure of uncertainty, difficulty, and effort required. These four categories were: (1) Early stage development; (2) Advanced stage development; (3) Major re-design; and (4) Minor re-design. Each risk element of a contractor proposal was assigned one of the above categories of corrective action.

C. The weapon system objective affected by the risk element was a characteristic designed to measure the degree of impact a particular risk element may have on the primary objectives of the weapon system as stated in the RFP. This characteristic could not be evaluated by studying factor and item level write-ups, therefore another approach was utilized. A survey was conducted to gather data to be used for determining the direct impact that each SSEB factor had on the primary objectives of the weapon system as stated in the RFP. Since the factors are established as evaluation criteria tailored to the specific program being evaluated, this appeared to be a meaningful approach for this characteristic.

The primary objectives of the weapon system were listed in the RFP in order of importance, therefore each objective was arbitrarily assigned a number as a quantitative measure of its relative importance. The procedure used to accomplish this is described below.

If there are n primary objectives of the weapon system, X_i would represent the i^{th} objective, where

$$i = 1, 2, 3, \ldots, n-1, n.$$

The most important objective would be X_1, the second most important objective would be X_2, etc. The least important primary objective would be X_n. A quantitative measure of the relative importance of each primary objective was arbitrarily established by assigning numbers to each primary objective in the inverse order of their relative importance. That is, the most important primary objective, X_1, was assigned the number n. The second most important primary objective, X_2, was assigned the number $n-1$, etc., such that

Primary Objective	Measure of Importance
X_1	n
X_2	n - 1
.	.
.	.
.	.
X_{n-1}	n - (n-2)
X_n	n - (n-1)

This scheme would be satisfactory only if every technical problem identified as a risk element directly affected at least one of the primary objectives of the weapon system. In order to take into account those risk elements that may not be considered to directly affect at least one of the primary objectives of the weapon system, an n + 1 program objective called "OTHER" was added. This required that the most important primary objective be given a measure of importance of n + 1, the second most important primary objective a measure of importance of n, etc. This results in

Primary Objective	Measure of Importance
X_1	n + 1
X_2	n
X_3	n - 1
.	.
.	.
.	.
X_{n-1}	n - (n-3)
X_n	n - (n-2)
X_{n+1} "OTHER"	n - (n-1)

In plain English, this simply means that if there are five primary objectives, a sixth objective called "OTHER" is added to allow the system to account for risk elements that do not affect primary objectives, but whose cumulative impact should not be ignored. The most important primary objective would have six as a measure of importance, and so forth, and the "OTHER" objectives affected would have one as a measure of importance. The measure of importance numbers assigned to the program objectives were, therefore, inversely consistent with the priority of importance, and were used as a weighting factor in the risk model for this characteristic.

The survey, a sample of which is presented in Figure 13, was completed by 18 individuals highly qualified in the SSEB process and members of the SSEB for this particular program. There was generally marked similarity in many of the answers provided by respondents, but there were some factors where a consensus was not clear. To insure objectivity, the survey answers were tabulated and individually analyzed by a select group of individuals experienced in the SSEB process and this particular program. The results of this group's analysis of the answers made it possible to obtain a unanimous determination of the level of importance value for each factor. Table I shows an example of how the results of this survey were tabulated. The Measure of Importance Values correspond to the survey answers as analyzed and evaluated by the process described above. The Measure of Importance Values were used as weighting factors for this

Instructions: Beside each Factor below, mark the Measure of Importance Value corresponding to the most important primary objective affected by that Factor alone. If the Factor affects both X_2 and X_3, use the Measure of Importance Value for X_2, since it is more important than X_3.

PRIMARY OBJECTIVE AFFECTED	MEASURE OF IMPORTANCE VALUE
X_1	5
X_2	4
X_3	3
X_4	2
X_5 "OTHER"	1

Survey:

FACTOR	YOUR JUDGMENT OF HIGHEST PRIMARY OBJECTIVE DIRECTLY AFFECTED
T.1.1	3
T.1.2	1
T.1.3	5
.	.
.	.
.	.
T.2.1	4
T.2.2	5
.	.
.	.
.	.
.	.
.	.
T.5.1	2
.	.
.	.
.	.
.	.
O.1.1	5
O.1.2	2
O.2.1	4
.	.
.	.
.	.
.	.

Figure 13. Survey for Factor Impact on Primary Objectives of Weapon System

TABLE I

RESULTS OF FACTOR/OBJECTIVE AFFECTED SURVEY

Area	Technical T.0																			Operations O.0							
Item	T.1				T.2					T.3			T.4					T.5		O.1		O.2			O.3		
Factor	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3	4	5	1	2	1	2	1	2	3	1	2	3
Measure of Importance Value	5	2	4	1	3	3	1	5	4	5	2	1	3	5	5	4	1	2	1	5	4	2	5	5	3	4	2

characteristic. The method of relating the weighting factor to each individual risk element will be discussed in the next section.

Initial Risk Model Weighting Criteria

Weighting factors for the three independent characteristics were established in the following manner:

A. Nature of the Risk Element -- To each division of weapon system hardware which was used to classify the nature of the risk element, an arbitrary numerical weighting factor was assigned:

	Weight
Sub-System	5
Critical Component	3
Minor Component	1

B. Corrective Action risk element dependent upon -- To each of the four categories established to provide a broad measure of the degree of uncertainty, degree of difficulty and levels of effort involved in correcting the risk element, an arbitrary numerical weighting factor was assigned.

	Weight
Early Stage Development . . .	10
Advanced Stage Development . .	5
Major Re-design	3
Minor Re-design	1

C. Program Objective affected by risk element -- In order to use the weighting factors (established by evaluation of the survey answers by 18 respondents, discussed in the preceding section), it was necessary to relate them to each risk element. This was accomplished by recording each risk element by factor and using the results of the survey to establish the weighting factor. That is, all of the risk elements for a particular proposal were recorded under the Factor in which it was written up. An example of how the weighting factor was determined for each risk element is as follows. If the risk element was written up in Factor T.1.3, the weighting factor assigned to the "program objective affected" characteristic for this risk element was determined by referring to Table I. For this risk element, the weighting factor for this characteristic would be four.

Figure 14 shows the process used in developing the initial risk model. It is important to note that the key to relating risk elements to the specific primary objectives affected by them was accomplished by identifying the factor in which the risk element occurred. It is the factor that has direct impact on the primary program objectives, which are operational requirements oriented.

Methodology for Applying Initial Risk Model

The evaluation process began by carefully reviewing every factor and sub-factor write-up (on a particular contractor proposal) in the technical and operations area to determine what should be identified as a risk element in accordance with the ground rules established for this risk

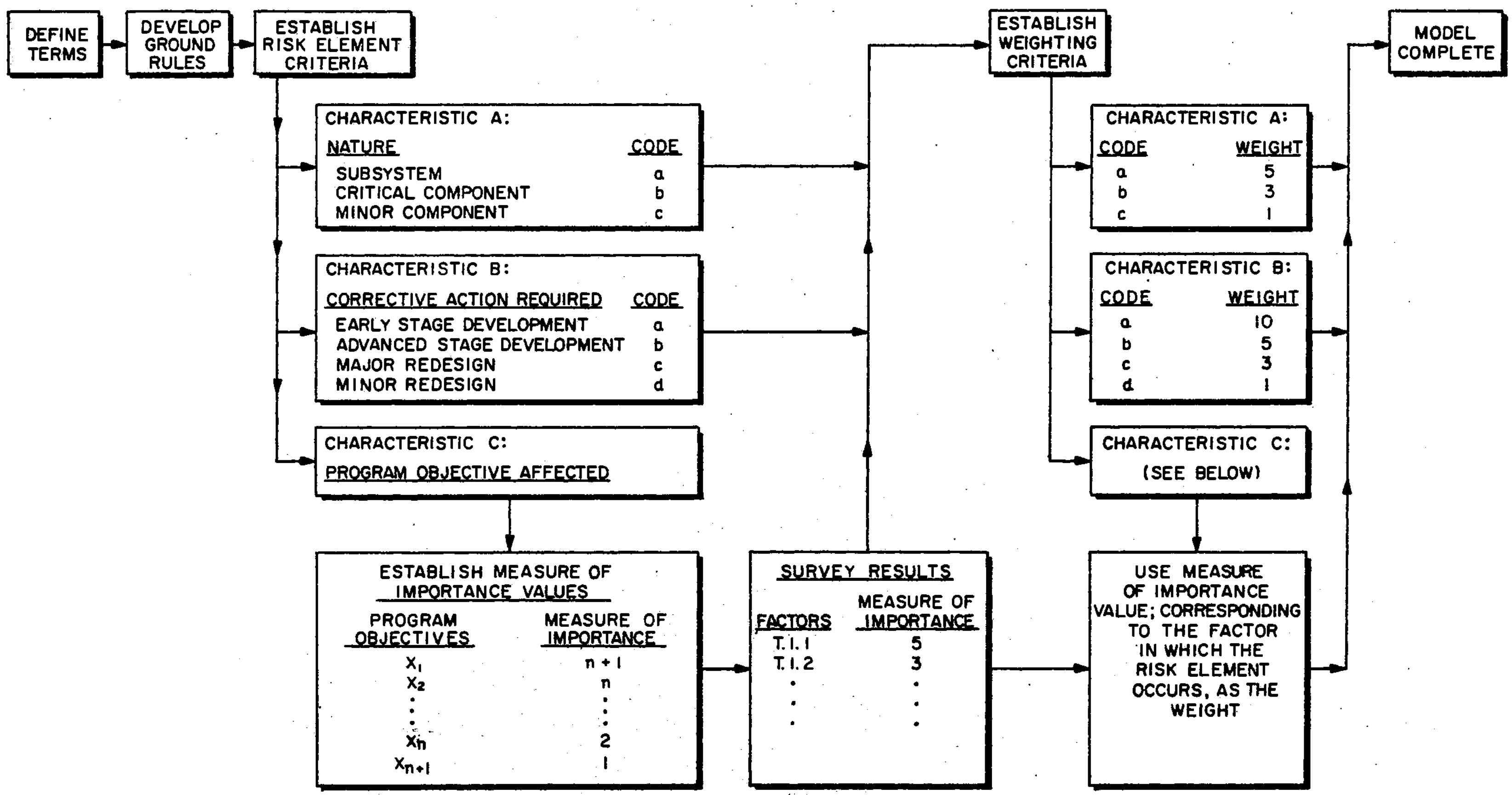


Figure 14. Development of Risk Model

analysis effort. This study effort included a careful review of the detailed narrative analysis for each weakness and risk itemized by the factor evaluator in his summary. In addition, the narrative analysis and summary of each item level write-up was reviewed. It was found that the item level write-ups only served to condense the factor level write-ups and did not add information useful to this risk analysis. For this reason, the factor level write-ups were used exclusively in this risk analysis effort.

A systematic procedure was developed to insure a comprehensive and objective evaluation of those risk elements identified in a particular contractor proposal. Figure 15 shows a sample of the Risk Analysis Worksheet that was developed to assist in this evaluation process. Figure 16 shows a sequential flow of the process used to develop the risk points by applying the initial risk model according to the following steps. In the following discussion of the procedural steps used, the reader will find it helpful to frequently refer to Figures 15 and 16.

STEP 1. -- Review a factor write-up. When a risk element is identified, record it sequentially by risk element number and write a brief narrative on the worksheet.

STEP 2. -- By studying the factor narrative, determine the proper characteristic code for Characteristics A and B relative to the risk element in question and place the selected codes in the appropriate block corresponding to the factor involved. The Characteristic A code is placed in the

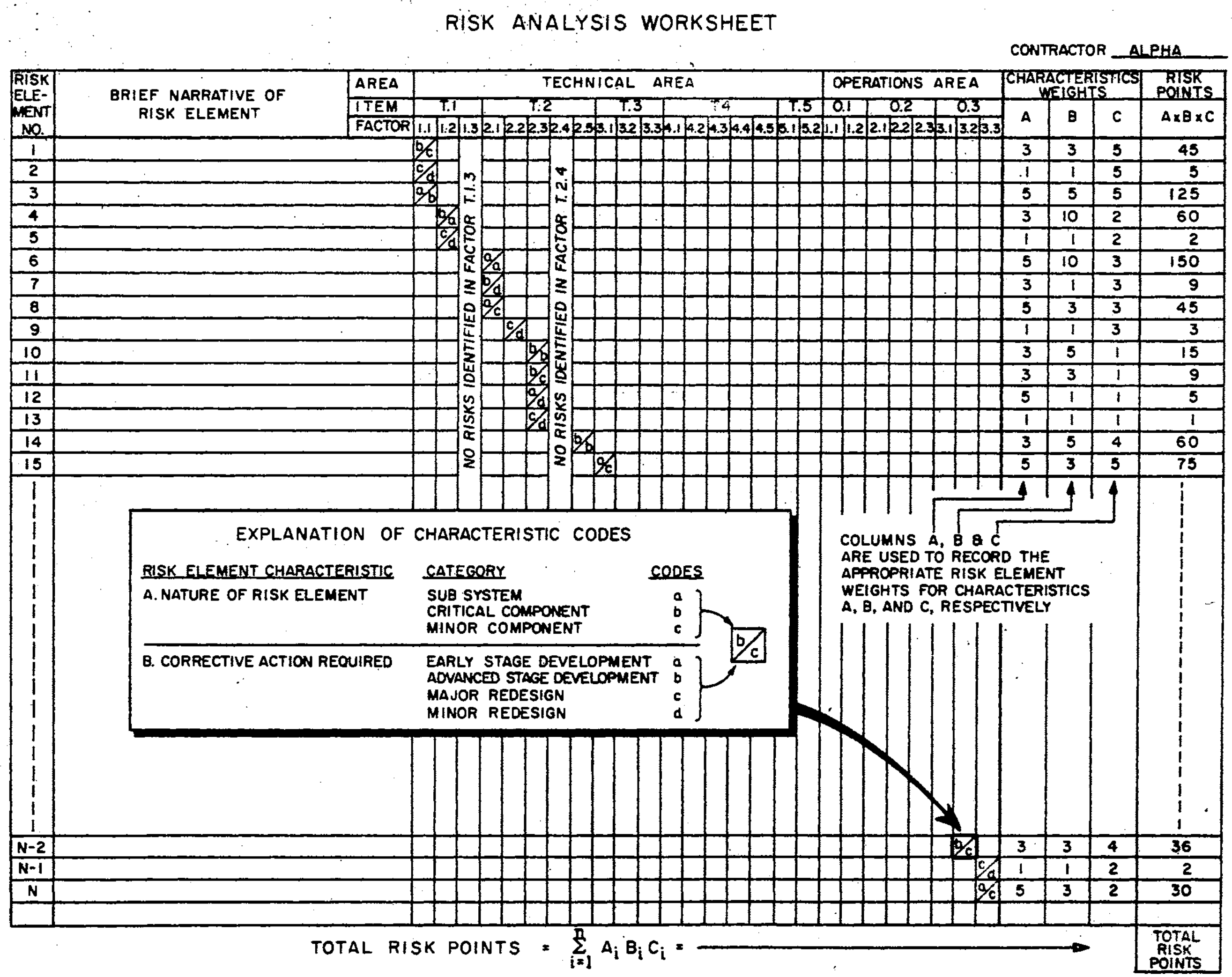


Figure 15. Risk Analysis Worksheet

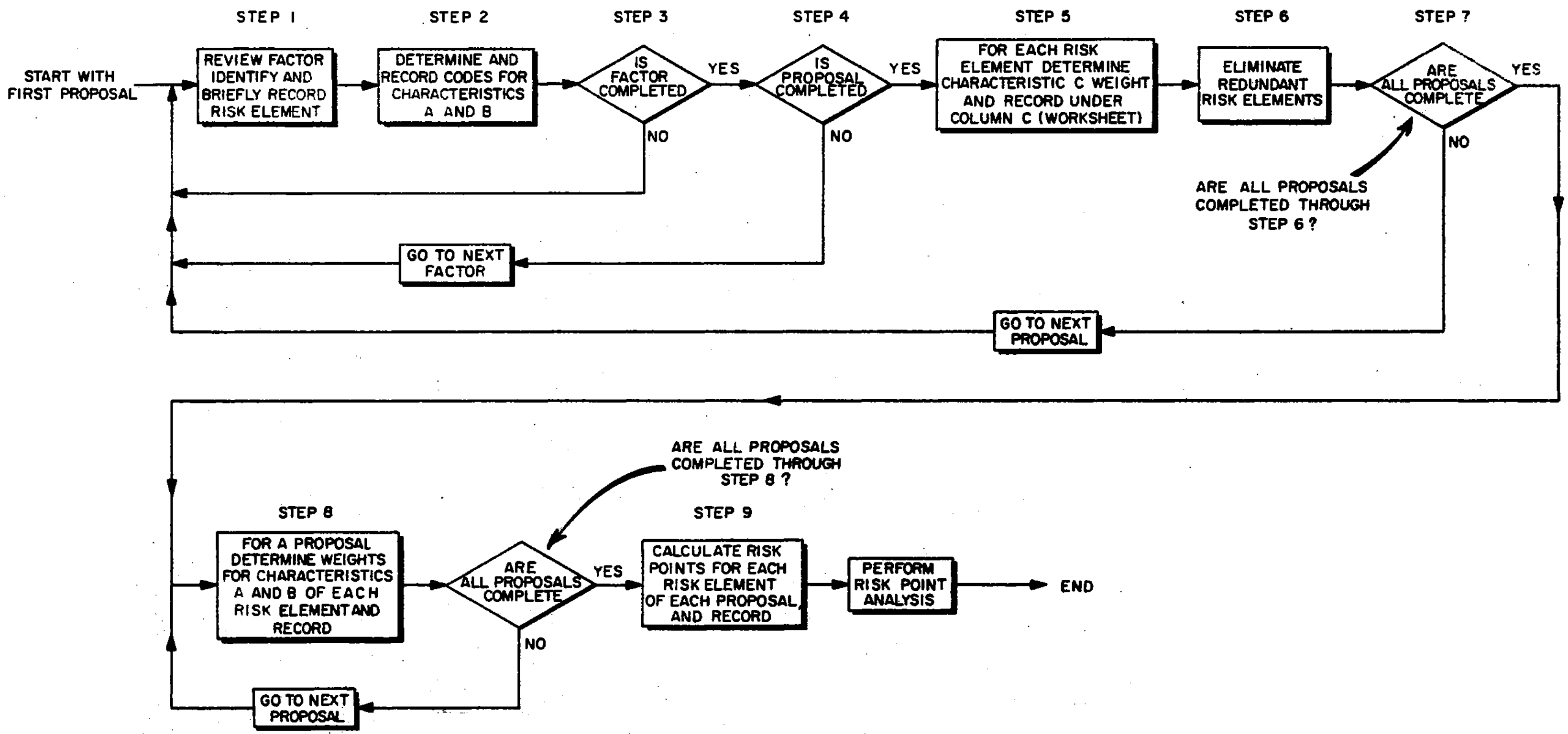


Figure 16. Applying Initial Risk Model

upper left corner and the Characteristic B code in the lower right.

STEP 3. -- Repeat Steps 1 and 2 until all the risk elements in a factor are entered on the worksheet.

STEP 4. -- Repeat Steps 1, 2, and 3 until all the risk elements in each factor are entered on the worksheet.

STEP 5. -- Begin with Risk Element Number 1 on the worksheet and place the appropriate weight under Column C. The appropriate weight is determined by noting the factor in which the risk element appears and using Table I. The numerical value of the "Level of Importance Value" in Table I will be used as the weight value. Using this procedure, find the appropriate weight of characteristic C for each Risk Element Number (1, 2, ..., n-1, n).

STEP 6. -- Review the risk element narratives on the worksheet and determine which risk elements may be redundant. This may require additional review of factor narratives. Redundancy occurs when the same identical risk element appears in two or more factors. In checking for redundancy, the categories (characteristic codes) of characteristics A and B must be compared. If they differ, particular caution should be exercised in stating redundancy. When redundancy exists, eliminate the redundant risk element by lining out that entire row, noting the risk element number that eliminated it. Retain the risk element row that contains the highest product of characteristic weights (A, B, and C). The risk element to be retained, in case of redundancy is usually determined by the Characteristic C weight.

STEP 7. -- Repeat Steps 1 through 6 for each contractor proposal.

STEP 8. -- Starting with Risk Element Number 1 on a contractor worksheet place the appropriate characteristic weights in columns A and B. This is done by finding the weight which corresponds to the characteristic codes for that risk element. Repeat for each risk element number on the worksheet not lined out. Weights for the Characteristic Codes are as follows:

	Codes	Weights
Characteristic A:	a	5
	b	3
	c	1
Characteristic B:	a	10
	b	5
	c	3
	d	1

Repeat this step on each contractor worksheet.

STEP 9. -- Risk points for each individual risk element are obtained by multiplying the characteristic weights associated with a particular risk element. That is, for Risk Element Number 1, multiply

$$3 \times 3 \times 5 = 45 \text{ Risk Points.}$$

Accomplish this multiplication on each risk element on each contractor worksheet.

STEP 10. -- Total risk points for each contractor proposal are found by summing the products obtained in Step 9. A very straight forward analysis of the Risk Analysis Worksheets will yield risk point summaries at any level desired. The worksheets themselves provide a separate look at risk points by contractor/by individual risk element. Table II shows a sample summary of risk points by Contractor/ by Item/by Factor, which can be extracted directly from the worksheets. Table III shows a sample summary of risk points by Contractor/by Area.

Summary

At present, there is no established methodology or procedure being used in ASD to quantitatively measure and assess the total risk associated with contractor proposals evaluated in the SSEB process. The method of analysis of a particular risk in the current SSEB process varies from one evaluator to another and are, for the most part, evaluated qualitatively and individually. The strengths, weaknesses, and risks of a contractor proposal are combined into one of three rating symbols at the factor level, and are combined into one numerical score at the item level. SSAC members are frequently not aware of the particular techniques used by SSEB factor and item evaluators to combine strengths, weaknesses, and risks into a single rating/score. They must, therefore, rely heavily on the summarized narratives presented

TABLE II

TOTAL RISK POINTS BY CONTRACTOR/BY ITEM/BY FACTOR

ITEM	FACTORS \ CONTRACTORS	A	B	C	D	E
T.1	AEROMECHANICS	430	225	600	175	800
	1.1 AIRCRAFT PERFORMANCE	125	75	300	0	430
	1.2 AERODYNAMICS	215	50	150	80	100
	1.3 STABILITY AND CONTROL	90	100	150	95	270
T.2	AIRFRAME	275	370	392	292	185
	2.1 WEIGHT AND BALANCE	35	130	22	37	75
	2.2 FLIGHT CONTROLS	125	165	200	150	110
	2.3 LANDING GEAR	15	75	172	105	0
T.3	PROPULSION & SECONDARY POWER					
	ETC.					

TABLE III

TOTAL RISK POINTS BY CONTRACTOR/BY AREA

CONTRACTORS	A	B	C	D	E
TECHNICAL AREA	1745	916	1175	537	1376
OPERATIONS AREA	546	215	492	325	820
TOTAL RISK POINTS	2291	1131	1631	862	2196

by the SSEB to objectively analyze and evaluate the results of the SSEB evaluation. When satisfied with the item level numerical score, which represents a combined figure of merit for strengths, weaknesses, and risks, the SSAC applies the weighting criteria to these scores.

The approach used by the writer to assess the over-all risk associated with contractor proposals was, of necessity, conducted completely independent of the normal SSEB scoring process. The risk model developed did not utilize any of the current rating/scoring methods, nor did it utilize the actual ratings and scores established by the evaluators for this program. Risk elements, derived from factor narratives describing proposal weaknesses and risks, were used as the basic input to the risk model. The risk elements were of a technical nature as they related to design and development of weapons system hardware. The output of the model provided total risk points associated with each contractor proposal. These risk points served as a quantitative measure of the over-all technological risk to the program relative to primary operational objectives. The shortcomings of this initial approach to risk assessment in the SSEB process are numerous. On the other hand, the model demonstrated that a cumulative measure of over-all risk associated with a contractor proposal is feasible. The results of this initial risk model showed a spread of approximately 1000 risk points between the least risk and highest risk proposal. The least risk proposal had approximately 700 total risk points and highest risk proposal had approximately 1700 total risk points. The proposal with the next to least total risk points had a total of approximately 950, which was approximately 250 less than the next competitor. The results of the model demonstrated that an integrated risk assessment/ scoring model could be developed and implemented to assist the SSAC in its over-all analysis and evaluation. One major advantage of the model and approach was that it provided the capability to easily retrace the risk analysis and resultant score back to the detailed evaluation at the factor level. The strengths and shortcomings of the initial risk model and methodology will be discussed in detail in Chapter VIII, in which a more comprehensive SSEB risk assessment methodology and model is developed.

CHAPTER VI

SOURCE SELECTION QUESTIONNAIRE

Introduction

While a member of the SSEB for the developmental program mentioned in Chapter V, the writer prepared and distributed a Source Selection questionnaire to 69 individuals experienced in the Source Selection process within ASD. To insure that those receiving the questionnaire were well qualified and represented a good cross-section of experience in the Source Selection process, the office of the Deputy for Systems Management at ASD provided the names of individuals to receive the questionnaire. In addition, the Technical Director for Weapons Systems in the Systems Management Directorate accomplished the distribution and retrieval of the questionnaires. The letter requesting distribution of the questionnaire, the cover letter for distribution, and the Source Selection questionnaire are included in Appendix A.

The purpose of the Source Selection questionnaire was to:

(1) Obtain data which would permit an objective analysis and assessment of the adequacy of the

present rating/scoring system used in the SSEB evaluation process at ASD.

(2) Obtain data which would permit an objective analysis and assessment of the affects that two specific aspects of the current DoD management philosophy have on the SSEB evaluation process.

The two specific aspects of the current DoD management philosophy involved are the "minimum documentation" and "prototype hardware development" concepts. Forty-four respondents completed and returned the questionnaire. A detailed analysis of respondents' answers to the questionnaire is provided in Appendix B.

The purpose of this chapter is to evaluate the analyses in Appendix B and present the major findings relative to the adequacy of the current Source Selection rating/scoring system, and the effects of minimum documentation and prototype hardware development on the SSEB technical evaluation. The chapter is divided into four major sections. The first section includes a discussion of the applicability and suitability of the questionnaire, the adequacy of the sample size, and the qualifications of the respondents to provide answers upon which conclusions and recommendations could be based. In addition, experience weighting factors are developed for use in evaluating respondent answers to the questionnaire. The second section includes an evaluation and discussion of the adequacy of the present rating/scoring system. This section also includes an evaluation and discussion of the interaction between technical and cost personnel, as related to risk analysis in the SSEB evaluation process. The third section evaluates and discusses the effects of current DoD management philosophy on the SSEB technical evaluation. The fourth section presents an overall summary of the combined effects of the major findings on the Source Selection process.

Question Number 6 of the Source Selection questionnaire was designed to obtain information which would permit an evaluation of what actually constitutes minimum documentation on prototype hardware development programs. The answers given by respondents were excellent, but they could not be analyzed or evaluated in any meaningful way. Therefore, no discussion on Question Number 6 will be presented in this chapter. The interested reader may review the most frequent and best substantiated respondent answers to Question Number 6 in Appendix B.

The major sections of this chapter include an evaluation of the analyses of respondent answers to the Source Selection questionnaire, contained in Appendix B. As each major question is addressed in this chapter, the interested reader may refer to the analyses of that specific question in Appendix B.

Validity of Questionnaire and Respondent Qualifications

The questionnaire was developed by the writer near the end of the SSEB participation mentioned in Chapter V. It was coordinated with approximately fifteen members of that SSEB effort, including the Chairman, two Co-Chairmen, several Item Captains and Factor members. After making several changes based upon recommendations from these SSEB members, the questionnaire was submitted to the Technical Director for Weapons Systems, Directorate of Systems Management, for distribution. Prior to making distribution, the Technical Director coordinated the questionnaire with several key members of the ASD staff to insure that the questionnaire was acceptable and useful. Based upon the coordinated approval for distribution, it is assumed that the questionnaire is satisfactory from the standpoint of design, information desired, and applicability and suitability for its intended purpose.

The acceptability and suitability of the respondents as being a representative sample of highly qualified individuals experienced in the Source Selection activities at ASD was validated by the analysis of Question Number 1 of the questionnaire. (See pages 253 to 261, Appendix B). The size of the sample of respondents (44) is considered to be sufficiently large since it was of primary importance to obtain answers from respondents considered by ASD to be most qualified. Discussions with key ASD personnel revealed that the number and functional levels of the respondents represent a very satisfactory cross-section of the personnel best qualified in Source Selection activities at ASD. The number of Item Captains and Factor members, although comparatively small, is considered adequate in view of the relatively few individuals who have had recent experience with prototype hardware development and the minimum documentation concept. The original target for the total number of respondents was fifty, six more than actually achieved. Ideally, six additional respondents would have provided a more balanced sample only if they had consisted of four more factor level and two more item level respondents. However, the total of 44 respondents, and their functional level distribution provide a very satisfactory sample.

1. Years Experience of Respondents

Taken as a group, the respondents averaged 10.72 years experience in Source Selection related activities. Thirteen respondents had five years or less experience, and 15 respondents had from 11 to 31 years experience. In the 11 to 31 years experience group, eleven respondents had from 16 to 31 years experience.

2. Years Experience by Highest Functional Level

The respondents were categorized by the highest functional level in which they had served, where functional levels are described as SSAC, SSEB Chairman, SSEB Co-Chairman, SSEB Item Captain, SSEB Factor Member, and Cost to the Government. Of the 44 respondents, 13 had served as

SSAC members, 8 as SSEB Chairman, 12 as SSEB Co-Chairman, 6 as SSEB Item Captain, 4 as SSEB Factor Member, and 1 as Cost to Government team member. Table IV shows the years experience by highest functional levels. The average years experience for all respondents would have been considerably higher than 10.72 had the average years experience of the eight chairmen been equal to any of the other functional levels. The reason for the relatively low average years experience in Source Selection by SSEB chairman is most likely that they are usually senior military officers with primarily staff, operational and support experience, and who are presently assigned as the SPO Director.

TABLE IV

YEARS EXPERIENCE BY HIGHEST FUNCTIONAL LEVEL

Functional Level	Number of Respondents	Average Years
SSAC	13	10.85
Chairman	8	4.0
Co-Chairman	12	13.41
Item Captain	6	14.32
Factor Member	4	10.75
Cost to Government	1	6.0

3. Experience in Source Selection Activities

Next, the experience level of the respondents was analyzed relative to the number of times that the respondents had actually performed some functional activity on a source selection. Taken as an entire group, the respondents had performed 235 source selection activities at various functional levels. This does not mean that 235 different source selections had been performed by the respondents. Rather, that the combined activities of all 44 respondents totaled 235 separate functional level activities. Table XXXV (in Appendix B) provides a comprehensive analysis of these 235 activities by functional level and by the respondent groups which performed them. The respondent groups were determined by segregating the respondents by the highest functional level in which they had served. In other words, if a respondent had served twice as a factor member, three times as a co-chairman, and once as a member of the SSAC, he would be included in the SSAC "highest functional level group". Using this analysis, a respondent group would be considered best qualified if the percentage of the total (235) activities performed by that group is equal to or greater than any other groups. That is, the group which has performed the highest percentage of the total number of activities is considered to be the most qualified group. The group that has performed the least percentage of the total number of activities is considered to be the least qualified group. Individual respondents within a respondent group are considered to be best qualified in any particular functional level if the average number of functional level activities per respondent exceeds the average number of functional level activities performed by individual respondents of other groups.

The 13 SSAC respondents accounted for 42.5% (100) of the total 235 Source Selection activities performed by all the respondents. Fifty of these 100 activities performed by the SSAC respondents were SSAC functional level activities. The remaining 50 were distributed across the other functional levels such that the SSAC members were individually most qualified in the SSAC and Contract Definition functional levels, second most qualified in the SSEB Chairman, Co-Chairman, Item Captain, and Cost to Government functional levels, and third most qualified in the Factor Member functional level.

The analysis showed that the highest functional level groups of respondents were best qualified in each of their respective functional levels. That is, the SSAC group was best qualified in the SSAC functional level, the SSEB chairman group was best qualified in the Chairman Functional level, etc. There were two minor exceptions to this. The first was a tie between the SSAC and Item Captain groups for the highest percentage of total activities performed in the Item functional level. The second was in the Cost to Government functional level, where the SSEB Co-Chairman group performed 67% of the total number of Cost to

Government functional activities.

The analysis also showed that individual respondents within highest functional level groups were best qualified in their respective functional levels. That is, the 13 individual respondents in the SSAC group averaged 3.85 SSAC functional level activities, the other groups zero. The eight individual respondents in the SSEB Chairman group averaged 1.75 Chairman functional level activities, while the only other group (SSAC) performing in the Chairman functional level averaged .46 activities per respondent. The 12 individual respondents in the SSEB Co-Chairman group averaged 3.0 Co-Chairman functional level activities, while the next most qualified individuals, by group, was an average of .54 by the SSAC members, etc.

The significance of the above findings is that it is possible to establish credible "experience weighting factors" by combining these data. An experience weighting factor was needed in order to improve the accuracy of and confidence in the findings resulting from the evaluation of respondent answers to the questionnaire. The experience in actual source selection activities is considered by the writer to be a more valid measure of respondent qualification in the Source Selection process than the number of years experience in source selection related work. Assuming this to be a correct assumption, the following rationale should be acceptable to the reader.

4. Establishment of Experience Weighting Factors

The individual respondents in each highest functional level group were best qualified in their respective functional level, based upon a higher average number of activities per respondent. This supports using the procedure which categorizes respondents by highest functional level as the primary technique for evaluating the questionnaire answers. The logic behind this is that by categorizing respondent answers to questions by highest functional level groups, you obtain an analysis of answers provided by respondents in the functional level where they are individually best qualified to answer.

A measure of the over-all experience of each group of respondents, by highest functional level, is obtained directly from the percentage of the grand total (235) of source selection activities performed by each group. This measure of over-all experience will be referred to as the Over-all Experience Rating. Table V shows the Over-all Experience Rating of each highest functional level group, expressed in an absolute value corresponding to the percentages in the right-hand column of Table XXXV (in Appendix B).

To determine the experience weighting factors for each highest functional level group, the Over-all Experience Rating is divided by the actual number of respondents in each group. This results in weighting factor which can be used for individual respondents within each highest functional level group. The results of these calculations are shown in Table VI.

TABLE V

OVER-ALL EXPERIENCE RATING BY HIGHEST FUNCTIONAL LEVEL

Highest Functional Level	Over-all Experience Rating
SSAC	42.5
SSEB Chairman	9.8
SSEB Co-Chairman	25.0
SSEB Item Captain	11.1
SSEB Factor Member	10.6
SSEB Cost to Government	1.0

TABLE VI

EXPERIENCE WEIGHTING FACTORS BY HIGHEST FUNCTIONAL LEVEL

Highest Functional Level	Experience Weighting Factor
SSAC	3.27
SSEB Chairman	1.22
SSEB Co-Chairman	2.08
SSEB Item Captain	1.85
SSEB Factor Member	2.65
SSEB Cost Team Member	1.00

The experience weighting factors will be used in the following manner. Respondent answers to questions are categorized by highest functional level group in the analysis in Appendix B. The total number of respondents in a highest functional level group selecting a particular answer will be multiplied by the appropriate Experience Weighting Factor for that group. The product of these values will be called the "Adjusted Score". By using this procedure, the value of each respondents answer, relative to a measure of experience, will be weighted into the evaluation. The sum of the Adjusted Scores for each functional level group will be referred to as the Total Adjusted Score for each particular answer to the questionnaire.

Evaluation of Present Rating/Scoring System

Questions 4 and 7 of the Source Selection questionnaire are addressed to the problem of assessing the adequacy of the rating/scoring system presently being used in the Source Selection process at ASD. Question 5 of the Source Selection questionnaire addresses the problem of assessing the adequacy of the interaction between technical and cost personnel during the SSEB evaluation process. The emphasis here is to assess the need for greater interaction between these two disciplines so as to integrate technical considerations into the cost estimates and cost risks of contractor proposals.

1. Evaluation of Question Number Four

a. Respondents by Highest Functional Level

In Question 4, the respondents were asked if the scoring process at the Item/Factor level should be modified, and to state the reasons for their answer. Twenty-eight (63.7%) of the 44 respondents stated that the scoring system should be modified and 13 (29.5%) of the respondents stated that the system should not be modified. Table VII shows the breakout of respondent answers by highest functional level.

It is interesting to note that a strong majority of respondents in the SSAC, Chairman, Item, and Factor groups stated that the scoring system should be modified. Those majorities were 77%, 75%, 83.4%, and 100%, respectively. The four factor members were unanimous in favor of modifications. Only 25% of the Co-Chairman group stated that the system should be modified, while 66.6% stated that the system should not be modified. Eight (61.5%) of the 13 respondents stating that the system should not be modified were members of the Co-Chairman group. The analysis below indicates strong support for modifying the scoring system, with the only functional level group opposing modification being the Co-Chairman.

Applying the Experience Weighting Factors in Table VII results in Adjusted Scores for each functional group. The sum of these Adjusted Scores is called the Total Adjusted Score. The results of this exercise is shown in Table VIII.

The Total Adjusted Score, which reflects the experience level of respondents, shows strong support for modifying the present scoring system.

TABLE VII

ADEQUACY OF SCORING SYSTEM

Answer	Total Respondents	Highest Functional Level					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
	44	13	8	12	6	4	1
Should be Modified	28	10	6	3	5	4	0
Should Not be Modified	13	3	1	8	1	0	0

TABLE VIII

ADEQUACY OF SCORING SYSTEM - WEIGHTING FACTORS APPLIED

Answer	Total Adjusted Score	Adjusted Scores					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
Should be Modified	66.1	32.7	7.3	6.2	9.3	10.6	0
Should Not be Modified	29.6	9.8	1.2	16.7	1.9	0	0

Twelve of the 13 respondents stating that the present system should not be modified also stated that the present system is adequate and preferred. None of the respondents stated that the present system is absolutely superior. Those respondents stating that the present system should be modified checked the reasons listed in Table IX. The reasons are listed in the order of relative importance, determined by the frequency that they were cited by respondents. Under the "Total Respondents" column, the percentage of the total (44) respondents selecting a particular answer is provided, along with the total adjusted score determined by applying the experience weighting factors. Under "Highest Functional Level", the percentage of the respondents in each functional level group that selected a particular answer is provided. The "other reasons" given by the respondents are not included in Table IX.

It is important to note that the order of relative importance of the reasons is the same when listed by the Total Adjusted Score. Reasons 2, 3, 4, and 5 are, however, approximately equal in relative importance. Reason number 8 is not considered to be significant, primarily since it is contradictory to reason number 5.

Table X shows the order of relative importance of the eight reasons in Table IX according to each functional level. Based upon incremental steps required to re-order the "functional group" reasons to correspond to the order established by the total respondents, the SSAC group would

TABLE IX

REASONS FOR MODIFYING PRESENT SCORING SYSTEM

Reasons	Total Respondents %	Total Adjusted Score	Highest Functional Level SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. Present system tends to force scores to average	36.4	35.0	38.5	62.5	25.0	33.3	25.0
2. Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as standards	22.7	23.4	23.0	12.5	16.7	50.0	25.0
3. Scoring and weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system	20.4	23.3	33.3	12.5	0	33.3	50.0
4. Technical risk too difficult to integrate into score	20.4	21.0	23.0	25.0	16.7	16.6	25.0
5. More definitive ranking/scoring of proposals needed at factor level	20.4	20.5	23.0	25.0	0	50.0	25.0
6. Present system tends to compromise the motivation for professional excellence in the evaluator	13.6	14.4	7.7	12.5	0	16.6	75.0
7. Upward flow of evaluation information is constrained	11.4	14.2	15.4	12.5	8.4	16.6	0
8. Less definitive ranking/scoring of proposals needed at factor level	4.5	5.4	7.7	0	8.4	0	0

require only 2, the Chairman group 8, the Item Captain group 8, The Factor member group 12, and the Co-Chairman group 14. This simply indicates that the SSAC group appears to be most representative of the respondent group taken as a whole, while the Co-Chairman group appears to be least representative. It is interesting to note that the Factor Member group strongly feels that the system compromises the professionalism of the evaluator. This appears to be significant since they should be, in reality, best qualified to determine that affect.

TABLE X

IMPORTANCE OF REASON BY FUNCTIONAL LEVEL

Total Respondents	SSAC	Chairman	Co-Chairman	Item	Factor
1	1	1	1	2	6
2	3	4	2	5	3
3	2	5	4	1	1
4	4	2	7	3	2
5	5	3	8	4	4
6	6	6	3	6	5
7	7	7	5	7	7
8	8	8	6	8	8

When the "other reasons", given by respondents to support a position to modify the scoring system, are included in the evaluation the results are essentially the same. The reason this evaluation was conducted separately is because it was necessary to use judgment in interpreting the meaning and intent of the respondent narratives. The interested reader may refer to page 279 of Appendix B to assess the validity of the writer's judgment. Table XI shows the results on combining the results in Table IX with the "other reasons" given in support of modifying the present scoring system. The numbers in parenthesis represent the order of the reasons established in Table IX. The only significant change is that the reason "more definitive ranking/scoring needed at factor level" moved from fifth to second place in the order of relative importance. Again, the Total Adjusted Score did not change the order of relative importance. The first seven reasons are considered to be the significant factors which support the need to modify the scoring system. Reasons 1, 2, and 3 appear to be most important, reasons 4 and 5 of secondary importance, and reasons 6 and 7 of tertiary importance. Strong support for reasons 2, 3, and 4 exists in the SSAC and SSEB working levels, even though all three reasons clearly propose actions that are contrary to current procedures and practices.

Based upon the order of the reasons given by the functional level groups, the SSAC is again most representative of the total respondents, while the Co-Chairman group appears to be least representative. Considering the percentage of respondents in each group stating the significant

TABLE XI

REASONS FOR MODIFYING PRESENT SCORING SYSTEM - INCLUDING "OTHER REASONS"

	Reasons	Total Respondents %	Total Respondents Total Adjusted Score	Highest Functional Level SSAC %	Highest Functional Level Chairman %	Highest Functional Level Co-Chairman %	Highest Functional Level Item %	Highest Functional Level Factor %
(1)	1. Present system tends to force scores to average	36.4	35.0	38.5	62.5	25.0	33.3	25.0
(5)	2. More definitive ranking/scoring of proposals needed at factor level	34.1	34.2	38.5	50.0	8.3	50.0	50.0
(2)	3. Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as standards	29.5	29.8	30.8	25.0	16.7	66.6	25.0
(3)	4. Scoring and weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system	22.8	25.1	30.8	12.5	0	50.0	50.0
(4)	5. Technical risk too difficult to integrate into score	22.8	24.3	30.8	25.0	16.7	16.7	25.0
(6)	6. Present system tends to compromise the motivation for professional excellence in the evaluator	13.6	14.4	7.7	12.5	0	16.7	75.0
(7)	7. Upward flow of evaluation information constrained	13.6	12.9	15.4	25.0	8.3	16.7	0
(8)	8. Less definitive ranking/scoring of proposals needed at factor level	6.8	8.6	15.4	0	8.3	0	0
	9. CI's and DR's results should be integrated into score	6.8	6.4	7.7	12.5	0	16.7	0
	10. Difficult to establish evaluation criteria so as to achieve meaningful scores	4.5	4.2	0	0	16.7	0	0

reasons, the Co-Chairman group again appears to be least representative of the total respondents.

b. Respondents by SSAC or SSEB

Of the total (44) respondents, 13 were SSAC members and 31 were SSEB members. A comparison of the respondent answers to question 4 by SSAC and SSEB membership revealed that the two groups were very similar in every respect, as shown in Table XLVI (Appendix B). This finding tends to support a conclusion that the SSEB members, when taken as a group, evaluate the present scoring system generally the same as do SSAC members taken as a group.

c. Respondents by Years Experience Level

The respondent answers to question 4 were analyzed by the experience level of the respondents, in terms of years, in Table XLVII (Appendix B). There was a significant trend toward acceptance of the present scoring system as the experience level of the respondents increased, in terms of years. Of the 13 respondents with five years or less experience, 84.8% stated that the present scoring system should be modified. Of the 15 respondents with 11 to 31 years experience, 53.3% stated that the scoring system should be modified. None of the five years or less group stated that the present system was adequate and preferred, while 46.7% of the 11-31 year group stated that it was adequate and preferred. Table XII shows the difference in the adequacy of the present scoring system as judged by groups of different "years experience" levels. The numbers under "Experience Level" are the percentages of respondents answering in each experience group. The number under "Total Respondents Answering" is the total number of respondents selecting that answer. Of the 28 respondents that stated the system should be modified, 39%, 32%, and 29% were from the groups in increasing experience levels, respectively. Of the 13 respondents that stated the system should not be modified, 8%, 38%, and 54% were from those groups in increasing experience levels, respectively.

TABLE XII

ADEQUACY OF SCORING SYSTEM BY YEARS EXPERIENCE

Answer	Experience Level			
	5 yrs or less (13 respondents)	6 to 10 yrs (16 respondents)	11 to 31 yrs (15 respondents)	Total Respondents Answering
Scoring system should be modified	84.8	56.2	53.3	28
Scoring system should not be modified	7.7	31.2	46.7	13
Present system adequate and preferred	0	31.2	46.7	12
Present system is superior	0	0	0	0

The reasons given by respondents for supporting the position to modify the scoring system are given in Table XIII, by years experience. The "other reasons" given by respondents are not included, therefore the results of Table IX are used for comparison. Only the order of relative importance of reasons given is shown for the three experience level groups.

Based upon incremental steps required to re-order the reasons listed by years experience groups to correspond to the order of importance of the reasons established by the total respondents, the "5 years or less" group would require 6 steps, the 6 to 10 year group 12 steps, and the 11 to 31 years group 14 steps. This surprisingly indicates that the group with the least experience appears to be most representative of the respondent group taken as a whole, while the group most experienced is least representative.

d. Summary of Findings on Question Number Four

The following is a discussion of the major findings as a result of the analysis and evaluation of respondent answers to question number 4 of the Source Selection questionnaire.

(1) Present scoring system should be modified.

(2) The major reasons that the scoring system should be modified are listed below in the order of relative importance:

TABLE XIII

REASONS FOR MODIFYING SCORING SYSTEM - BY YEARS EXPERIENCE

Reasons Given by Total Respondents in the Order of Their Relative Importance	Order of Importance Given By		
	5 yrs or less	6 to 10 years	11 to 31 years
1. Present system tends to force scores to average	1	1	2
2. Emphasis should be placed upon factor and item evaluators to rank prospects against each other as well as standards	4	3	3
3. Scoring and weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system	2	4	6
4. Technical risk too difficult to integrate into score	5	6	1
5. More definitive ranking/scoring needed at factor level	3	2	7
6. Present system tends to compromise the motivation for professional excellence in the evaluator	6	8	4
7. Upward flow of evaluation information constrained	7	7	5
8. Less definitive ranking/scoring of proposals needed at factor level	8	5	8

Primary Importance:	(a)	Present system tends to force scores to average
	(b)	More definitive ranking/ scoring of proposals needed at factor level
	(c)	Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as standards
Secondary Importance:	(d)	Scoring and weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system
	(e)	Technical risk too difficult to integrate into score
Tertiary Importance:	(f)	Present system tends to compromise the motivation for professional excellence in the evaluator
	(g)	Upward flow of evaluation information constrained

(3) SSAC respondents are most representative of the respondents taken as a total group. The evaluation shows that the answers by the group of SSAC respondents is significantly more representative of the total group of respondents than any other functional group of respondents. On the other hand, the Co-Chairman group appears to be least representative.

(4) Satisfaction with present scoring system generally increases as the experience level (in years) of respondents increases. The "5 years or less" experience level group was more representative of

the total group answers than the groups of respondents who were more experienced in terms of years service.

(5) When compared by SSAC and SSEB groups, the respondents evaluate the present scoring system very similarly.

(6) The results of applying the Experience Weighting Factors were used to establish the major findings in (2) above. While the Total Adjusted Score values were relatively close to the raw percentage values, the weighted results are considered to be more accurate. In addition, the separate analysis permitted by the Experience Weighting Factors provided quantitative support for the technique of dividing the respondents by highest functional level to assess the data.

(7) The factor members were strongly inclined to feel that the present scoring system tends to compromise the motivation for professional excellence in the evaluator.

2. Evaluation of Question Number Seven

In question 7 the respondents were asked to discuss the influence and impact that the Contractor Inquiry (CI) and Deficiency Report (DR) have on the SSEB evaluation process. More specifically, they were asked to discuss the impact that the CI and DR have on the SSEB technical evaluation, risk assessment, and scoring system. The question was rather poorly designed in that it resulted in answers that were difficult to systematically analyze and evaluate. The significant findings of that analysis are evaluated in this section.

a. Impact on Technical Evaluation

(1) CI Impact on Technical Evaluation. Table XIV shows the various areas of impact that the CI has on the SSEB technical evaluation. The areas of impact are listed in the order of relative importance, determined by the frequency they were cited by respondents. The numbers in the body of the table are percentages of respondents in that column specifying a particular impact. Under the column called "Total Respondents" the total adjusted score was derived by applying the "Experience Weighting Factors" and summing the Adjusted Scores.

The total Adjusted Score values require re-ordering of areas 2 and 3 and areas 4 and 5. In the second area of impact, the respondents were not specific as to why the CI is essential to the SSEB evaluation process, but it appears reasonable to assume that areas 1 and 2 are essentially the same impact area. In any case, it is evident that almost one-half of the SSAC respondents and 87.5% of the SSEB Chairman respondents consider the CI very helpful and/or necessary for technical evaluation. The most frequent remark by factor members was that the CI process is too time

TABLE XIV

CI IMPACT ON TECHNICAL EVALUATION

Areas of Impact	Total Respondents		Highest Functional Level				
	%	Total Adjusted Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. Better evaluation possible through clarification	22.8	27.7	46.2	0	25.0	16.7	0
2. Essential to Evaluation process	20.4	14.5	7.7	87.5	0	0	25.0
3. Creates excessive delays, process should be improved	18.2	19.6	15.4	12.5	8.3	16.7	75.0
4. Creates inequities in favor of contractor in question	11.4	10.3	7.7	25.0	0	16.7	25.0
5. CI use should be sharply reduced or eliminated	11.4	12.1	7.7	0	16.7	16.7	25.0
6. No effect on evaluation process	9.1	9.4	7.7	0	16.7	16.7	0

consuming, and that the process should be streamlined. Of those selecting the fourth area of impact, the SSEB Chairman and Factor Member groups were most inclined to believe that the CI creates inequities in the technical evaluation in favor of the contractor in question. Of those selecting the fifth area of impact, the SSEB Co-Chairman and Item Captain groups were most inclined to believe that the CI had no effect on technical evaluation. However, the percentage is relatively low (16.7%) in both groups.

There is evidence to indicate that the higher levels of management feel that the CI is more necessary to the SSEB evaluation process than do the lower management and working levels. Likewise, the lower management and working levels appear to be more inclined to feel that the CI creates excessive delays which could be reduced by improved procedures, and that the use of the CI should be sharply reduced or eliminated. This is interesting since the working levels are the ones who actually prepare the CI and perform detailed evaluation of the CI response in the SSEB evaluation process. The belief that inequities occur as a result of the CI appears to be shared primarily by the two highest management levels and the Item and Factor working levels. The respondents stating that the CI has no effect on the evaluation process are considered to be a distinct minority of the respondents in each functional level group. The logic for this conclusion is that all the other areas of impact cited by respondents are relatable to <u>some</u> affect that the CI has on the SSEB evaluation process, with perhaps the exception of area number 5.

(2) DR Impact on Technical Evaluation. Table XV shows the various areas of impact that the DR has on the SSEB technical evaluation. The areas of impact are listed in the order of relative importance, determined by the frequency they were cited by respondents. Table XV is constructed in the same manner as Table XIV.

The Total Adjusted Score values indicate that the first and second areas of impact are very close in relative importance. This is surprising for two reasons. First, they are contradictory, and second, they are both substantially higher in relative importance than the other areas of impact. The only functional level group that appears to take a consistent position on these two areas of impact is the SSEB Chairman group, where 50% stated that the DR has no effect and 0% stated that the DR is essential. The Co-Chairman group had more respondents stating "no effect" than "essential to", while the SSAC, Item and Factor groups had more respondents stating "essential to" than "no effect". Since the only other area of impact that could be considered supportive to a "no effect" opinion is sixth area listed in Table XV, it is concluded that those respondents stating "no effect" represent a substantial minority of the respondents taken as a total group.

According to official policy and actual practice, one of the primary uses of the DR is to identify major problem

TABLE XV

DR IMPACT ON TECHNICAL EVALUATION

Areas of Impact	Total Respondents %	Total Respondents Total Adj. Score	Highest Functional Level SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. No effect on evaluation	20.4	17.1	7.7	50.0	25.0	0	25.0
2. Essential to evaluation	15.9	17.9	15.4	0	16.7	16.7	50.0
3. Essential for contract definition	13.6	12.9	15.4	25.0	8.3	16.7	0
4. Creates inequities in favor of contractor in question	13.6	10.5	0	25.0	25.0	16.7	0
5. Creates excessive delays	9.1	9.1	7.7	12.5	0	16.7	25.0
6. Should reduce and/or restrict use of DR	6.8	6.1	0	0	16.7	16.7	0

areas, actual or potential, associated with contractor proposals so they may be satisfactorily considered in contract negotiations. This is at least indirectly associated with the technical evaluation at the SSEB level. However, the respondents stating that the DR is essential to contract definition are referring more to its use in contract negotiations than its direct impact on the SSEB technical evaluation and formal report.

Approximately 14% of the total respondents stated that the DR tends to create inequities in favor of the contractor. These respondents were primarily from the Chairman and Co-Chairman groups. As in the case of the CI, the respondents stating that the use of the DR should be reduced or eliminated were from the lower functional levels.

(3) Summary of CI/DR Impact on Technical Evaluation. In summary, the higher functional levels were more strongly inclined to feel that the CI is necessary for accomplishing the technical evaluation. On the other hand, the lower functional levels, who actually use the CI, were more inclined to feel that the CI process is too time consuming to be useful and that it tends to create inequities in favor of the contractor in question. In the DR area, there was less distinction in respondent answers when compared by functional level. The middle and lower functional levels are more inclined to feel the DR has no effect on technical evaluation. The middle functional levels, however, were also most inclined to feel that the DR creates inequities in

favor of the contractor in question and that its use should be reduced or eliminated. Additional discussion of these findings are discussed later.

b. Impact on Risk Assessment

(1) CI Impact on Risk Assessment. Table XVI shows the various areas of impact that the CI has on the SSEB risk assessment. These areas of impact are listed in the order of relative importance, determined by the frequency they were cited by respondents. Table XVI is constructed in the same manner as Table XIV.

The majority (52.3%) of all respondents stated that the CI assists in identifying and assessing risk associated with a contractor proposal. The Co-Chairman group was the only functional level group in which less than 50% of the respondents cited this as an area of impact by the CI. The working level groups were more inclined to state that the CI actually tends to reduce risks. It is noteworthy that only 9.1% of the total respondents stated that the CI has no effect on risk assessment.

Table XVII shows the various areas of impact that the DR has on the SSEB risk assessment. Again, the areas of impact are listed in the order of relative importance, determined by the frequency they were cited by respondents.

(2) DR Impact on Risk Assessment. A relatively large percentage of the total respondents (41.0%) stated that the DR assists in identifying and assessing risks associated

TABLE XVI

CI IMPACT ON RISK ASSESSMENT

Areas of Impact	Total Respondents		Highest Functional Level				
	%	Total Adj. Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. Assists in identifying and assessing risk	52.3	52.9	53.8	62.5	41.7	50.0	75.0
2. Tends to reduce risk	11.4	11.5	7.7	0	50.0	50.0	25.0
3. No effect on risk assessment	9.1	8.7	7.7	12.5	16.7	0	0

TABLE XVII

DR IMPACT ON RISK ASSESSMENT

Areas of Impact	Total Respondents		Highest Functional Level				
	%	Total Adj. Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. Assists in identifying and assessing risk	41.0	45.0	52.8	37.5	41.6	0	75.0
2. Tends to reduce risk	15.0	13.7	7.7	25.0	0	50.0	25.0
3. No effect on risk assessment	13.6	11.2	7.7	37.5	16.7	0	0
4. All major items identified by DR's	4.5	4.2	0	0	16.7	0	0

with contractor proposals. The Item group, with 0%, was the only functional level group who varied significantly from the other respondents in stating the first area of impact, but the Item group had the highest percentage of respondents who felt that the DR tends to reduce risks. Another interesting finding is that 37.5% of the Chairman group stated that the DR assists in identifying and assessing risk, and another 37.5% stated that the DR has no effect on risk assessment.

c. Impact on Scoring

(1) CI Impact on Scoring. Table XVIII shows the various areas of impact that the CI has on the SSEB scoring process. These areas of impact are listed in the order of relative importance, determined by the frequency they were cited by respondents.

Here again the two most important areas of impact identified by respondents are contradictory. Within the SSAC group, 30.8% stated that both impact number 1 and 2 exist, and 23.0% stated that scores should reflect the CI response. Since impact number 3 is not necessarily related to impact number 1 or 2, it can only be concluded that the SSAC group is about equally split between the conflicting views of impact number 1 and 2. The same condition exists for the Item Captain group. The Chairman group substantially favors the view that the CI improves the accuracy of the scores, while the Co-Chairman group favors the view that the CI has

TABLE XVIII

CI IMPACT ON SSEB SCORING PROCESS

Areas of Impact	Total Respondents		Highest Functional Level				
	%	Total Weighted Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. No effect on scores	22.8	24.5	30.8	12.5	33.3	16.7	0
2. Improves accuracy of scores	22.8	23.5	30.8	37.5	8.3	16.7	25.0
3. Scores should reflect CI response	15.9	17.1	23.0	12.5	16.7	16.7	0
4. Leads to inequities in favor of contractor in question	15.0	13.9	0	25.0	25.0	0	50.0

no effect on the scores. Within the Factor group, 50% stated that the CI has no effect on scoring. It is interesting to note that the Factor group is the only functional level group that is consistent in stating that the CI effects the scoring. Among the other groups, there is considerable division between stating that the CI has "no effect" and stating that it has "some" effect. The Factor group was more inclined to feel that the CI creates inequities in favor of the contractor in question. This finding is consistent with a similar finding relative to the CI impact on technical evaluation.

Based upon an over-all consideration of the areas of impact, there were considerably more respondents that have the viewpoint that the CI does have some effect than those who consider that the CI has no effect on scoring.

(2) DR Impact on Scoring. Table XIX shows the various areas of impact that the DR has on the SSEB scoring process. These areas of impact are again listed in the order of relative importance, as in previous tables.

A larger percentage (36.4%) of the total group felt that DR has no effect on the scoring process, however the distribution of respondent answers in every group again shows a considerable division of opinion as to whether or not the DR affects the scoring process. This is particularly true in the Chairman group. Over-all, it is concluded that there is generally divided opinion in the group as a whole as to whether or not the DR affects the SSEB

TABLE XIX

DR IMPACT ON SSEB SCORING PROCESS

Areas of Impact	Total Respondents		Highest Functional Level				
	%	Total Adjusted Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. No effect on scores	36.4	36.7	46.2	37.5	50.0	16.7	0
2. Improves accuracy of scores	15.9	17.8	23.1	12.5	16.7	0	25.0
3. Leads to inequities in favor of contractor in question	13.6	11.0	0	37.5	8.3	0	50.0
4. Scores should reflect DR response	13.6	13.8	15.3	12.5	16.7	16.7	0
5. Cause higher probability of low score	9.1	7.23	0	12.5	16.7	16.7	0

scoring process. These findings are discussed in greater detail in the following paragraphs.

d. Combined Results of Question Number 7

The two dimensional (CI and DR) and multiple factor (technical evaluation, risk assessment, and scoring) nature of this question make it very difficult to evaluate and assess. First, it is necessary to determine if the CI and DR do, or do not have effects on the three factors. In order to determine this, it is necessary to divide the "no effect" answers from those that constitute "some effect". The answers that constitute "some effect" can then be combined in a manner so as to obtain a combined percentage measure of the respondents who consider "some effect" to exist. This is done by simply summing the percentages of respondents stating that "some effect" exists. The following is a break-out of numbers of the areas of impact, for each of the Tables XIV through XIX, according to "no effect", "some effect", and "undetermined effect".

	"No Effect"	"Some effect"	"Undetermined Effect"
Table XIV	6	1, 2, 3, 4	5
Table XV	1	2, 3, 4, 5	6
Table XVI	3	1, 2	
Table XVII	3	1, 2, 4	
Table XVIII	1	2, 4	3
Table XIX	1	2, 3, 5	4

These areas of impact in the category "undetermined effect" were considered neutral; that is, the percentages of respondents stating these areas were not added to "no effect" or "some effect". The results of this exercise are shown in Tables XX and XXI for the CI and DR, respectively.

Table XX clearly shows that the CI has "some effects" on the SSEB technical evaluation and the risk assessment. While the percentage of "some effects" exceeds that of "no effects" for the SSEB scoring process, the results do not provide comfortable assurance that the CI consistently effects the scoring process.

Table XXI clearly shows that the DR has "some effects" on the SSEB Risk Assessment. There is also substantial evidence that the DR has "some effects" on the SSEB Technical Evaluation. As for the DR effect on the SSEB scoring process, the results appear to show that the respondents are about equally divided on this issue.

e. Summary of Findings on Question 7

The following is a discussion of the mjaor findings as a result of the analysis and evaluation of the respondent answers to question number 7 of the Source Selection questionnaire:

(1) The CI has significant effects on the SSEB technical evaluation. These effects, in the order of their relative importance are:

(a) Insures a better evaluation by clarifying questionable data in the contractor proposals.

(b) Essential to insure the data is equitable

TABLE XX

IMPACT SUMMARY OF CI

		SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Technical Evaluation	No Effect	7.7	0	16.7	16.7	0	9.1
	Some Effects	77.0	125.0	33.3	50.1	125.0	72.8
Risk Assessment	No Effect	7.7	12.5	16.7	0	0	9.1
	Some Effects	61.5	62.5	41.7	100.0	100.0	63.7
Scoring	No Effect	30.8	12.5	33.3	16.7	0	22.8
	Some Effects	30.8	62.5	33.3	16.7	75.0	38.7

TABLE XXI

IMPACT SUMMARY OF DR

		SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Technical Evaluation	No Effect	7.7	50.0	25.0	0	25.0	20.4
	Some Effects	38.5	62.5	50.0	66.8	75.0	52.2
Risk Assessment	No Effect	7.7	37.5	16.7	0	0	13.6
	Some Effects	60.5	62.5	58.3	50.0	100.0	61.4
Scoring	No Effect	42.6	37.5	50.0	16.7	0	36.4
	Some Effects	23.1	62.5	41.7	16.7	75.0	38.6

and accurately evaluated.

(c) Creates excessive delays in the evaluation process that could be significantly reduced by a more efficient and effective procedure.

(d) The use of the CI should be significantly reduced.

It should be noted that the higher levels of management strongly supported effects (a) and (b), while the working levels were more supportive for effects (c) and (d).

(2) The CI has significant effects on the SSEB risk assessment. These effects, in the order of their relative importance, are:

(a) Assists in identifying and assessing risks associated with contractor proposals.

(b) Tends to reduce the risk associated with contractor proposals.

(3) The effect of the CI on the SSEB scoring process could not be determined with any substantial degree of certainty. A slightly greater percentage of the respondents feel that the CI has some effects than those who feel that it has no effect. The Chairman and Factor groups appear to be most consistent in the view that the CI has effects on the scoring process. When the CI does effect

scoring, the major effects are:

(a) Improves the accuracy of the scores.

(b) Leads to inequities in favor of the contractor in question.

Many of the respondents expressed the opinion that the scores should reflect the CI responses. It is concluded that the CI effects SSEB scoring more often than not.

(4) The DR has significant effects on the SSEB technical evaluation. These effects in the order of their relative importance are:

(a) Essential to insure that major problem areas, actual or potential, related to the proposal data are equitably and accurately evaluated.

(b) Essential to identify major problem areas, actual or potential, related to the proposal data are satisfactorily negotiated during contract definition.

(c) Lead to inequities in favor of the contractor in question.

(d) Create excessive delays in the SSEB technical evaluation.

A small number of respondents feel that the use of the DR should be reduced and/or restricted in the scope of application.

(5) The DR has significant effects on the SSEB

risk assessment. The effects, in the order of their relative importance, are:

(a) Assist in identifying and assessing risks associated with contractor proposals.

(b) Tend to reduce the risks associated with contractor proposals.

(6) The effect of the DR on the SSEB scoring process could not be determined. Approximately, the same percentage of respondents stated that the DR has no effect on scoring as those who stated that the DR has some effects. When the DR does effect scoring, which appears to be about 50% of the time, the major effects are:

(a) Improves accuracy of scores.

(b) Leads to inequities in favor of contractor in question.

(c) Causes higher probability of a low score.

It is seen that effects (b) and (c) above are also contradictory. The effect of the DR on scoring appears to be an area that merits further study and attention by ASD managers responsible for source selection.

It should be noted here that the uncertainty associated with both the CI and DR relative to SSEB scoring was a primary factor in providing definitive scoring procedures for the CI and DR in the integrated risk assessment/scoring model developed in Chapter VIII of this study.

3. Evaluation of Question Number Five

Question number 5 addressed the problem of assessing the adequacy of the present interactions between SSEB personnel in the technical and cost areas relative to integrating technical considerations into cost estimates and cost risks. In the present SSEB evaluation process, the cost area is not scored, but it is considered appropriate to discuss question 5 in this section since there may be some relationship between cost risk and an optimum scoring system which integrates scoring and risk assessment.

a. Respondents by Highest Functional Level

The respondents were asked if the communication and interaction between cost and technical design personnel should be increased, unchanged, or decreased in order to insure adequate technical and risk considerations in the cost data. Of the total respondents, 79.5% stated that the communication and interaction should be increased; 18.2% stated that no change was needed; and 2.3% stated that the communication/interaction should be decreased. The Co-Chairman, Item, and Factor groups appear to represent the majority of the respondents who feel that no change is needed; however, a substantial majority of every functional level group stated that the communication and interaction should be increased. Most of the respondents who stated that no change is needed also stated that the current system of technical/cost interaction is adequate and preferred.

A very small percentage of the respondents who voiced a "no change" position also stated that the cost data should be divorced from technical design.

Table XXII shows the reasons given by respondents in support of increasing the communication and interaction. The reasons are listed in the order of relative importance, determined by the frequency that they were cited by respondents. Approximately 70% of the respondents feel that the cost data should reflect technical and other risks. Nearly 50% of the respondents believe that technical design personnel could assist in improving the methods used to arrive at cost estimates, and approximately 27% feel that the cost data should more accurately reflect design, material, and manufacturing processes.

While only one of the 44 respondents had served, at the highest functional level, as a working member of an SSEB cost team, four of the 44 respondents had experience in the area of cost. It is interesting to note that these four respondents answered question 5 in the same manner as the majority of the total respondents. While the number of respondents experienced in the cost area was relatively small, there is evidence that the cost people support increased communication and interaction to the same degree as respondents from other disciplines, and for the same reasons.

The order of relative importance of the reasons given by highest functional level groups was essentially the same as the order established by the respondents taken as a total

TABLE XXII

REASONS FOR INCREASING COST/TECHNICAL INTERACTION

Reasons	Total Respondents		Highest Functional Level					
	%	Total Adjusted Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %	Cost %
1. Cost data should reflect technical and other risks	68.2	70.0	84.7	62.6	50.0	66.6	75.0	100.0
2. Technical design people could assist in improving cost models and programs	47.8	45.2	30.7	62.6	50.0	16.7	100.0	100.0
3. Cost data does not adequately reflect design material, and manufacturing processes	27.3*	24.9	30.7	50.0	16.7	0	25.0	100.0

*Increased to 45.5% when "other reasons" were included in evaluation.

group. The "other reasons" given by respondents were not included in Table XXII. However, when the "other reasons" given by respondents to support the position that communication/interaction should be increased are included, the results in Table XXII remain essentially the same. The reason that the "other reasons" were evaluated separately is because it was necessary to use judgment in interpreting the meaning and intent of the respondent narratives. The interested reader may refer to page 291 of Appendix B to assess the validity of the writer's judgment. While the "other reasons" given were more specific and detailed, the majority of them were generally covered under reason number 3. Therefore, the only significant change to Table XXII resulting from the "other reasons" was to increase the percentage of total respondents giving reason number 3 to 45.5%.

b. <u>Respondents by SSAC or SSEB</u>

As in question number 4, a comparison of the respondents' answers to question number 5 by SSAC and SSEB membership revealed no significant differences. The reader may verify this by the review of Table L of Appendix B. However, when the respondents' answers were analyzed and evaluated relative to the experience level of respondents, in terms of years, a noticeable trend was found. As the experience level of the group increases, there is evidence that the respondents increasingly feel that no change is necessary. Table XXIII shows the difference in the respondents' statements when divided into groups by years experience. The numbers in Table XXIII are percentages of the respondents in that experience level group.

c. Respondents by Years Experience Level

Dividing the respondents into groups by "years experience" did not change the order of relative importance of the reasons given to support the need for increased communication and interaction. That is to say, each experience level group gave reasons for increased communication/interaction in the same order of relative importance as did the group of respondents taken as a whole. The six to 11 year group appears to be more representative of the total group answers than the other two groups.

TABLE XXIII

RESPONDENT ANSWER ON COMMUNICATION/INTERACTION BY YEARS EXPERIENCE

Respondent Answer	Experience Level		
	5 yrs or less (11 respondents)	6 to 10 yrs (16 respondents)	11 to 31 yrs (15 respondents)
Should be increased	91.5	87.5	60.0
No change needed	7.5	12.5	33.3
Should be decreased	0	0	6.7

d. Summary of Findings on Question Number Five

The following is a discussion of the major findings as a result of the analysis and evaluation of respondent answers to question number 5 of the Source Selection questionnaire:

(1) Communication and interaction between SSEB technical design and cost personnel should be increased so as to better integrate technical considerations into cost estimates and cost risks.

(2) The major reasons that communication and interaction should be increased are listed below in the order of relative importance:

  (a) Cost data should reflect technical and other risks.

  (b) Technical design people could assist in improving cost models and programs.

  (c) Cost data does not adequately reflect design, material, and manufacturing processes.

(3) Satisfaction with the current level of communication and interaction increases as the experience level (in years) of respondents increases.

Evaluation of Minimum Documentation/Prototype Hardware Effects

Question 2 of the Source Selection questionnaire is addressed to the problem of assessing the effect that minimum documentation has on the difficulty level of technical evaluation in the SSEB. Question 3 of the questionnaire is addressed to the problem of assessing the effect that prototype hardware development has on the difficulty level of technical evaluation in the SSEB.

1. Evaluation of Question Number Two

a. Respondents by Highest Functional Level

In question number 2, the respondents were asked to state whether the PUD concept of minimum documentation causes the SSEB technical evaluation to be more, equally, or less difficult. Approximately 30% of the respondents did not attempt to answer this question, primarily because of unfamiliarity and inexperience with PUD and the so-called minimum documentation concept. Seventeen (38.0%) of the 44 respondents stated that technical evaluation was more difficult, eight (18.2%) stated that technical evaluation was equally difficult, and three (6.8%) stated that technical evaluation was less difficult. Table XXIV shows the breakout of respondent answers by highest functional level. The Factor group was unanimous in stating that the technical evaluation was more difficult. In the SSAC group, 38.5% stated that the technical evaluation was more difficult, while another 38.5% stated that it was equally or less difficult. The Co-Chairman group was the only one in which the respondents stating that the technical evaluation was equally or less difficult out-numbered those stating that it was more difficult.

Applying the Experience Weighting Factors to Table XXIV strengthens the position that the application of the minimum documentation concept causes the SSEB technical evaluation to be more difficult. The results of applying The Experience Weighting Factors are shown in Table XXV.

The respondents that stated that the technical evaluation is equally or less difficult were essentially the same respondents that gave the following reasons to support these positions:

(1) Technical data generally better in all respects.

(2) Technical data not significantly influenced by minimum documentation.

(3) Standards satisfactory.

(4) Technical risks easier to identify and assess.

The percentages of total respondents stating these answers are 4.5%, 6.8%, 9.1%, and 6.8%, respectively.

The respondents who stated that the technical evaluation was more difficult gave the reasons shown in Table XXVI to support their position. These reasons are listed in the order of their relative importance, determined by the frequency that they were cited by the respondents. The "other reasons" given by the respondents are not included in Table XXVI. The Total Adjusted Score values do not change the order of relative importance of the reasons. Rather, they clearly establish the first two reasons as the most

TABLE XXIV

EFFECT OF MINIMUM DOCUMENTATION ON DIFFICULTY LEVEL

Answer	Total Respondents (44)	Highest Functional Level					
		SSAC (13)	Chairman (8)	Co-Chairman (12)	Item (6)	Factor (4)	Cost (1)
More difficult	17	5	2	3	2	4	1
Equally difficult	8	3	1	4	0	0	0
Less difficult	3	2	0	0	1	0	0

TABLE XXV

MINIMUM DOCUMENTATION VERSUS DIFFICULTY LEVEL-WEIGHTING FACTORS APPLIED

Answer	Total Adjusted Score	Adjusted Scores					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
More difficult	40.3	16.3	2.4	6.3	3.7	10.6	100.0
Equally difficult	18.1	9.8	1.2	8.3	0	0	0
Less difficult	8.4	6.5	0	0	1.9	0	0

TABLE XXVI

REASONS MINIMUM DOCUMENTATION RESULTS IN GREATER DIFFICULTY

Reasons	Total Respondents		Highest Functional Level				
	%	Total Adjusted Score	SSAC	Chairman	Co-Chairman	Item	Factor
1. Variance in the depth of technical data between proposals	36.4	38.7	38.5	37.5	25.0	16.7	100.0
2. Technical risks harder to identify and assess	25.0	30.6	38.5	0	0	33.3	100.0
3. Too much latitude allowed in Technical data requirements	18.2	19.4	23.0	25.0	0	16.7	50.0
4. Standards too general and hard to apply	15.9	18.5	15.4	0	8.3	16.7	75.0
5. Variance in data submitted formats between proposals	15.9	16.1	15.4	25.0	0	16.7	50.0
6. Standards too detailed and restrictive	2.3	3.3	7.7	0	0	0	0

significant ones, and indicate that reasons number 3, 4, and 5 are approximately equal in importance.

Comparing the order of the reasons, given by highest functional level group, reveals that the SSAC group was again most representative of the respondents taken as a whole. The Co-Chairman group appears to be least representative of the total group, since the percentage of respondents stating the reasons were relatively low or zero for all six reasons. It is noteworthy that the Factor group, which actually performs the detailed technical evaluation, is second to the SSAC in being most representative of the total respondents in terms of the order of reasons given. Perhaps more important, however, is the evidence that the Factor group had the highest percentage of respondents stating that the first five reasons in Table XXVI are significant in causing the technical evaluation to be more difficult.

The "other reasons" given by respondents for question 2 are summarized on page 266 of Appendix B. These comments were evaluated separately since it was necessary to use judgment in interpreting their meaning and intent, and categorizing them into general problem areas. The "other reasons" that were given in support of stating that the technical evaluation is more difficult did not change the results of Table XXVI. There were, however, two important problem areas identified by this analysis. The first is the critical need to tailor the data required by the RFP to the desired level of technical evaluation. The second is the need to establish evaluation and scoring criteria and procedures which are tailored to the minimum documentation concept. The majority of the significant "other reasons" given by all respondents are considered to fall within these two problem areas. The number of respondents who gave "other reasons" that could be classified under these problem areas are shown in Table XXVII.

b. Respondents by SSAC or SSEB

Comparing the answers by SSAC respondents to those by SSEB respondents revealed that members of the SSAC were more inclined to believe that the technical evaluation was equally or less difficult. Consistent with this was the finding that SSAC members were more inclined to state the reasons which support the position that the technical evaluation is equally or less difficult. Table XXVIII shows the items associated with question 2 where the SSAC and SSEB respondents differed. The numbers are percentages of respondents in each group which stated that answer.

c. Respondents by Years Experience Level

The respondent answers to question 2 were analyzed by the experience level of the respondents, in terms of years, in Table XXXVIII of Appendix B. The percentages of the three experience level groups stating that the technical evaluation is "more difficult" varied only 15%, with the middle group having the lowest percentage. The percentage

TABLE XXVII

PROBLEM AREAS ASSOCIATED WITH MINIMUM DOCUMENTATION

Problem Area	Total Respondents	Highest Functional Level				
		SSAC	Chairman	Co-Chairman	Item	Factor
1. Need to tailor data required by RFP to desired level of technical evaluation	10	1	3	4	1	1
2. Need to establish evaluation criteria and procedures tailored to the minimum documentation concept	4	2	1	0	0	1

TABLE XXVIII

DIVERGENCE OF SSAC VERSUS SSEB ON QUESTION TWO

Answers	SSAC	SSEB
Equally difficult	23.0	16.1
Less difficult	15.4	3.2
Technical data not significantly influenced by PUD	15.4	3.2
Standards satisfactory	15.4	6.5
Technical risks easier to identify and assess	15.4	3.2

of respondents stating that the evaluation was equally difficult increased substantially as the experience level increased. On the other hand, the percentage of respondents stating that the evaluation was less difficult decreased noticeably as the experience level increased. As a result of the above, no trend was established that would differentiate the pattern of respondent answers relative to years experience. With regards to the order of relative importance of the reasons given by the three groups, the least experienced group was least representative and the other two groups very representative of the total respondent group. Over-all, the answers by the most experienced group were most representative of the total respondent group.

d. Summary of Findings on Question Number Two

The following is a brief discussion of the major findings resulting from the analysis and evaluation of question number 2:

(1) The SSEB technical evaluation is more difficult when the minimum documentation concept of the current DoD management philosophy is applied. Although 30% of the respondents were not familiar with the minimum documentation concept, a large majority of the respondents answering question 2 felt that the technical evaluation was more difficult.

(2) The major reasons that the technical evaluation

is more difficult are listed below in the order of relative importance:

(a) Variance in the depth of technical data between proposals

(b) Technical risks harder to identify and assess

(c) Too much latitude allowed in technical data requirements

(d) Standards too general and hard to apply

(e) Variance in data submittal formats between proposals.

(3) Two major needs exist relative to the SSEB technical evaluation when using the minimum documentation concept:

(a) The data required by the RFP must be carefully tailored to the desired level of technical evaluation.

(b) Evaluation criteria and procedures should be tailored to the minimum documentation concept.

(4) SSAC respondents are more representative of the total group of respondents than any other functional level group.

(5) The Factor group was by far the most consistent group in stating that the technical evaluation was more difficult and in stating the five major reasons listed in (2) above.

(6) When compared by SSAC and SSEB groups, the SSAC group tends to be more inclined to feel that the technical evaluation is equally or less difficult than does the SSEB group.

(7) The application of Experience Weighting Factors tends to strengthen the findings in (1) and (2) above.

2. Evaluation of Question Number Three

a. Respondents by Highest Functional Level

In question 3, the respondents were asked if the SSEB technical evaluation was more, equally, or less difficult when proposals are responsive to a prototype hardware developmental program. Only 11% of the total respondents gave no response to question 3, compared to 30% to question 2. Approximately 57% of the total respondents stated that technical evaluation is more difficult. Approximately 32% of the total respondents were equally divided in stating that the technical evaluation is equally and less difficult.

Table XXIX shows the break-out of respondent answers by highest functional level. The SSAC group had a substantially higher percentage of respondents stating "more difficult", than the combined percentages of those stating "equally difficult" and "less difficult". At the working level, the Factor group respondents were equally divided between "more difficult" and "equally/less difficult".

TABLE XXIX

EFFECT OF PROTOTYPE HARDWARE ON DIFFICULTY LEVEL

Answer	Total Respondents	Highest Functional Level					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
	44	(13)	(8)	(12)	(6)	(4)	(1)
More difficult	25	9	5	6	3	2	0
Equally difficult	7	1	1	2	2	1	0
Less difficult	7	2	2	2	0	1	0

TABLE XXX

PROTOTYPE HARDWARE VERSUS DIFFICULTY LEVEL - WEIGHTING FACTORS APPLIED

Answer	Total Adjusted Score	Adjusted Scores				
		SSAC	Chairman	Co-Chairman	Item	Factor
More difficult	58.8	29.4	6.1	12.5	5.5	5.3
Equally difficult	15.1	3.3	1.2	4.2	3.7	2.7
Less difficult	15.8	6.5	2.4	4.2	0	2.7

Applying the experience weighting factors to Table XXIX strengthens the position that the SSEB technical evaluation is more difficult with prototype hardware. The results of applying the experience weighting factors are shown in Table XXX.

The respondents that stated that the technical evaluation is equally or less difficult were essentially the same respondents that gave the following reasons to support these positions:

(1) Data requirements and review are the same

(2) Less data review is required for hardware proposals

(3) Level of evaluation effort less with hardware

(4) Level of evaluation effort the same

(5) Emphasis on technical risks the same.

The percentages of total respondents stating these answers are 9.1%, 6.8%, 4.5%, 9.1%, and 4.5%, respectively.

The respondents that stated that the technical evaluation was more difficult gave the reasons shown in Table XXXI to support their position. These reasons are listed in the order of their relative importance, determined by the frequency that they were cited by the respondents. The "other reasons" given by respondents are not included in Table XXXI. While there is a 10 point spread in the Total Adjusted score values, all three reasons are considered to be factors causing greater difficulty in the technical evaluation. The SSAC, Item, and Factor groups had the highest

TABLE XXXI

REASONS PROTOTYPE HARDWARE RESULTS IN GREATER DIFFICULTY

Reasons	Total Respondents		Highest Functional Level				
	%	Total Adjusted Score	SSAC %	Chairman %	Co-Chairman %	Item %	Factor %
1. More emphasis on technical risk with hardware	54.5	49.3	53.8	25.0	41.6	66.6	50.0
2. Level of evaluation effort always greater with hardware	43.2	47.7	61.5	25.0	33.3	50.0	50.0
3. It is necessary to obtain and review more data	31.8	39.8	53.8	12.5	8.4	66.6	25.0

percentages of respondents which stated these three reasons.

The "other reasons" given by respondents for question 3 are summarized on page 276 of Appendix B. These comments were evaluated separately since it was necessary to use judgment in interpreting their meaning and intent, and categorizing them into general problem areas. The "other reasons" that were given in support of stating that the technical evaluation caused the order of reason number 1 and 2 of Table XXXI to be reversed. Generally, the "other reasons" given tended to strengthen the reasons in Table XXXI as being the primary factors causing the technical evaluation to be more difficult.

b. Respondents by SSAC or SSEB

Comparing the answers by SSAC respondents to those by SSEB respondents revealed that the SSAC members were more inclined to state that the technical evaluation was more difficult and less inclined to state that it was equally difficult. Likewise, the SSAC respondents were more inclined to specify the three major reasons supporting a "more difficult" position.

c. Respondents by Years Experience Level

The respondent answers to question 3 were analyzed by the experience level of the respondents, in terms of years, in Table XLII of Appendix B. No significant differences were noted in the way the three groups answered question number 3.

d. Summary of Findings on Question Number Three

The following is a brief discussion of the major findings resulting from the analysis and evaluation of question 3:

(1) The SSEB technical evaluation is more difficult when prototype hardware development is involved.

(2) The major reasons that the technical evaluation is more difficult are listed below. All three reasons are considered equally important.

(a) Level of evaluation effort always greater with hardware

(b) More emphasis on technical risk with hardware

(c) It is necessary to obtain and review more data.

(3) The SSAC, more than any other functional level group, was strongly inclined to believe that the technical evaluation was more difficult.

Combined Effects

In this section, the combined effects of the major findings in this chapter will be discussed. In the SSEB process, the technical evaluation, risk assessment, and scoring of a contractor proposal are not, and cannot be unrelated and independent activities. In performing the detailed technical evaluation, the Factor member carefully studies the contractors technical data and compares it with the established evaluation criteria. During this process, the evaluator may discover several problem areas of a minor or major nature, some of which he may classify as risks. Since there is no established procedures or methods for quanitatively assessing the impact of risks, the evaluator must include his assessment of the risks in the narrative of his technical evaluation report. Based upon this technical evaluation report, the Factor evaluator rates the proposal in accordance with the present scoring procedures.

1. Factor Level

When the SSEB involves a program to which the current DoD management concepts for prototype hardware and minimum documentation are applied, the Factor evaluator is confronted with the following situations (the reader will find it helpful to refer to Figure 17 while reading the following paragraphs). The technical evaluation is more difficult with prototype hardware since the level of evaluation effort is greater, and it is necessary to obtain and review more technical data. In addition, there is more emphasis on risks with prototype hardware since the consequences of failure are greater when hardware is involved. The minimum documentation concept compounds the difficulty of the technical evaluation due to excessive latitude in data requirements specified in the RFP. This results in variance in the

Question 2 -

Minimum Documentation makes SSEB technical evaluation more difficult because:

1. Variance in depth of technical data between proposals
2. Technical risks harder to identify and assess
3. Too much latitude allowed in technical data requirements
4. Standards too general and hard to apply
5. Variance in data formats between proposals.

Data required by RFP must be tailored to desired level of technical evaluation.
Evaluation criteria and procedures should be tailored to management concepts.
SSAC group most representative of total respondents
Factor group most convinced that technical evaluation more difficult.

Question 3 -

Prototype hardware development makes SSEB technical evaluation more difficult because:

1. Level of evaluation effort always greater with hardware
2. More emphasis on technical risks with hardware proposals
3. It is necessary to obtain and review more data.

SSAC group most convinced that technical evaluation more difficult.

Question 4 -

The SSEB scoring process at the factor and item level should be modified because:

1. Present system tends to force scores toward average
2. More definitive ranking/scoring of proposals needed at factor level
3. Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as against standards
4. Scoring and weighting should be accomplished at the factor and item levels consistent with the primary objectives/requirements of the weapon system
5. Technical risks too difficult to integrate into score
6. Present system tends to compromise the motivation for professional excellence in the evaluator
7. Upward flow of evaluation information constrained

SSAC group most representative of total respondents.
Co-Chairman group least representative of total respondents.
Satisfaction with current system increases with years experience.
SSAC and SSEB, as groups, answer similarly.
Factor group most convinced system compromises professionalism in evaluators.

Figure 17. Summary of Major Findings on the Source Selection Questionnaire

Question 5 -

Communication/interaction between technical and cost should be increased because:

1. Cost data should reflect technical and other risks
2. Technical design people could assist in improving cost models and programs
3. Cost data does not adequately reflect design, materials, and manufacturing processes

Satisfaction with present communication/interaction increases with years experience level.

Question 7 -

Influence and effects of CI upon:

1. Technical Evaluation

   a. Insures better evaluation through clarification of data
   b. Essential to insure equitable and accurate evaluation
   c. Creates excessive delays
   d. Use should be sharply reduced or eliminated

2. Risk Assessment

   a. Assists in identifying and assessing risks
   b. Tends to reduce risks

3. Scoring

   A slight majority indicated that the CI effects scoring by:

   a. Improving accuracy of scores
   b. Leading to inequities in favor of contractor in question

DR upon:

1. Technical Evaluation

   a. Essential to insure equitable and accurate evaluation
   b. Essential to assist in contract negotiations
   c. Leads to inequities in favor of contractor in question
   d. Creates excessive delays

2. Risk Assessment

   a. Assists in identifying and assessing risks
   b. Tends to reduce risks

3. Scoring

   The respondents were approximately equally divided between saying the DR has "no effects" and that it has "some effects". Those stating the DR has some effects stated:

   a. Improves accuracy of scores
   b. Leads to inequities in favor of contractor in question
   c. Cause higher probability of low score.

Figure 17. (Continued)

depth and format of the technical data submitted in contractor proposals. In addition, minimum documentation makes risks harder to identify and assess. Also, standards are too general and hard to apply.

In order to obtain clarification of the contractor data, the Factor evaluator uses the CI and DR to insure an equitable and accurate evaluation. This creates excessive delays in the technical evaluation process, but also assists in identifying, assessing, and reducing risks. Next, the Factor evaluator rates the proposal using the original data submitted by the contractor, since existing policy does not allow supplemental data provided in the CI/DR responses to influence the SSEB proposal rating or scores. The rating system used by the factor evaluator tends to force proposal scores to an average value. This, in turn, has a tendency, according to factor evaluators, to compromise the motivation for professional excellence in the evaluator.

2. Item Level

When the factor evaluators have completed the rating of a proposal, the Item Captain evaluates the narrative write-ups, reviews the CI and DR responses and prepares an Item summary report, which includes narrative assessment of the risks. Next, the Item Captain scores the proposal using the Factor ratings and narrative write-ups. The score should be based upon original data as submitted by the contractor; therefore, the CI and DR responses should not affect the score. However, policy states that,

> ... evaluation report narratives will include, and the scores will reflect, whether the evaluator considers the deficiency as an overlooked detail, easily correctable, or whether the required correction involves lengthened schedules, high risks, or cost changes (15, p. 12).

As best can be determined, the CI and DR are essential to insure an accurate and equitable SSEB technical evaluation, assist in identifying, assessing, and reducing risk, and actually affect the SSEB scores about 50% of the time. When the score is affected by the CI/DR, the result may be improved accuracy, inequities in favor of the contractor in question, or a higher probability of a low score. The uncertainty related to how the CI/DR affects the score is quite significant, as will be discussed later.

The official <u>scoring system</u> used by Item Captains tends to force the proposal scores toward an average value, and it is too difficult to integrate technical risks into the score.

3. Contract Negotiations

The Contract Definition team uses the DR's to identify major problem areas, actual or potential, and insures that these problems are satisfactorily considered in negotiations for a definitive contract.

4. Cost to the Government

The Cost team evaluates the cost data submitted by the contractor and prepares a summary report of its findings.

The cost data does not adequately reflect technical and other risks, nor does it adequately reflect the technical design, material and manufacturing processes.

5. SSAC Level

The SSAC uses the SSEB detailed evaluation report, summary of DR's, cost report, and definitive contract to analyze and evaluate each proposal. Weighting factors are applied to the raw scores in the SSEB evaluation report to obtain converted raw scores, which introduce a measure of relative importance to each item. Next, the SSAC is faced with the extremely difficult task of determining how the DR responses should influence the over-all assessment of the converted raw scores. The SSEB raw scores, to which the weighting factors are applied, may or may not have been affected by the CI/DR responses. This tends to make the SSEB raw scores of limited use to the SSAC in determining the influence and effects of the DR responses on the over-all evaluation. Furthermore, unless it is assumed that there was complete standardization relative to the CI/DR effects on the SSEB raw scores of all contractors, the usefulness of the "converted raw scores" to compare contractor proposals becomes limited. While at first, this may seem to be a reasonable assumption, there is a wide variance in the way Source Selection officials view the effects of the CI/DR on the SSEB scoring. The above may, at least in part, explain the reason that the selection of a contractor is frequently forced into a cost decision.

CHAPTER VII

THREE RELATED PROBLEMS

The major findings of the Source Selection Questionnaire identified three important and related problems associated with the Source Selection process. The three problem areas are SSEB technical evaluation, risk assessment, and scoring of contractor proposals. The purpose of this chapter is to discuss the nature of each problem area and how each is related to the others. In addition, the purpose of the chapter is to show that effective corrective actions for these problem areas are interdependent. The problem areas are discussed separately, but the interrelationships between the problems and the interdependence of required corrective actions are emphasized.

Technical Evaluation

The minimum documentation and prototype hardware development concepts of the present DoD management philosophy appear to have compounding effects on the difficult level of the SSEB technical evaluation. For example, prototype hardware makes it necessary to obtain and review more data, while minimum documentation tends to allow too much latitude in technical data requirements. Prototype hardware development requires a greater level of technical evaluation effort, while minimum documentation creates a variance in the depth and format of proposal data. Prototype hardware development places more emphasis on technical risks, while minimum documentation makes technical risks harder to identify and assess. While these rather contradictory results do not create an impasse, they make it very clear that the RFP requirements for data must be carefully tailored to the level of technical evaluation required and desired. It is certainly not the intent of the minimum documentation concept to limit or restrict data that is needed and used in the Source Selection decision process. It is the intent of minimum documentation to require selectivity in stating requirements for data. While it has been well recognized that the quality of source selection actions depend largely upon the quality of the RFP, the minimum documentation and prototype hardware concepts make the RFP document more crucial than ever before. In large measure, the success of the current DoD management philosophy is dependent upon immediate recognition of the need to more closely tailor the RFP to specific program needs <u>and</u> the management/contract approach employed.

The final report of the Air Force RFP Study Team provides key recommendations for improving the RFP. While the study tends to focus on the three-phase Contract Definition approach to Source Selection, its conclusions and recommendations are generally consistent with the current DoD management philosophy for minimum documentation and prototype hardware development. The impact of the problems associated with the SSEB technical evaluation which result from minimum documentation and prototype hardware can be substantially reduced by implementing the following recommendations paraphrased from this RFP study:

(1) Develop a Request for Proposal Manual to consolidate and clarify the instructions for preparing an RFP that are contained in approximately 38 different documents.

(2) Revise the existing regulatory material to eliminate the mandatory requirement for submission of various "ility" plans, and to allow the RFP to require data only in those areas which are pertinent to the Source Selection and definitive contract for a specific program.

(3) Require that the RFP include detailed evaluation criteria organized into areas, items, and factors along with a narrative definition which will identify matters of major significance in the order of relative importance.

(4) Require that the RFP specify that the use of cross-indexing of proposal parts to evaluation criteria.

(5) Require that technical proposal formats and

guidance as to their use be included in the RFP (22, pp. 7-26).

The first two recommendations, if implemented, should result in vast improvements in the over-all quality of RFPs. Specifically, it could eliminate fragmented, inadequate, and duplicated instructions which often result in a "shot gun" approach to specifying data requirements in the RFP, which in turn causes the generation of considerable proposal data which is unnecessary. In addition, it would authorize the SPO to be selective in requiring data associated with approximately 50 "ilities", such as Reliability, Maintainability, Configuration Management, Maintenance, Supply, etc. This could result in meeting the intent of the Minimum Documentation Concept, and at the same time focus more attention on the specific technical data requirements necessary to satisfy program objectives and accomplish the SSEB technical evaluation. This should reduce the problems of too much latitude in data requirements, and variance in the depth of technical data in proposals. In short, it would allow more emphasis on tailoring the data requirements to the particular program objectives, and result in proposal data more consistent with the level of technical evaluation desired and required.

Implementation of the third recommendation would generally enhance the effectiveness of the over-all technical evaluation. In addition, it would substantially assist the SSEB evaluators in identifying and assessing risks related to the most important aspects of the weapon system objectives. The intent of this recommendation appears to require that the RFP specifically include a narrative description of detailed evaluation criteria down to the factor level, and that the relative importance of these factor level evaluation criteria be specified. Implementation of this recommendation would tend to force greater emphasis on establishing evaluation criteria and would most likely result in more responsive and satisfactory proposal data. With detailed evaluation criteria, more responsive proposal data, and relative orders of importance, the difficulty of identifying and assessing risks should be reduced. Furthermore, the effectiveness of the over-all technical evaluation should increase.

Implementation of the fourth and fifth recommendation would significantly reduce or eliminate the variance in proposal data formats and result in more timely and accurate technical evaluations.

The problems of the SSEB technical evaluation relative to the minimum documentation and prototype hardware concepts make it extremely important that the above recommendation by the Air Force RFP Study Team be implemented. It will be shown later in this chapter that recommendation number three above is also vital to an improved SSEB scoring system.

Risk Identification and Assessment

SSEB risk identification and assessment is perhaps the most difficult and nebulous activity in the Source Selection process. There are no official criteria established to help determine what actually constitutes a risk, and what the differences are, if any, between a "risk" and a "weakness". Furthermore, there are no established procedures for quantitatively assessing the impact of a risk once it has been identified. The layman, in reading the regulatory and procedural material relating to Source Selection, may be convinced that risk analysis and assessment in the SSEB/SSAC is a separate and perhaps rigorous quantitative process. Those familiar with the Source Selection activity know that this is not the case. Moreover, they realize that some of the complex interactions of multiple program variables, the time dependent nature of unanticipated unknowns relative to hardware integration and testing, and the many intangible aspects that are simply unquantifiable make it impossible to be precise in assessing the total program risks either qualitatively or quantitatively, particularly when the source selection action occurs. This is not to imply that SSEB and SSAC members do not identify and assess the impact of actual risks associated with contractor proposals. Nor does it imply that evaluators do not recognize the need for identifying and assessing the impact of program risks. It simply says that while improvements are needed in the Source Selection process to identify and quantitatively assess technological, schedule, and cost risks, it is unrealistic to expect that all program risks can be anticipated, identified, and precisely quantified.

The major findings of the Source Selection questionnaire confirm that risk analysis and assessment is a major concern of evaluators. Minimum documentation makes the technical evaluation more difficult because technical risks are harder to identify and assess. Prototype hardware development makes the technical evaluation more difficult because more emphasis is placed upon technical risks. The interaction between cost and technical personnel should be increased because cost data should reflect technical and other risks. The CI/DR responses assist in identifying and assessing risks, and also tend to reduce risk. The present rating/scoring system should be modified because technical risks are too difficult to integrate into the score. These findings indicate that SSEB/SSAC evaluators consider risk analysis and assessment to be an integral part of the Source Selection evaluation and scoring process (referred to in Chapter VI).

Air Force Manual 70-10 requires that technical areas should be initially evaluated without reference to associated costs, but that high risk areas must be made known to the appropriate teams so that cost impact can be properly evaluated. Cost risk should be assessed to determine the probability of future cost variances on proposals with high technical risk. Air Force Manual 70-10 also requires that the SSEB narrative and scores reflect whether the evaluator considers proposal deficiencies to be easily correctible, or whether the required correction involves lengthened schedules, high risk, or cost changes. The manual further requires that the SSEB evaluation will assess the probability of success of each proposal (15, pp. 10-16). It is interesting to note that the only mention of risk in the Air Force RFP study was the finding that, "... the greatest risk areas should be weighted the heaviest". This was identified as an essential factor in the Source Selection process through interviews with key source selection officials (22, p. II-3).

The ASD guide for preparing the SSAC and SSA briefings recommends that the strengths, weaknesses, and risks for each item be presented (20, p. 238). Because of the time element, the SSEB must be continually pointing toward the SSAC briefing as the evaluation proceeds. It is, therefore, expedient to tailor the factor, item, and area write-ups to be compatible with the SSAC briefing format. Thus, the factor narratives and summaries attempt to identify and evaluate the proposal strengths, weaknesses, and risks. Since the procedural mechanics are simply not geared to permit an integrated process of identifying and quantitatively assessing and scoring risks in the SSEB, the SSAC must rely upon narrative discussions, value judgments, experience, and over-all knowledge to assess the importance of the risks identified. There is no question in the writer's mind that the SSEB and SSAC do, in fact, identify and assess the great majority of high risk problem areas associated with contractor proposals. The writer is equally confident that a systematic approach to quantify and assess the probabilities of success, impacts on schedule and costs, and impacts on performance requirements of high risk problem areas would assist the SSAC in its analysis and evaluation. Perhaps the greatest value of a quantitative risk assessment capability would be a measure of smaller, but cumulatively important, problem areas where there is some degree of uncertainty involved.

Effective risk assessment in the SSEB process is dependent upon knowledge and understanding of the critical program requirements, proposal data that is responsive to critical program requirements, and procedures which define the purpose, scope, and approach of the risk assessment activity. In addition, the risk assessment activity must be integrated into the established evaluation and scoring process since risks are an integral part of the technical, schedule, and cost problems.

SSEB Scoring System

The third major problem area is the inadequacy of the present SSEB scoring system. As mentioned above, technical risk is too difficult to integrate into the score. In addition, the present rating/scoring system tends to cause the proposal scores to be clustered in a narrow range about the average value. The most likely reason for this is the fact that the Factor member, who performs the most detailed evaluation, has only three symbols available for rating the proposal - one to indicate an above average, average, and below average rating. The ASD Source Selection Process Manual states that this approach is used because in previous SSEB's the quantitative assessments at the Factor level were additively reflected as the Item score, and that this process tended to obscure serious deficiencies and/or decided assets in the proposal (20, p. 176). Air Force Manual 70-10 explains the same thing by saying that if the 10 points normally assigned to each item are prorated among the factors, the impact of each factor on the item as a whole will depend largely upon the number of factors involved - and failure of one of these factors to meet the standard may be overlooked when the item score is mathematically derived (15, p. 17). While the present rating/scoring system may solve the previous problem, it creates a new one just as serious by prohibiting adequate discrimination in the assessment of the proposals.

Present policy requires the SSAC to establish weighting criteria and apply weights to the Areas and Items scored (15, p. 12). Since ASD does not score areas, the SSAC establishes and applies weights to Items, the only functional level receiving a score. Special precautions are taken to insure that the SSEB members are not made privy to the weighting criteria (20, pp. 184-188). The entire scoring system is, therefore, designed for a possible 10 point score for each SSEB item so as to be compatible with the application of the established weighting criteria by the SSAC. Any procedure for quantitative scoring below the item level must, therefore, be compatible and consistent with the over-all item scoring and SSAC weighting process. Since the previous attempts to quantitatively score proposals at the factor level were apparently not compatible and consistent with the over-all scoring/weighting process, the three-symbol factor rating system was developed to eliminate factor scoring. In the following paragraphs, the writer will attempt to show that it is primarily the current policy for weighting and scoring that constrains the effectiveness of the source selection scoring process.

As mentioned earlier, the Air Force RFP Study Team recommended that the RFP include evaluation criteria organized into areas, items, and factors along with a narrative definition which will identify matters of major significance in the order of relative importance. In addition, the RFP Study Team recommended that:

(1) Detailed scoring standards be included in the RFP.

(2) Existing directives should be revised to allow re-scoring of proposals after correction of deficiencies in the absence of technical transfusion (22, pp. 17, 41).

All of the above recommendations are contrary to current policy and/or practices. At the same time, they are considered by the writer to be the key actions required to develop and implement an improved SSEB scoring system. The first two recommendations by the RFP Study Team have at least two major effects. The first is that it would tend to improve the responsiveness of proposal data to the critical needs of the program, thereby enhancing the effectiveness of the evaluation and scoring process. The second is that it would require greater continuity between the RFP, Evaluation Criteria, and Weighting Criteria. This should result in a much improved evaluation and scoring plan. Inclusion of significant matters of relative importance at the factor level should result in the establishment of weighting criteria at the factor, instead of item level. Weighting criteria at both levels would result in distortion of the scores, and weighting the factor level is a vital key to an improved scoring system as will be shown later. Presently, the SSAC establishes the weighting criteria for items after the RFP has been written, distributed, and while the companies are preparing proposals for submittal (20, p. 43). The third recommendation by the RFP Study Team calls for re-scoring proposals after evaluating the CI/DR responses. The scoring system could be designed to effectively accomplish this, and the gross uncertainty surrounding the effects of the CI/DR on scoring dictates that some significant changes are in order to resolve this problem area.

The major findings of the source selection questionnaire revealed strong support for modifying the present scoring system so that:

(1) More definitive ranking/scoring of proposals is accomplished at the factor level.

(2) Emphasis be placed upon factor and item evaluators to rank proposals against each other as well as against standards.

(3) Scoring and weighting can be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system.

All of these suggestions for modifying the present scoring system would require changes that are contrary to existing source selection policy. Policy prohibiting scoring at the factor level was discussed previously, as was the policy limiting the application of weighting criteria to item levels as strictly an SSAC function. Policy also prohibits that proposals be evaluated against one another (15, p. 10). Thus, suggestion number 2 above also conflicts with present policy.

The suggestions for modifying the present scoring system resulting from the Source Selection Questionnaire are consistent with the RFP Study recommendations and are considered to be essential to allow development and effective implementation of an improved scoring system. In order to achieve more definitive scoring at the factor level, where the most detailed evaluation occurs, the scoring system must focus on that functional level. The key to focusing the scoring system at the factor level is to establish weighting criteria for that level. Having established the weighting criteria at the factor level, and specifying in the RFP the matters of major significance in order of relative importance, the framework would exist for applying the weighting criteria at the factor or item level. In addition, basing a more definitive SSEB scoring system at the factor level would facilitate the integration of technical risk scoring into the over-all process where the technical expertise is greatest. The item evaluators could be used to validate the basic scores, assess the probability estimates associated with areas of risk, assess the impact of interaction between factors, eliminate redundancies, and consolidate the proposal score. The area Co-Chairman could provide the same overview and consolidation as they presently do, and be responsible for rescoring the proposal based upon the CI/DR responses. Ranking of proposals per se would essentially be accomplished by a more definitive scoring system at the factor level.

Conclusions

Implementation of the Air Force RFP Study Team recommendations discussed in this chapter are considered essential to improved contractor proposals and more effective source selection evaluation and scoring. Of equal importance is the need to develop and implement an improved capability within the Source Selection process to quantitatively assess the adequacy of contractor proposals. The key to developing and successfully implementing a more effective scoring system is the establishment of weighting criteria at the factor level. This would permit a definitive scoring process at the functional level where the detailed technical evaluation occurs. If standards and the relative importance of significant matters at the factor level are included in the RFP, it would be logical to have the weighting criteria applied at the factor or item level. Basing the definitive scoring system at the factor level would better facilitate the integration of risk consideration into the scoring process. These conclusions are the basis for the integrated risk assessment and scoring model and procedural methodology developed in Chapter VIII.

CHAPTER VIII

INTEGRATED RISK ASSESSMENT/SCORING MODEL

Introduction

The purpose of this chapter is to present a model and procedural methodology to quantitatively integrate the risk assessment and scoring processes in the SSEB. The model and methodology are tailored to source selection actions for major weapon systems within ASD. The over-all process developed here is generally tailored to the single-phase source selection activity associated with the current DoD management concepts of minimum documentation and parallel prototype development. However, the process is designed to be compatible with the three-phase Contract Definition approach to programming through the Program Decision/ Validation Phase of the R & D cycle. The writer attempted to develop the model and methodology to be consistent with the current Air Force emphasis to improve Conceptual Phase planning and documentation up through and including the RFP. In addition, every effort was made to design a process adaptable to the approaches which this writer considers to be the most promising for risk assessment in the Conceptual Phase. Two very promising approaches for risk assessment in the Conceptual Phase are the works of Rogers (23) and Tillman (24).

Any evaluation and scoring system used in the SSEB must be flexible enough to allow close tailoring to the specific requirements and primary objectives of the weapon system described in the RFP. On the other hand, the evaluation and scoring system must be somewhat standardized to insure that evaluators can maintain a basic familiarity with the process used so as to assure timely, equitable, and accurate assessments of proposals. The activity which attempts to complement both the flexibility and familiarity conditions is the establishment of the Evaluation and Weighting Criteria. These criteria serve as a mechanism to link the RFP to the SSEB evaluation and scoring system and allow evaluators to synthesize the various aspects of a program into a narrative and quantitative basis to assist the Source Selection decision makers.

In addition to being flexible and familiar, the SSEB evaluation and scoring system should be designed to obtain maximum utilization and benefit from the detailed evaluation effort at the factor level. That is, the narrative and quantitative assessments at the factor level should be such that the maximum amount of definitive information relative to the proposals is presented in a clear and concise manner. To the extent possible and practical, the scoring system should provide an integrated quantitative assessment of a proposal's strengths, weaknesses, and risks. It is in this particular area that the present SSEB scoring system is inadequate.

The basic philosophy of an integrated risk assessment and scoring model is that uncertainty is inherent in developmental programs and that proposal scores should reflect, to the degree possible, an assessment of that uncertainty. The SSEB detailed evaluation of a proposal may identify many strengths and weaknesses that vary, in terms of impact on the program, from minor to major importance. Likewise, the probability of success or failure resulting from these particular strengths and weaknesses may vary from near 100% to near zero. Risk to the program associated with a proposal must, therefore, be measured in terms of the actual or expected impact of both strengths and weaknesses, and the likelihood or probability of success or failure. In order to obtain a quantitative measure of the cumulative effects of the potential strengths and weaknesses of a proposal, it is essential that the risk analysis effort be integrated into the over-all scoring process. If this is not done, the factor and item evaluators cannot effectively synthesize the extremely large volume of evaluation data. Moreover, unless the detailed evaluation and analysis work of the factor and item evaluators is reflected in a definitive and quantitative presentation, the SSAC is not able to effectively benefit from the work accomplished. The basic approach used in developing the model and methodology in this chapter is based upon the major findings and conclusions in the previous chapters of this study.

Critique of Initial Risk Model

The initial risk model developed in Chapter V proved to be a basically sound approach for assessing the technological and operational weaknesses in a proposal that were considered to be risk elements. The approach insured that all risk elements, large and small, were considered in arriving at a total risk assessment. However, since the model was not integrated into the SSEB process, it was necessary for the writer to determine what was to be identified as a risk element and what was not. This obvious weakness in the model was overcome by including as risk elements essentially all the "weaknesses" and "risks" identified in factor narratives. The output of the model tended to support the proposition that such an approach will result in a definitive quantitative assessment of the proposal's relative technological merits. Since the assessment of proposal strengths was not included in the initial risk model, it may appear that assessing proposal weaknesses alone will adequately identify the most satisfactory proposal(s). Such a conclusion is considered to be invalid, but it does appear that the weaknesses of a proposal will tend to have a greater impact on the over-all score than will the strengths of a proposal.

A significant weakness of the initial risk model was the fact that for each risk element, the characteristics A and B (the "nature" and "corrective actions required" for the risk element) were assessed by one person, the writer. While this undoubtedly tended to weaken the credibility of the assessment for this program, the results of the effort should support the credibility of the approach taken in the initial risk model. The assessments of characteristics A and B were accomplished by reading the complete factor narratives, which indicates that the basic information is there if some system were employed to extract and quantitatively synthesize it.

The method used to relate the impact of the risk elements (weaknesses and risks) to the primary operational objectives of the weapon system was effective but far from optimum. This was, in effect, a form of weighting the importance of factors to the over-all program or system objectives. The only thing wrong with this approach is that it should be integrated into the total process. That is, the SSAC should actually accomplish this in the form of weighting criteria at the factor level. The important thing to recognize is that the approach used in the initial risk model proved that it is both feasible and effective to relate risk elements, identified at the factor level, to the primary system objectives by weighting criteria at the factor level.

The method used to determine redundant risk elements in the initial risk model is considered to be unsatisfactory, since again this was accomplished by only one person, the writer. This simply points out that to insure knowledgeable and accurate assessments, the effort must be integrated into the over-all SSEB evaluation process. This particular function could perhaps be accomplished most effectively by the item level evaluators. The basic approach used in the initial risk model to insure that redundant risk elements are not assessed at double or triple their actual impact is considered sound and essential to accurate and equitable evaluations.

The initial risk model did not attempt to assess the probability of failure of each risk element, nor did it attempt to assess the impact of risk elements on the schedule and cost considerations. While these aspects were infeasible to attempt in the initial risk model, they are important considerations in any risk analysis effort in source selection actions. Still another aspect that the initial risk model did not consider is the particular <u>strengths</u> of a proposal. It is quite possible that while a proposal may have numerous weaknesses that create a significant degree of unfavorable risk, it may also have strong points that would tend to significantly off-set the weak points. A comprehensive risk analysis and scoring model should consider both strengths and weaknesses.

The integrated risk assessment and scoring model developed in this chapter will incorporate the basic approach of the initial risk model, but will modify and expand it to attempt to eliminate its shortcomings and broaden its scope and effectiveness.

Ground Rules for Model

In order to develop a methodology and model for scoring that is capable of providing improved quantitative measures of the detailed SSEB evaluation effort, including risks, it is necessary to construct a foundation of underlying ground rules upon which to build the model. This section presents the ground rules for the integrated risk assessment and scoring model, along with a discussion of the rationale for each ground rule. The model and procedural methodology developed to implement it are designed to replace the present source selection scoring system and process. It is important to note, however, that the basic approach and methods used by evaluators to actually perform the detailed analysis and evaluation of proposal data remains essentially the same. The changes to the SSEB and SSAC scoring process required by the model are designed primarily to facilitate more definitive risk assessment and scoring of the detailed evaluation at the factor level.

<u>Ground Rule 1</u>: The integrated risk assessment and scoring model, hereafter referred to as the scoring model, will be initially designed to score only the technical and operations areas.

The technological and operational aspects of a proposal provide the vast majority of identifiable strengths and weaknesses that are of major importance to the source selection action. The scoring model will, therefore, be initially limited to scoring the technical and operational areas. After the model and procedural methodology is fully described, the model will be modified to provide the capability for scoring the logistics and management areas in a manner that will allow consolidation of all area scores into a total proposal score, if desired. Until otherwide noted, the scoring model described and developed will pertain only to the technical and operations areas.

Ground Rule 2: The SSEB process of detailed evaluation and narrative analysis and assessment of proposal data at the factor level will remain the same except that risks, per se, will not be itemized in the summary.

The factor level evaluators will continue to perform a detailed evaluation of proposal data relative to established standards. The data requested in the RFP and the standards should be consistent with the level of relative importance of that factor and the depth of technical evaluation desired and required. The narrative analysis and assessment at the factor level will stress the proposal strengths and weaknesses as in the past, but the risks will not be itemized separately. Instead, a risk analysis at the factor level will be incorporated into the evaluation of various strengths and weaknesses of the proposal.

<u>Ground Rule 3</u>: Weighting criteria will be established at the factor level.

The SSAC will establish weighting criteria at the factor level based upon the direct or indirect impact that individual factors have on the primary operational objectives of the weapon system. Detailed discussions of the reasons for this are presented in Chapters VI and VII. The primary reason is to allow more definitive risk assessment and scoring at the factor level. While it may be feasible to establish weighting criteria at both the factor and item level, such an approach would appear to be impractical since it would tend to cause a double weighting of each factor. For this reason, weighting at the item level will be eliminated in this model.

<u>Ground Rule 4</u>: Definitive risk assessment and scoring will be accomplished at the factor level.

The SSEB scoring activity will be focused at the factor level for reasons which are discussed in detail in Chapters VI and VII of this study. The primary reason is to achieve maximum utilization and syntheses of detailed evaluation information in quantitative terms. The risk analysis and assessment performed by factor evaluators will be accomplished progressively during the course of the detailed analysis and evaluation of the proposal data. This effort will result in an initial factor score.

Ground Rule 5: The scoring model has one basic parameter, which will be called an attribute. An attribute is any particular identifiable feature of a proposal that has the potential for causing a factor to exceed and/or fail to satisfy the established standard. Each attribute of a proposal will be scored separately at the factor level based upon the scoring model criteria. The sum of the scores for each attribute in a factor will determine the initial factor score.

An attribute is what in the past has been termed a strength, weakness, or risk in factor narratives. It is possible, even probable that some attributes of a proposal will have the potential to benefit the system if it is successful, but also the potential to detrimentally affect the program if it fails. It is also probable that an attribute could potentially benefit the system if it is successful, but would not adversely affect the system if it fails. Likewise, an attribute could have detrimental effects if it fails but no particular benefits if it does not fail. The scoring model must be designed to account for the various characteristics of an attribute relative to its potential strength and/or weakness, and also the probability of success and failure. Summing the individual scores for each attribute will insure that the cumulative effect of all of a proposals strengths and weaknesses of varying importance will be incorporated into the initial factor score.

<u>Ground Rule 6</u>: Item Captains will insure that redundant attributes are eliminated and the initial factor scores are adjusted accordingly. This is necessary to insure that certain attributes are not scored at double or triple their actual impact on the system.

<u>Ground Rule 7</u>: Item captains will apply the established weighting criteria to the initial factor scores. Applying weighting criteria to the factor scores is necessary to insure that the factor scores, and the resultant proposal scores reflect the impact of proposal strengths, weaknesses, and risk analyses on the primary objectives of the weapon system. Item and area scores will be derived by the cumulative totals of factor scores.

<u>Ground Rule 8</u>: The factor evaluators will incorporate responses to CI's into the scoring of individual attributes, but will not incorporate DR responses into the scoring model in any way. The factor evaluators should not be made privy to DR responses until after the initial factor score is completed and submitted to the Item Captain.

It is essential that the process of issuing and obtaining contractor responses to CI's be streamlined and expedited to enable the factor evaluator to incorporate the CI response into the score. If this is not considered feasible or satisfactory to the program management, the CI should be discontinued and only DR's written.

<u>Ground Rule 9</u>: Area Co-Chairmen will incorporate the

responses to DR's into the scoring model and rescore the proposal as appropriate. The SSEB Evaluation Report will include the original factor, item, and area scores and also the results of rescoring as a result of the DR responses.

Ground Rule 10: Weaknesses in a technical factor that are determined to involve a "substantial" degree of risk will be coordinated with the cost and management areas to determine the impact on cost and schedule estimates.

The criteria for a "substantial" degree of risk will be developed and described later. This activity will take place at the item level to avoid the possibility of redundancy.

Figure 18 presents a flow diagram of the general scoring process described by the ground rules.

Criteria for the Scoring Model

It was necessary to establish specific criteria to provide the framework for the scoring model. The basic parameter of the scoring model will be called an attribute. As discussed earlier, an attribute is any particular identifiable feature of a proposal that has the potential for causing a factor to exceed and/or fail to satisfy the established standard. The key to identifying attributes of a proposal is for factor evaluators to simply continue using the present procedures for identifying notable strengths and weaknesses in the course of their detailed analysis and evaluation of proposal data. Since an attribute may have

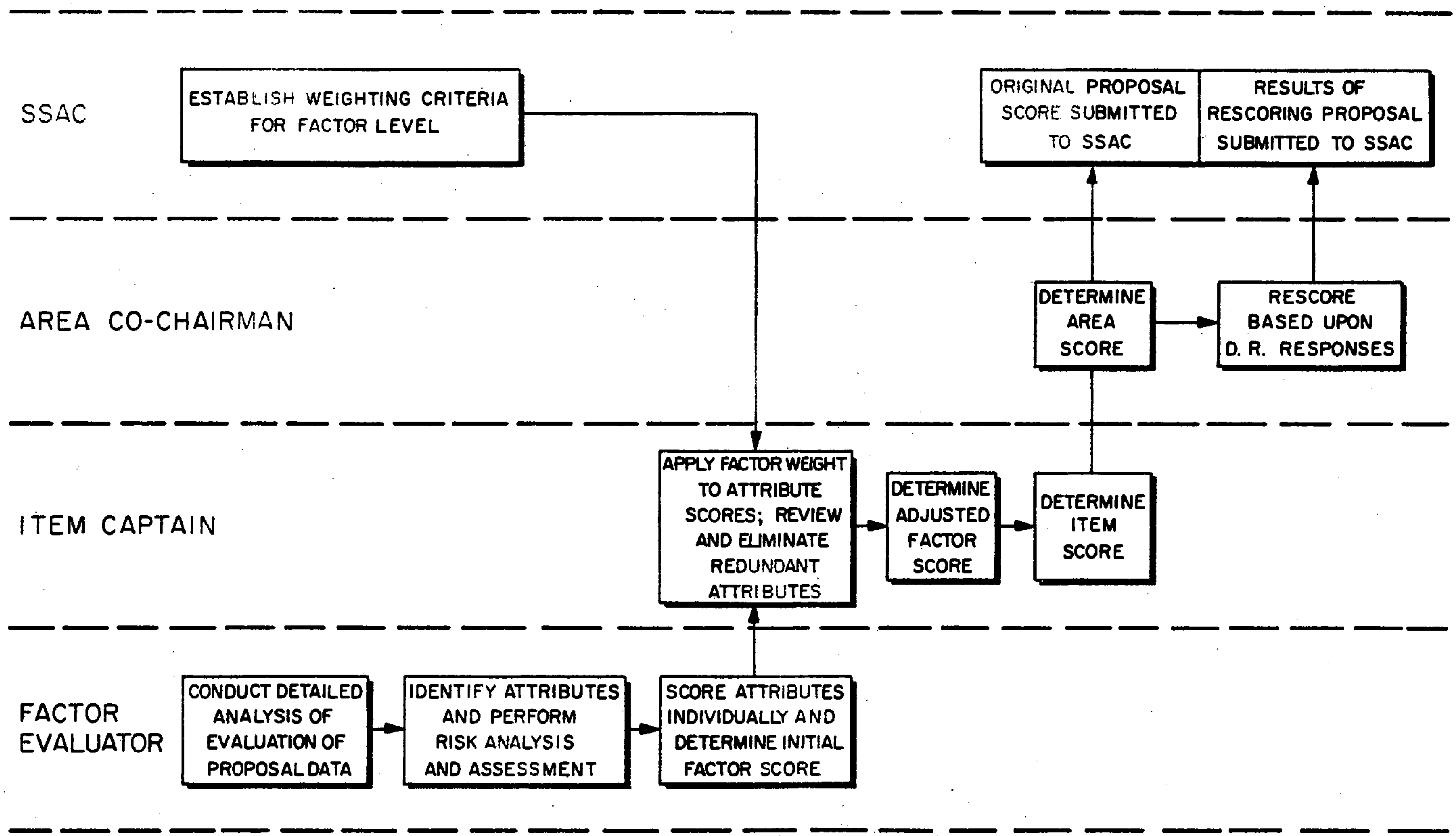


Figure 18. General Scoring Process

the potential for both beneficial and detrimental affects, three independent characteristics of each attribute will be evaluated. These three characteristics are the nature, the strength, and the weakness of the attribute. The separate criteria developed for each of these characteristics will provide the primary framework for the scoring model. Weighting criteria established by the SSAC for the factors will complete the framework for the scoring model.

Figure 19 presents an over-all sketch of how an attribute is scored by a factor evaluator by determining the category and numerical value for each of the three characteristics of an attribute. Notice that when the nature of the attribute has been determined, the value associated with the nature is applied to both the strength and weakness characteristics of the attribute. Notice also that the strength and weakness characteristics each have two major properties. The two major properties of the strength of an attribute are the "benefits of success" and the "probability of success". Similarly, the two major properties of the weakness of an attribute are the "impact of failure" and the "probability of failure". While the three characteristics of an attribute are independent, there are two distinct interrelationships between them which permits an assessment of the over-all importance, or degree of risk for the attribute. The first is that the nature of the attribute is common to both the strength and weakness characteristics. The second is that the probability of the attribute, P(A),

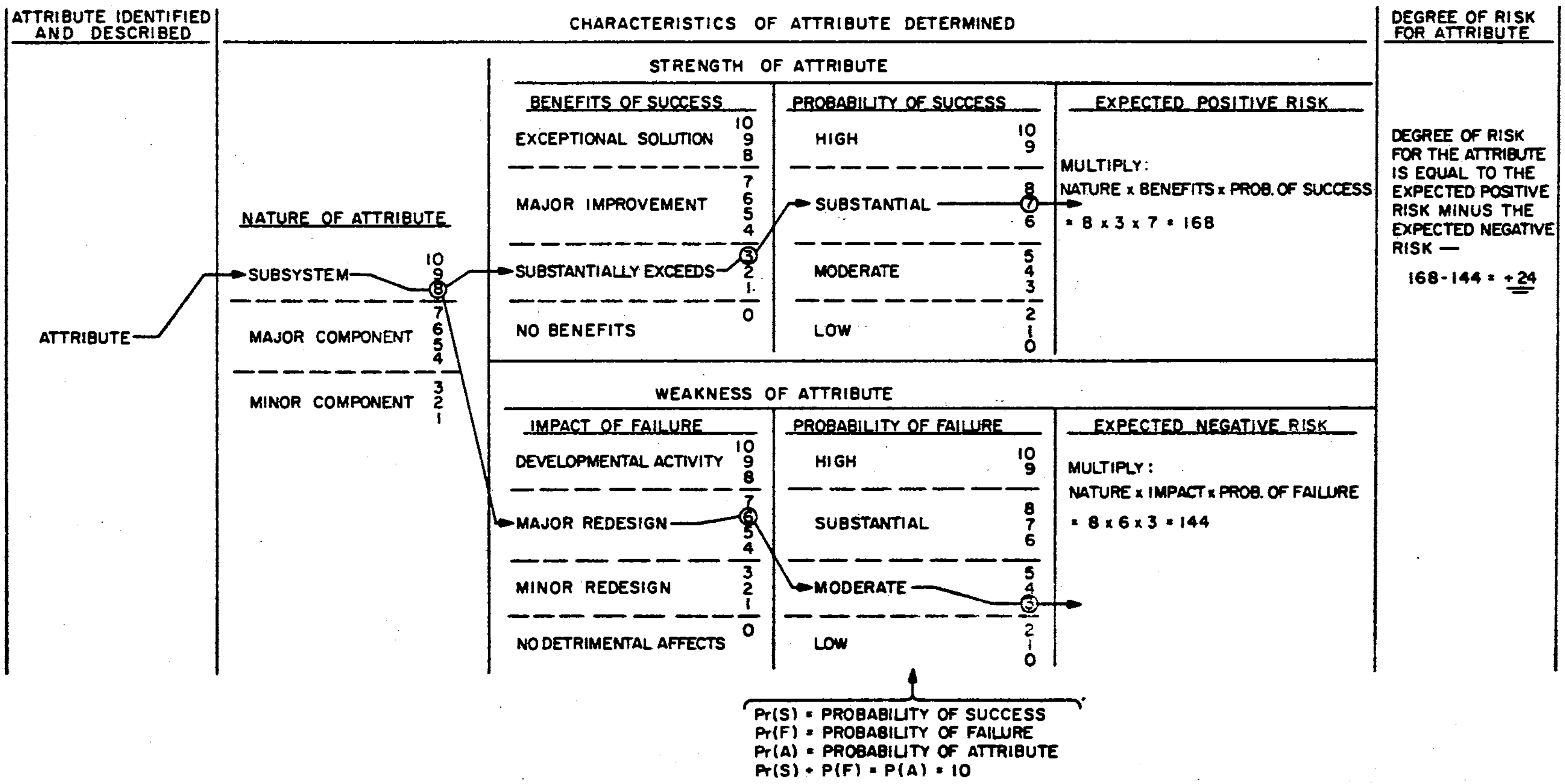


Figure 19. Factor Scoring by Attribute

is always equal to 10, and the sum of the probability of success, P(S), and the probability of failure, P(F), is always equal to the P(A).

The example of the attribute shown in Figure 19 resulted in a degree of risk value of +24. It is quite obvious, however, that any particular attribute could result in a value for the degree of risk which is either zero, positive, or negative. The degree of risk value for each individual attribute will be algebraically summed to derive the initial factor score.

A detailed discussion of the specific criteria established for the three characteristics of an attribute, and the weighting criteria for factors is presented in the following paragraphs.

Nature of Attribute

In order to develop a manageable approach to integrating risk assessment into the scoring process, it is essential to select a common basis upon which to establish the risk and scoring criteria. In both the technical and operations areas, the primary concern is with the technological and operational aspects of the air vehicle hardware. Therefore, the air vehicle hardware provides an excellent basis upon which to establish the risk and scoring criteria.

The nature of an attribute is the characteristic which describes the attribute in terms of the scope, type, function, and/or complexity of the air vehicle hardware, or hardware design directly involved and/or affected by the attribute. The nature of an attribute is basically a measure of its importance in terms of the extent to which the air vehicle hardware or hardware design is involved or affected. In other words, an attribute of a proposal may have the potential for being an important strength and/or weakness. The nature of the attribute defines the air vehicle hardware or hardware design that is directly involved and/or affected by this attribute. The nature is independent of the degree or difficulty of the corrective action required if the attribute fails, or the degree of benefits accrued if the attribute succeeds.

An example of the nature of an attribute is as follows. If the particular attribute is that the gun exhaust gases may be injected into the engine which could cause a flame-out, the nature of the attribute could be the gun and the engine. The nature says <u>nothing</u> about the corrective action alternatives. The corrective action required may be to move the gun, move the engine intake, or to simply deflect the gun gases away from the engine intake.

Evaluators must use a large measure of common sense in determining the nature of an attribute. For example, a factor such as "Aircraft Performance" in the technical area may not specifically relate to any particular air vehicle hardware, but practically any attribute identified in this factor may involve major portions of the aircraft hardware. An attribute in this factor might be that the single engine rate of climb seriously fails to meet the standard. Such an attribute is obviously relatable to various aspects of the hardware such as airframe, propulsion system, etc. Evaluators must keep in mind that the nature of the attribute is a measure of its importance in terms of the extent to which the air vehicle hardware or hardware design is involved. If the attribute has the potential for both beneficial and detrimental affects, the nature should reflect a "hardware basis" that is relatable to both the strength and the weakness of the attribute.

Specific criteria were developed to categorize the nature of an attribute. The evaluator will determine the nature of a particular attribute by selecting from these criteria the category that best fits the attribute. The categories and scoring criteria for the nature of an attribute are as follows:

CATEGORIES	SCORING CRITERIA
Subsystem	10 9 8
Major Component	7 6 5 4
Minor Component	3 2 1

The description of each category for the nature of an attribute is as follows:

(1) Subsystem. A major assembly of parts joined together or interdependently related so as to

perform a specific key function necessary and essential to the performance of the over-all weapon system. A subsystem would normally involve hardware associated with two or more factors, and may even involve multiple items. An example of the nature of an attribute that could be categorized under "subsystem" would be a complete hydraulic system if the hydraulic system is extremely complex, poorly designed, and underpowered. Another example which could be greater in importance would be the propulsion and airframe if there was a problem associated with the engine/airframe compatibility. Still another would be the entire propulsion system when there is a problem of insufficient power of the aircraft engine(s) to meet operational specifications and accessory drive requirements.

(2) Major Component. A part or particular group of parts within a subsystem which, by nature of its materials, design, and/or fabrication, is absolutely essential to the performance of the subsystem of which it is a part. A major component would normally involve hardware in one factor, but may involve hardware in two or more factors. A major component will involve hardware in a single item only. An example of

the nature of an attribute could be the ejection seat, where the attribute was some strength or weakness of the in-flight egress system. Another example could be the design approach to the fuel system piping, tankage, single point refueling, defueling, etc., where the attribute is some notable strength or weakness in design. Depending on the scope of the hardware affected by this attribute in the last example, its nature might be categorized as "subsystem".

(3) Minor Component. A part or particular group of parts within a subsystem which, by nature of its design and fabrication, play a supportive role to the primary function of the subsystem of which it is a part. A minor component does not involve extensive hardware, hardware design, complexity, or functional aspects. An example of an attribute whose nature would be categorized as "minor component" could be the type or amount of protective armor to be used. Another example could be an attribute involving an important but relatively small portion of the hydraulic system or flight control system hardware or hardware design. Another example could be an attribute involving

some portion of the aircraft brakes or braking system.

Strength of Attribute

The fundamental basis of the specific criteria for both the strength and weakness of an attribute is derived from the definition of an attribute. An attribute is any particular identifiable feature of a proposal that has the potential for causing a factor to exceed and/or fail to satisfy the established standard. Therefore, if success of the attribute would result in just satisfying (not exceeding) the standard, the attribute would be considered to have no strengths. This could occur when an attribute has the potential for detrimental affects if it fails, but offers no benefits other than just meeting the standard if it does not fail.

It is important to keep in mind that the strength of an attribute is an independent characteristic. That is, the strength of the attribute is not dependent upon the nature or the weakness of the attribute. The strength is a measure of how much better the proposed weapon system has the potential for being as a result of the success of the attribute. If the success of the attribute has the potential for simply satisfying the minimum requirements of the standard, its value, in terms of strength, would be zero. On the other hand, if success of the attribute has the potential for significantly improving some aspect of the weapon system, its value in terms of strengths would be some value greater than zero.

In developing specific criteria for the strength of an attribute, it was necessary to create some means whereby the uncertainty associated with the potential benefits of the attribute could be evaluated and integrated into the model. This was accomplished by dividing the strength of an attribute into two properties. The first property is the "benefits of success" of the attribute, and the second is the "probability of success" of the attribute. Separate criteria was established for these independent properties, and the factor evaluator will determine the strength of an attribute by selecting from these criteria the categories that best fit the attribute. The property categories and scoring criteria for the strength of an attribute are shown in Figure 20.

The description of each category for the benefits of success of an attribute is as follows:

(1) Exceptional Solution. The attribute shows evidence of an exceptional solution to a technical and/or operational requirement. The evidence may be a rare technical approach, an unusually effective trade-off alternative, or an extraordinary or uncommon innovation which has the potential for significantly improving the suitability, utility and/or performance of the hardware

Benefits of Success		Probability of Success	
Category	Scoring Criteria	Category	Scoring Criteria
	10		
Exceptional	9	High	10
Solution	8		9
	7		8
Major	6	Substantial	7
Improvement	5		6
	4		
	3		5
Substantially	2	Moderate	4
Exceeds	1		3
No Benefits	0	Low	2
			1
			0

Figure 20. Properties of Attribute Strength Characteristic

involved. This category should be used when the company's proposal clearly demonstrates unusual initiative in seeking new and effective ways to satisfy technical or operational requirements.

(2) Major Improvement. The attribute offers some unique device, process, or approach which has the potential for important savings of time and material, or which may notably improve the suitability and utility of the hardware involved.

(3) Substantially Exceeds. The attribute offers a technical approach, design, and or combination of hardware that has the potential for substantially exceeding the standard. This category should be used when some aspect of the proposal is particularly noteworthy and contributes to exceeding the minimum standard; for example, some "stimulative" requirement has been satisfied in a manner that is considered to be worthy of mention by the evaluator.

(4) No Benefits. The attribute offers no particular benefits other than meeting the minimum requirements of the standard.

The probability of success of an attribute is simply an estimate of the likelihood that it will succeed in accomplishing that which is proposed. The probability of success must be determined by the factor evaluator by evaluating the attribute relative to the proposal data, his knowledge of the state-of-art, historical information, and his overall experience and technical expertise. This will obviously require an element of judgment and decision-making that the factor evaluator is not accustomed to quantifying. This would be the case, however, with whomever was required to estimate the probability of success and express it quantitatively. The factor evaluator is, by the nature of his experience, education, and functional responsibility, considered to be best qualified to estimate the probability of success and the probability of failure of an attribute. This statement is supported by Helmer in his discussion of the role of expertise in prediction. He states that

> ... the expert has at his ready disposal a large store of (mostly inarticulated) background knowledge and a refined sensitivity to its relevance, through the intuitive application of which he is often able to produce trustworthy personal probabilities regarding hypotheses in his area of expertness (24, p. 38).

The sum of the probability of success and the probability of failure of an attribute always equals 10 (the probability of the attribute). Therefore, a reasonable approach for the factor evaluator would be to first estimate the probability of that characteristic about which the most can be determined. That is, if the attribute is basically a weakness, it might be more suitable to first estimate the probability of failure, from which the probability of success is automatically determined -- and vice versa.

The categories of the probability of success of an attribute are described below. The factor evaluator will select from these criteria the category which best fits the particular attribute:

(1) High. Essentially no uncertainty involved and success in accomplishing the benefits of the attribute are reasonably assured based upon the proposal approach.

(2) Substantial. The probability of successfully accomplishing the benefits of the attribute is exceptionally good. This category should include situations where the evaluator is reasonably confident that the attribute will be successful in providing or accomplishing the benefits it offers.

(3) Moderate. The probability of successfully providing or accomplishing the benefits of the attribute as proposed may be equal to or considerable less than the probability of failure. This category should be used when the evaluator is reasonably confident that the attribute does not stand a good chance of succeeding to provide or accomplish the benefits it offers, or at best offers a 50-50 chance.

(4) Low. There is very little to no chance that the attribute as proposed will successfully provide or accomplish the benefits that it

offers. This category should be used when the evaluator is reasonably confident that probability of success is extremely low.

Weakness of Attribute

The weakness of an attribute is a characteristic that is independent of the nature and strength characteristics. The weakness is a measure of the impact that failure of the attribute would have on the proposed weapon system in terms of the corrective action that would be required. If the attribute were such that no corrective action would be required if the attribute failed its value, in terms of weakness, would be zero. This could occur when an attribute had the potential for some strength if it were successful, but would still result in the proposal meeting the minimum standard even if it were not successful. That is, failure of the attribute would create no adverse affects. On the other hand, if failure of the attribute has the potential for requiring corrective action in order to meet the minimum requirements of the standard, its value in terms of weakness would be greater than zero.

As was the case for strengths, developing specific criteria for the weakness of an attribute required the establishment of two independent properties. The first property is the "impact of failure" of the attribute, and the second is the "probability of failure" of the attribute. Separate criteria was established for these independent properties, and the factor evaluator will determine the weakness of an attribute by selecting from these criteria the categories that best fit the attribute. The property categories and scoring criteria for the weakness of an attribute are shown in Figure 21.

Impact of Failure		Probability of Failure	
Category	Scoring Criteria	Category	Scoring Criteria
Developmental Activity	10, 9, 8	High	10, 9
Major Redesign	7, 6, 5, 4	Substantial	8, 7, 6
Minor Redesign	3, 2, 1	Moderate	5, 4, 3
No Detremental Affect	0	Low	2, 1, 0

Figure 21. Properties of Attribute Weakness Characteristic

The description of each category for the impact of failure of an attribute is as follows:

(1) Developmental Activity. This category should be used when failure of the attribute as

proposed could result in the requirement for developmental activity for new hardware to replace all or an important portion of the hardware associated with the attribute. This category should also be used when failure of the attribute could result in extensive program delays and/or cost increases for additional development and testing of the associated hardware to prove technical feasibility or performance validation and qualification.

(2) Major Redesign. This category should be used when failure of the attribute as proposed could result in extensive modification of the associated hardware or hardware design configuration. This category applies to technological or operational problems involving hardware design, compatability, suitability, and utility that would be difficult to correct if the attribute fails. The correction action required by failure of an attribute may result in relatively short program delays and small cost increases but alternative solutions, though difficult, are possible without initiating new development activity or major developmental retesting.

(3 Minor Redesign. This category should be used

when failure of the attribute as proposed could result in relatively minor, but important modification of the associated hardware or hardware design configuration. This category applies to technological or operational problems involving hardware design, compatibility, suitability, and utility that would be necessary, but relatively easy to correct.

(4) No Detrimental Affect. This category would be used when a particular attribute has a strength that offers potential benefits if the attribute succeeds, but requires no corrective action, even if the attribute fails. In other words, if the attribute fails, the proposal, relative to this attribute, would still meet the minimum requirements of the standard.

Weighting Criteria

A very important assumption and ground rule made for the development of this scoring model is that the SSAC will establish weighting criteria for the factor level, and that this weighting criteria will be applied by the Item Captains. The purpose of the weighting is to insure that an appropriate measure of the relative importance of the primary operational objectives of the weapon system is incorporated into each proposal score. The Item Captain will first use the weighting criteria to assist in determining which attributes are to be eliminated due to redundancy. Then, the Item Captain will use the weighting criteria to determine the factor and item scores.

There are obviously many ways to establish weights for factors based upon the primary objectives of the weapon system. A simplified version of the method used in the initial risk model (developed in Chapter V of this study) is presented as an adequate and effective approach to establishing the weighting criteria for this scoring model. The weighting criteria is designed to permit a measure of the degree of impact that a particular attribute may have of the primary objectives of the weapon system. This is accomplished by first determining the weight for each factor, and then applying the factor weight to each attribute in a factor. The process used by the SSAC to establish the weighting criteria is presented below.

The primary operational objectives will be reviewed and listed in the order of relative importance. If there are n primary objectives of the weapon system, X_i would represent the i^{th} objective, where

$$i = 1, 2, 3, \ldots, n-1, n.$$

The most important objective would be X_1, the second most important objective would be X_2, etc. The least important primary objective would be X_n.

The Factors identified in the Evaluation Criteria will be evaluated and a determination made as to direct impact or influence that each factor has on the primary objectives of the weapon system. This would be accomplished by reviewing each factor separately and determining the most important primary objective that a particular factor directly affects or influences. A factor may influence more than one primary objective, but only the highest, or most important primary objective influenced will be assigned to that factor. It is recognized that some Factors may not directly affect or influence any of the primary objectives of the weapon system. In order to account for this, an $n+1$ objective of the weapon system called "other" is added. Therefore, if there were five primary operational objectives of the weapon system, a sixth (X_6) objective called "other" would be added. Those Factors which do not affect or influence any of the primary operational objectives would be assigned the X_6 objective called "other", which would be the least important objective listed. The Delphi method would be an excellent technique for the SSAC to use in determining a consensus on the most important primary objective affected or influenced by each individual Factor. An excellent overview of how to conduct a Delphi study is presented by Gordon (26).

Regardless of the method or technique used to accomplish this, the result would be similar to the example shown in Figure 22. In this example, there are five primary operational objectives and one "other" objective. The weighting for each factor is determined by simply assigning "importance values" to each primary objective in the inverse order

Factor	Most Important Primary Objective Affected	Factor Weight
T.1.1	X_2	5
T.1.2	X_4	3
T.1.3	X_1	6
T.1.4	X_6	1
T.2.1	X_3	4
T.2.2	X_5	2
T.3.1	X_1	6
T.3.2	X_2	5
T.3.3	X_6	1
.	.	.
.	.	.
.	.	.
.	.	.
O.1.1	X_3	4
O.1.2	X_1	6
O.2.1	X_4	3
O.2.2	X_2	5
O.3.1	X_6	1
.	.	.
.	.	.
.	.	.
.	.	.

Figure 22. Primary Objectives Affected by Factors

of their relative importance, such that

Primary Objective	Importance Values
X_1	n+1
X_2	n
X_3	n-1
.	.
.	.
X_{n-1}	n-(n-3)
X_n	n-(n-2)
X_{n+1} "other"	n-(n-1)

This simply means that in the example in Figure 22, X_1 would have an importance value of 6, X_2 would have 5, etc., and X_6 (OTHER) would have an importance value of 1. The importance value of the most important objective affected by a factor would become the factor weight.

Procedural Methodology

The scoring model and the procedural methodology developed to implement it may at first appear to be too complicated and involved to use in the Source Selection process. It must be recognized that any process or system used to equitably and accurately score proposals is both complicated and involved, regardless of how informative or useful the output. Before discussing the details of implementing the scoring model, it is important to review some of the advantages provided by the integrated risk assessment/scoring model and methodology. These advantages are listed below:

(1) Provides more definitive scoring at the Factor level where the detailed evaluation is accomplished.

(2) Allows the initial proposal score to be determined incrementally while the factor and item evaluators are in the process of accomplishing the detailed evaluation and while the information is fresh on their minds.

(3) Provides the capability to quantitatively assess proposals in terms of the cumulative impact of its strengths and weaknesses on the program, including relatively "small" but cumulatively important strengths and weaknesses.

(4) Integrates the probabilities of success and failure of notable strengths and weaknesses of a proposal into the scoring process.

(5) Provides the capability to insure that particular strengths and weaknesses of a proposal are not assessed at double or triple their actual impact on the program.

(6) Provides the capability of incorporating into the over-all proposal score the individual and cumulative impact of proposal strengths and weaknesses relative to the primary objectives of the weapon system.

(7) Provides the capability for rescoring the proposals in the SSEB based upon the response to DR's.

(8) Provides the capability of identifying a particular weakness of a proposal that results in a

degree of risk which warrants an investigation of its impact on program schedules and cost estimates.

(9) Provides the SSAC a definitive quantitative score for each proposal which is based upon a standardized process. The definitive scores, which incorporate an assessment of risks, should provide the SSAC excellent backup information for its analysis and evaluation. The SSAC will receive the results of the original proposal scores and the results of rescoring based upon DR responses.

(10) The model and methodology can be accomplished by the same manpower resources that would be assigned to the SSEB using the present scoring system.

The methodology developed for implementing the scoring model uses a "building block" concept. That is, the score for a proposal is incrementally developed at the factor level by scoring each attribute individually as it is identified, analyzed, and evaluated by the factor evaluator. The resultant of the attribute scores determines the initial factor score. When the factor evaluator determines the initial factor score, the responsibility for scoring then shifts to the Item Captain. The Item Captain applies the factor weight to each attribute and then reviews the attributes in each factor of his item for redundancy. The Item

Captain will then coordinate with other Item Captains to review the attributes for redundancy. The factor weight applied to the attributes will assist Item Captains in determining which attributes are redundant and should be eliminated. When redundant attributes have been eliminated, the Item Captain will determine the adjusted factor scores and compute the item score. The responsibility for scoring then shifts to the Area Co-Chairman. The Co-Chairmen will compute the area scores and the over-all proposal score. In addition, the Co-Chairmen are responsible for rescoring the proposals based upon the responses to the DR's. Because the scoring process involves different functional levels, the details of the methodology will be discussed by functional level.

Factor Level

The factor evaluator will analyze and evaluate the proposal data against the established standard. Those aspects of the proposal identified as attributes will be evaluated and individually scored using the scoring model criteria "Scoring Guide" shown in Figure 23, and the "Factor Scoring Worksheet" shown in Figure 24. The procedural steps for evaluating and scoring the factor are as follows:

(1) Analyze and evaluate proposal data against the established standard. The CI responses should be incorporated into the factor evaluation and

SCORING MODEL CRITERIA
(SCORING GUIDE)

(A) NATURE OF ATTRIBUTE	
SUBSYSTEM	10 9 8
MAJOR COMPONENT	7 6 5 4
MINOR COMPONENT	3 2 1
↑ CATEGORY	↑ SCORING CRITERIA

STRENGTH OF ATTRIBUTE

(B) BENEFITS OF SUCCESS		(C) PROBABILITY OF SUCCESS		EXPECTED POSITIVE RISK
EXCEPTIONAL SOLUTION	10 9 8	HIGH	10 9	
MAJOR IMPROVEMENT	7 6 5 4	SUBSTANTIAL	8 7 6	A x B x C
SUBSTANTIALLY EXCEEDS	3 2 1	MODERATE	5 4 3	
NO BENEFITS	0	LOW	2 1 0	

WEAKNESS OF ATTRIBUTE

(D) IMPACT OF FAILURE		(E) PROBABILITY OF FAILURE		EXPECTED NEGATIVE RISK
DEVELOPMENTAL ACTIVITY	10 9 8	HIGH	10 9	
MAJOR REDESIGN	7 6 5 4	SUBSTANTIAL	8 7 6	A x D x E
MINOR REDESIGN	3 2 1	MODERATE	5 4 3	
NO DETRIMENTAL AFFECTS	0	LOW	2 1 0	

DEGREE OF RISK FOR ATTRIBUTE

(AxBxC)-(AxDxE)

P(A) = PROB. OF ATTRIBUTE = 10
P(A) = (C)+(E) = PROB. OF SUCCESS + PROB. OF FAILURE

Figure 23. Scoring Model Criteria

FACTOR SCORING WORKSHEET

CONTRACTOR A FACTOR T.1.1

NO.	BRIEF DESCRIPTION OF ATTRIBUTE	D.R. WRITTEN	NATURE	STRENGTH		WEAKNESS		DEGREE OF RISK	ATTRIBUTE SCORE	RE-SCORED
				BENEFITS OF SUCCESS	PROB. OF SUCCESS	IMPACT OF FAILURE	PROB. OF FAILURE			
1.	SAMPLE ATTRIBUTE		6	3	8	4	2	+88		
2.	SAMPLE ATTRIBUTE		3	1	9	5	1	+12		
3.	SAMPLE ATTRIBUTE	201	8	0	5	7	5	-280		
4.	SAMPLE ATTRIBUTE		4	1	1	3	9	-104		
5.										
6.										
7.										
8.										
9.										
10.										
							TOTALS	-284		
								INITIAL FACTOR SCORE	ADJUSTED FACTOR SCORE	FACTOR RESCORED

C. I. INCORPORATED INTO SCORE:

C.I. NUMBER	YES	NO
001	✓	
002	✓	

Figure 24. Factor Scoring Worksheet

scoring, but this is contingent upon streamlining the CI process to allow timely responses and evaluation. The factor evaluator will indicate whether the CI's written are or are not incorporated into the score.

(2) Identify and briefly describe proposal attributes and score them individually. Scoring in this manner will allow the evaluator to evaluate and score the particular strengths and weaknesses of a proposal on an incremental basis, thereby "building" the factor score as he actually accomplishes the detailed analysis and evaluation process. When a DR is written that is related to an attribute, place the DR number in the "DR Written" column.

(3) For each attribute, first determine the appropriate category and scoring criteria for the nature of the attribute and record the value selected.

(4) If the attribute is primarily a strength, next determine and record the category and scoring criteria for both properties of the strength of the attribute, i.e., the benefits of success and the probability of success. The probability of failure is then determined by

$$\text{Prob.(Failure)} = 10\text{-Prob.(Success)}.$$

If the attribute is primarily a weakness, the evaluator would determine the category and scoring criteria for both properties of the weakness of the attribute in this step.

(5) Determine the category and scoring criteria for both properties of the characteristic that was not accomplished in step 4. The factor evaluator must remember that some attributes may have the potential for both beneficial and detrimental affects on the system and score accordingly.

(6) Repeat steps 3 through 5 until all attributes have been evaluated and the scoring criteria selected and recorded.

(7) Determine the expected positive risk of each attribute by multiplying the values selected for the scoring criteria of the nature, benefits of success, and probability of success of the attribute.

(8) Determine the expected negative risk of each attribute by multiplying the values selected for the scoring criteria of the nature, impact of failure, and probability of failure of the attribute.

(9) Determine the degree of risk for each attribute by subtracting the value of the expected negative risk from the value of the expected positive risk.

(Expected Positive Risk) -

(Expected Negative Risk) =

Degree of Risk.

Notice that the degree of risk may be a positive or negative value; therefore, a + or - sign should be placed in front of the degree of risk value for each attribute as appropriate.

(10) Repeat steps 7 through 10 until the degree of risk value is determined for all attributes in the factor.

(11) Algebraically, sum the degree of risk values for each attribute to obtain the initial factor score. This completes the scoring activity for the factor evaluator.

(12) Complete the factor narrative.

Figure 24 (page 204) provides an example of the scoring process. Four attributes are identified and scored using the scoring guide. Two CI's, numbers 001 and 002, were incorporated into the factor score. The third attribute is related to a DR number 201. The algebraic sum of the attribute degree of risk values is -284. This completes the factor level scoring for this example. The item level scoring for this example will be covered in the paragraphs below.

Item Level

The Item Captain is primarily responsible for the scoring process after the factor evaluator provides him the factor narrative and the Factor Scoring Worksheet with the initial factor score entered. The Item Captain will use the Factor Scoring Worksheet to complete the scoring process using the following procedural steps:

(1) Review the factor narrative and Factor Scoring Worksheet. If a related CI is not incorporated into the score, determine if any adjustment of the initial factor score is required as a result of the CI response.

(2) Apply the appropriate factor weight (which is established by the SSAC Weighting Criteria) to each attribute degree of risk value. This is accomplished by multiplying the factor weight value times the degree of risk value for each attribute and recording the product in the "Attribute Score" column of the Factor Scoring Worksheet.

(3) Review the attributes and attribute scores in all factors of the item to identify and eliminate redundant attributes. It is possible that a particular attribute could be written up in several different factors and the effect or impact of the attribute could be very similar. Special care should be taken to review the attributes within an item and also compare them with attributes of other items to insure that a particular attribute is not assessed at double

or triple its actual impact on the weapon system. If the same attribute is written up in two or more factors such that redundancy is judged to exist, the attribute will be retained in the factor in which the attribute score is lowest. The redundant attribute(s) would be lined out (eliminated) in the factor(s) where it appears. It should be noted that an attribute could appear in several different factors without being redundant. For example, if an attribute that appears to be redundant is written up in two different factors, but the degree of risk is significantly different in each factor, one should be very careful in declaring either write-up of the attribute redundant.

(4) The Item Captain will determine the Adjusted Factor Score by algebraically summing the non-redundant values of the attribute scores.

(5) When the Adjusted Factor Score for each factor is determined, the Item Captain will sum the Adjusted Factor Scores to derive the Item Score.

(6) The item summary will be prepared in the same manner that it is presently being prepared. Attributes judged to constitute substantial technological and operational risks will be

itemized and discussed for subsequent corrective action. The scoring model criteria and Factor Scoring Worksheets can be used to determine what is to be considered substantial risks in a program. The writer has established the criteria that any attribute with a degree of risk value of -224 or less will be considered a substantial and reportable risk.

An attribute degree of risk value of -224 or less can result from many different combinations of the scoring model criteria, but the upper limit for a "substantial" degree of risk (-224) is basically established by an attribute with the following characteristics:

	Characteristic	Category	Scoring Criteria		Degree of Risk
1.	Nature of Attribute	Major Component	4		(Expected Positive Risk minus Expected Negative Risk
2.	Strength of Attribute			Expected Positive Risk	
	Benefits of Success	No Benefits	0		
	Probability of Success	Moderate	3	(4) (0) (3) = 0	
					0 - 224 = -224
3.	Weakness of Attribute				
	Impact of Failure	Developmental Activity	8	Expected Negative Risk	
	Probability of Failure	Substantial	7	(4) (3) (7) = 224	

(7) The Item Captain will insure that each attribute with a "substantial" degree of risk is brought to the attention of the management and cost areas and assist in determining the impact on the cost and schedule estimates. The specific activities of the Item Captain in this regard are discussed later when the model is expanded to cover scoring for the management and logistics areas.

Figure 25 continues with the example for Contractor A, Factor T.1.1 shown in Figure 24. It is assumed that the weight established for factor T.1.1 is 3. Notice that the values in the "Attribute Score" column are the product of the Factor Weight (3) times the value of the attribute degree of risk. In this example, attribute number 4 was determined to be redundant and was, therefore, eliminated. The Adjusted Factor Score (-540) is the algebraic sum of the non-redundant values in the "Attribute Score" column. Attribute number 3 has a degree of risk value of -280, which is less than that necessary to make it a "substantial" risk (-224 is the upper limit). Therefore, this attribute would be coordinated to evaluate its potential impact on schedule and cost estimates.

Notice also that the attribute number 3 is shown to be rescored based upon the DR response. This activity does not occur at the item level, but is shown here for convenience. Rescoring, based upon DR responses, is an area level

FACTOR SCORING WORKSHEET

CONTRACTOR A — FACTOR T.I.I

NO.	BRIEF DESCRIPTION OF ATTRIBUTE	D.R. WRITTEN	NATURE	STRENGTH: BENEFITS OF SUCCESS	STRENGTH: PROB. OF SUCCESS	WEAKNESS: IMPACT OF FAILURE	WEAKNESS: PROB. OF FAILURE	DEGREE OF RISK	ATTRIBUTE SCORE	ATTRIBUTE RESCORED
1.	SAMPLE ATTRIBUTE		6	3	8	4	2	+88	+264	+264
2.	SAMPLE ATTRIBUTE		3	1	9	5	1	+12	+36	+36
3.	SAMPLE ATTRIBUTE	201	8	0	5	7	5	-280	-840	(-504)
4.	~~SAMPLE ATTRIBUTE~~ REDUNDANT		~~4~~	~~1~~	~~1~~	~~3~~	~~9~~	~~-104~~	~~-312~~	
5.										
⋮	*NOTE: FOR THIS EXAMPLE ASSUME THE WEIGHT ESTABLISHED FOR FACTOR T.I.I IS 3.*									
							TOTALS	-284	-540	-204
								INITIAL FACTOR SCORE	ADJUSTED FACTOR SCORE	FACTOR RESCORED

C. I. INCORPORATED INTO SCORE:

C.I. NUMBER	YES	NO
001	✓	
002	✓	

Figure 25. Factor Scoring Worksheet

responsibility and is discussed in the paragraphs below.

Area Level

The area Co-Chairman is primarily responsible for the scoring process after the Item Captain has completed and submitted the Adjusted Factor Scores, the Item Score, and the item narrative summary. The procedural steps necessary to complete the scoring process are as follows:

(1) The Co-Chairman will derive the area score by summing the item scores. The proposal score will be derived by summing the area scores.

(2) The Co-Chairman will then review the DR responses and rescore the proposals as appropriate. This will be accomplished by referring back to the Factor Scoring Worksheets to evaluate the attribute or attributes related to a particular DR response. In Figure 25, attribute number 3 was related to DR number 201 and was rescored to a value of -504. In this hypothetical case, the score was improved, due to reducing the probability of failure from 5 to 3 (not shown). The results of rescoring the factor is the algebraic sum of the "Attribute Rescored" column (-204). Notice that this attribute was also one which, because it constituted a

"substantial" degree of risk, was coordinated with the cost and management areas to assess the impact on cost and schedule estimates. The area Co-Chairman will, therefore, need to re-assess this attribute with the cost and management areas based upon the rescoring activity. It should be noted that an attribute with a "substantial" degree of risk will not necessarily be associated with a DR. When each DR response has been reviewed and rescoring accomplished, the item, area, and proposal scores resulting from rescoring will be recorded.

(3) The area narrative summary will then be prepared, and the results of the original scoring and rescoring will be included in the SSEB report to the SSAC. This completes the scoring process.

Figure 26 presents a flow chart of the scoring model process at each functional level in the SSEB.

Figure 27 presents a pictorial view of the building block approach provided by the scoring model. The result or output of the scoring model could be similar to the fictitious numbers in Figures 28, 29, and 30.

The Adjusted Factor scores are derived in a manner shown by the example in Figure 25, and the factor total for Contractor A in Figure 28 shows the score from that example.

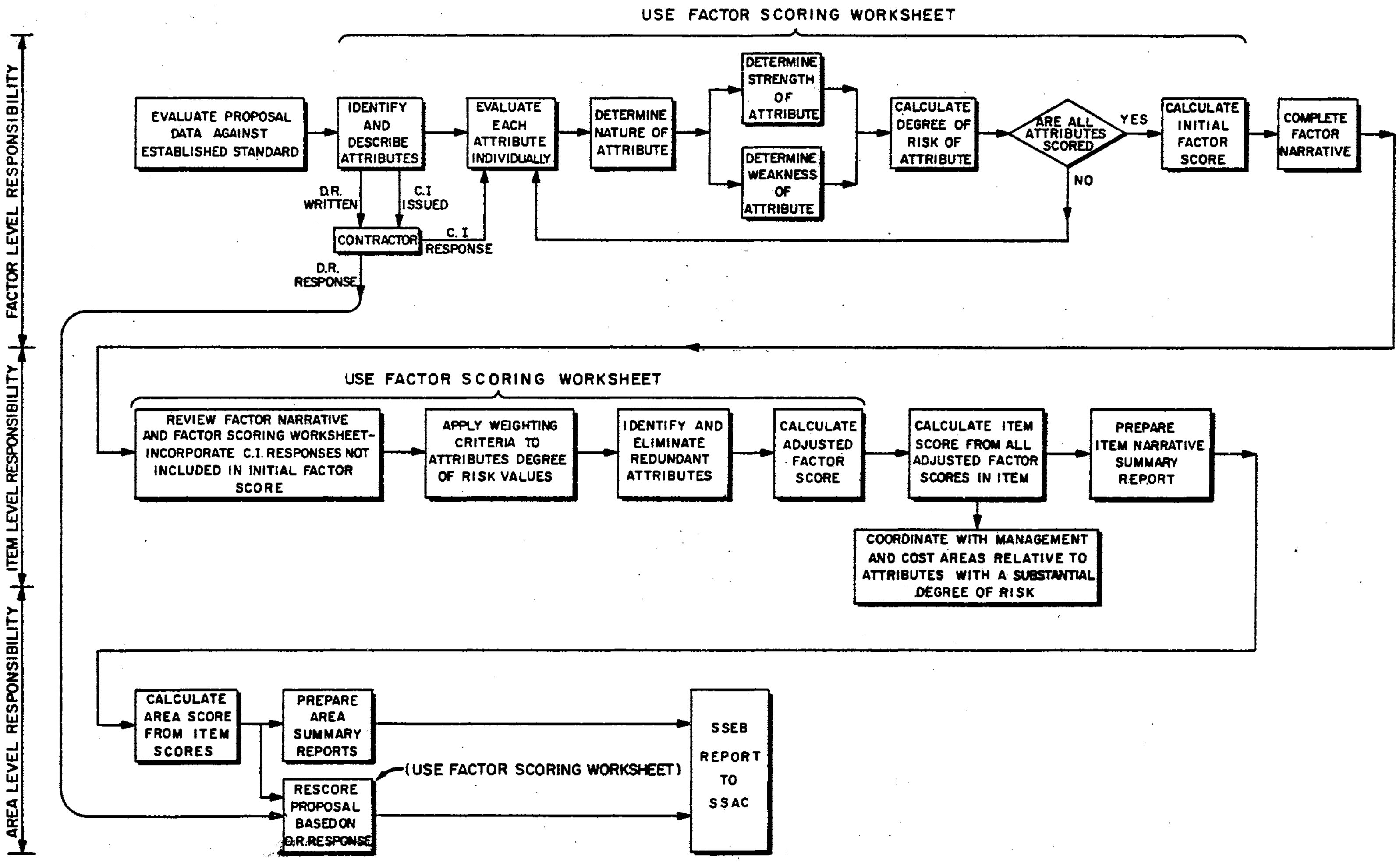


Figure 26. Procedural Methodology for Scoring Model

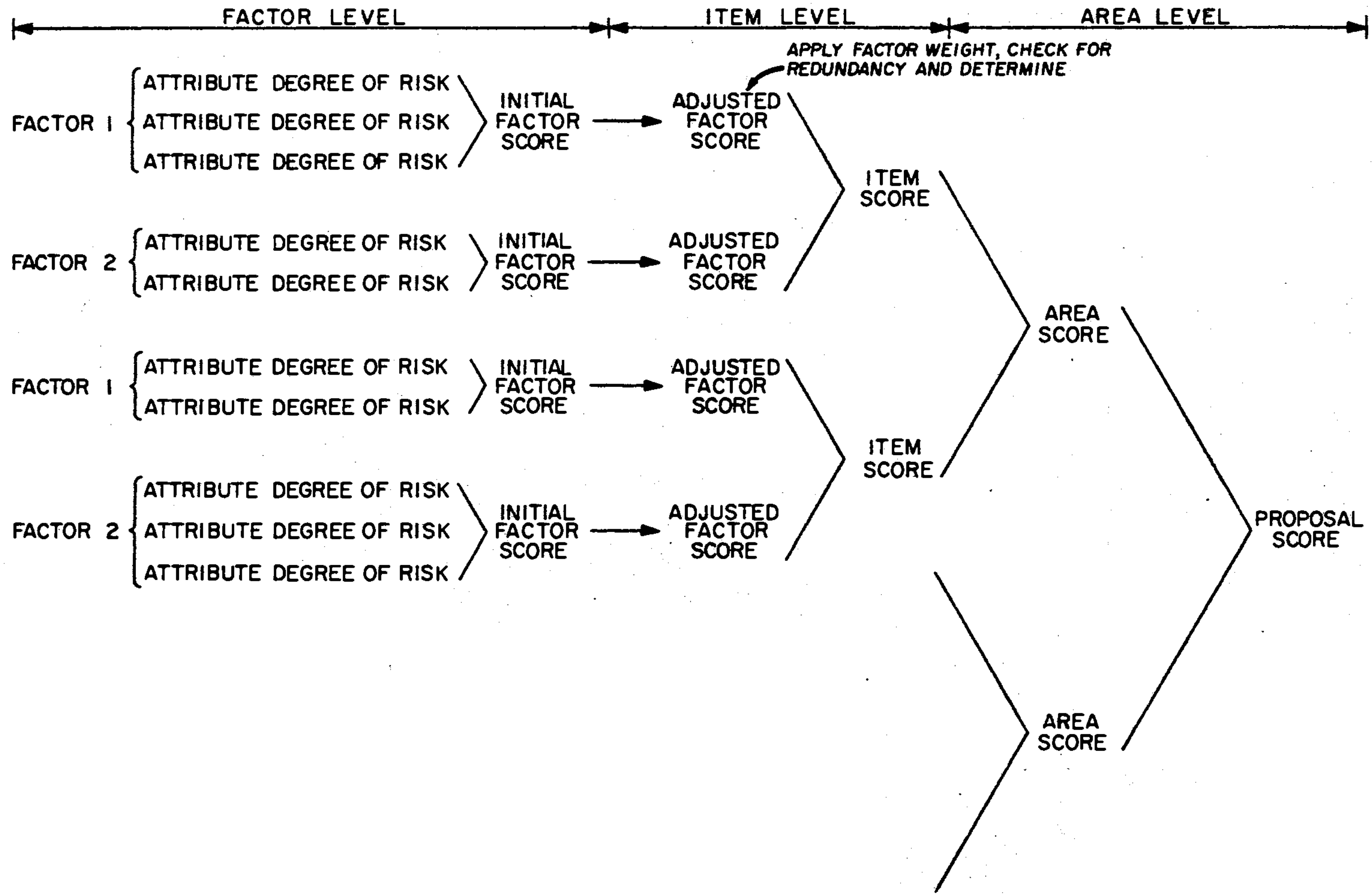


Figure 27. Incremental Scoring (Building Block Approach)

SCORE BY CONTRACTOR/BY FACTOR

		CONTRACTOR				
ITEM	FACTOR	A	B	C	D	F
T.1.	1	-540	+175	+315	-214	0
	2	+68	0	-28	-185	+212
	3	-319	-38	-133	0	+65
T.2.	1	-89	0	-216	0	-137
	2	+341	-49	+191	-416	+31
	3	-740	-177	+542	-322	0
	4	0	+238	0	+179	-76
T.3.	1	+56	0	-374	+142	+381
	2	+172	0	-18	+56	0
T.4.	1	-256	+460	+79	0	+153
	2	-27	+222	0	-133	-271
	3	-350	-139	0	+18	-716
O.1.	1	-292	+77	-42	-210	-347
	2	+65	-86	-373	+147	+96
O.2.	1	-402	-107	-211	-230	-217
	2	-184	+92	+271	+10	+132
	3	+35	+12	+93	-123	-222
PROPOSAL SCORE		-2462	+680	+96	-1281	-916

Figure 28. Score By Contractor/By Factor

SCORE BY CONTRACTOR / BY ITEM

ITEM	CONTRACTOR A	B	C	D	E
T.1	-791	+137	+154	-399	+277
T.2	-488	+12	+517	-559	-182
T.3	+228	0	-392	+198	+381
T.4	-633	+543	+79	-115	-834
O.1	-227	-9	-415	-63	-251
O.2	-551	-3	+153	-343	-307
PROPOSAL SCORE	-2462	+680	+96	-1281	-916

Figure 29. Score By Contractor/By Item

SCORE BY CONTRACTOR / BY AREA

AREA	CONTRACTOR A	B	C	D	E
TECHNICAL	-1684	+692	+358	-875	-358
OPERATIONS	-778	-12	-262	-406	-558
PROPOSAL SCORE	-2462	+680	+96	-1281	-916

Figure 30. Score By Contractor/By Area

Notice that several of the factors in Figure 28 have zero for an Adjusted Factor Score. This could result from a situation where there were either no attributes identified, or where the attributes that were identified had positive and negative degree of risk values which exactly cancelled each other.

Notice also that in Figure 29, Contractor B had an item score of zero for item T.3. This occurred because both factors in the item had a zero Adjusted Factor Score, but an item could have a zero score resulting from Adjusted Factor scores which cancel each other. It is possible that a proposal could have a zero score. Although highly unlikely, it is possible that this could occur as a result of an entire proposal being evaluated without having any notable attributes identified. It is much more likely that a zero score for a proposal would result from positive and negative item scores that exactly cancel each other. The proposal score for Contractor C is relatively close to zero (+96) as a result of the cancelling effect of the factor/item/area scores.

The scoring model results provide a relative measure of the acceptability of each proposal in terms of its ability to satisfy the technological and operational requirements, and the primary objectives of the weapon system. Each proposal score is completely traceable, which enables higher level source selection officials to conveniently and effectively analyze, evaluate, and compare the proposals. Those proposals which are clearly superior or inferior can be quickly identified and the supporting evidence easily assimilated. Those proposals which appear to be close contenders can be reviewed in detail using the scoring model results. For example, suppose the two leading proposals have relatively close scores, both of which are near zero. The first proposal with a score near zero could result from very few attributes, all of which are relatively minor in importance. The second proposal with a near zero score could result from many attributes, some of which have large positive degree of risk values, and others with large negative degree of risk values. The scoring model will permit a detailed review of how each score was derived, thereby providing the SSAC more definitive and supportable evidence upon which to make recommendations.

Management and Logistics Scoring

Up to this point, the scoring model and methodology have been limited to scoring only the technical and operations areas. The purpose of this section is to expand the scoring model to facilitate scoring the management and logistics areas. In addition, the interaction between the technical and cost areas relative to attributes with a "substantial" degree of risk will be described in this section.

It is important at this point to emphasize that the scoring model and methodology developed in the previous sections will continue to be applicable to the technical and operations areas. It will be shown later that although the output of the scoring model for the technical and operations areas is based upon different criteria than that of the management and logistics areas, there is no conflict in combining the two outputs to derive the over-all proposal score.

The management and logistics areas will be scored using criteria very similar to that used in the present scoring system. However, the scoring will be accomplished at the factor and item levels in a manner very similar to that used in the technical and operations areas. Figure 31 presents a flow diagram of the process to be used for scoring the logistics and management areas. The reader will find it helpful to refer to Figure 31 while reading the following procedural steps which describe the process by functional level.

Factor Level

The factor evaluators will perform the following procedural steps:

(1) Evaluate the proposal data against the established standard in the same manner used in the present SSEB evaluation process.

(2) Identify notable attributes of the proposal and record same on the Factor Scoring Worksheet.

(3) Evaluate the strengths and weaknesses of the

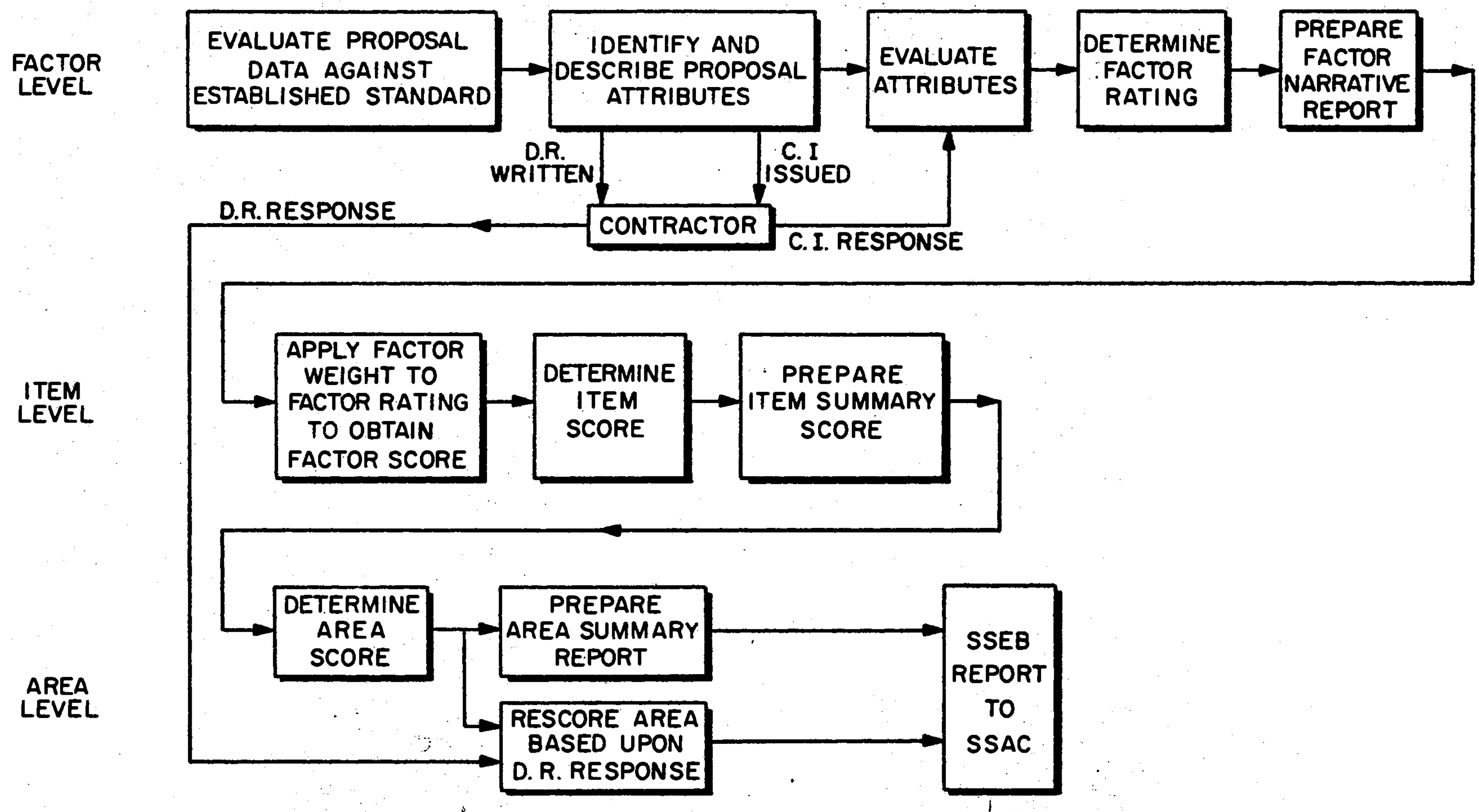


Figure 31. Scoring Process for Logistics and Management Areas

attributes relative to the degree in which they tend to exceed or fail to satisfy the standard. The CI response will be incorporated into the evaluation of the attributes in a manner consistent with the program management policy. The evaluation of attributes will be accomplished in the same manner that strengths and weaknesses are presently assessed in the current SSEB evaluation process.

(4) Determine the Factor Rating by assessing the over-all and combined impact of the attributes and selecting the appropriate category for the over-all factor assessment and the numerical factor rating from the following criteria:

Over-all Factor Assessment	Factor Rating
Superior Proposal	100
Substantially Exceeds Standard	90 80
Comfortably Exceeds Standard	70 60
Meets Minimum Standard	50
Below Standard	40 30
Seriously Fails to Meet Standard	20 10
Unacceptable	0

A "superior" rating should be used when the proposal approach is excellent in every respect and has the potential for significantly improving the effectiveness of that portion of the system to which it applies.

A "substantially exceeds standard" rating should be when it is evident that the contractor has used noteworthy initiative in developing some innovative approach, technique, device, or process which has the potential for saving time, material, and/or improving the effectiveness of that portion of the system to which it applies. The keynote here is that the standard is substantially exceeded.

A "comfortably exceeds standard" rating should be used when the proposal is better than the required minimum standard. This rating can be used when the evaluator considers the proposal to be particularly responsive to the RFP and comfortably meets all the minimum requirements of the standard.

A "meets minimum standard" rating should be used when the proposal just barely meets the minimum requirements of the standard.

A "below standard" rating should be used when the proposal fails to meet some or all of the minimum requirements of the standard, but the corrective actions required are relatively minor and the impact on the rest of the system is considered slight.

A "seriously fails to meet standard" rating should be used when the proposal fails to meet some or all of the minimum requirements of the standard, where the corrective action required is difficult and the impact on the rest of the system could be severe.

An "unacceptable" rating should be used when the proposal approach is clearly and totally unacceptable.

(5) Prepare the factor narrative report and itemize the notable attributes of the proposal. The narrative discussion of the attributes will include a clear but concise explanation of the strengths and weaknesses, the degree of impact, and the seriousness of any corrective action required.

Item Level

When the factor evaluator has determined the factor rating and completed the factor narrative report, the Item Captain will be primarily responsible for the scoring process. The Item Captain will accomplish the following procedural steps:

(1) Review the factor narrative and rating. In the

management area, the Item Captain will coordinate with the technical area to determine the specific impact on the program schedule resulting from attributes with a "substantial" degree of risk. This activity will actually be initiated by an Item Captain in the technical area who has identified an attribute with a degree of risk value of -224 or less. When the management area Item Captain has assessed the impact of the attribute on the program schedule, he will rescore the Factor rating as appropriate.

(2) Apply factor weight to the factor ratings by multiplying the weight value times the value of the factor rating. The product of the weight and the factor rating will be the factor score.

(3) When each factor score is determined, sum the factor scores to derive the item score.

(4) Prepare the item narrative summary report. The narrative report should include a clear and concise discussion of the notable attribute strengths and weaknesses. The management item summary should include an assessment of the schedule impact of each attribute reported by the technical area as having a "substantial" degree of risk.

Area Level

When the Item Captain completes the item score and item narrative report has been submitted, the primary responsibility for scoring shifts to the area co-chairman. The co-chairman will accomplish the following procedural steps:

(1) Sum the item scores to derive the area score.

(2) Review the DR responses applicable to his area and rescore the area as appropriate.

(3) Prepare area narrative summary.

(4) Submit area summary report, area score and the results of rescoring for inclusion in the SSEB report to the SSAC.

The scoring process for the logistics and management areas will utilize the slightly revised Factor Scoring Worksheet shown in Figure 32. The factor evaluator will list and briefly describe the attributes on the scoring worksheet. If a DR is written that is applicable to an attribute, the number of the DR will be recorded in the "DR Written" column. The related CI's will be noted at the bottom of the form. Since the attributes will not be scored individually in the logistics and management areas, the remaining columns of the scoring worksheet will be left blank. After evaluating the over-all and combined impact of the attributes and selecting the appropriate Factor Rating, the evaluator will enter the numerical value of the Factor Rating in the appropriate blank at the bottom of the scoring worksheet.

FACTOR SCORING WORKSHEET

CONTRACTOR ______ FACTOR ______

NO.	BRIEF DESCRIPTION OF ATTRIBUTE	D.R. WRITTEN	NATURE	STRENGTH		WEAKNESS		DEGREE OF RISK	ATTRIBUTE SCORE	ATTRIBUTE RESCORED
				BENEFITS OF SUCCESS	PROB. OF SUCCESS	IMPACT OF FAILURE	PROB. OF FAILURE			
1.										
2.										
3.										
4.										
5.										

C. I. INCORPORATED INTO SCORE:

C. I. NUMBER	YES	NO

	INITIAL FACTOR SCORE	ADJUSTED FACTOR SCORE	FACTOR RESCORED
TECHNICAL AND OPERATIONS →			

	FACTOR RATING	FACTOR SCORE	RESCORED
LOGISTICS AND MANAGEMENT →			

Figure 32. Factor Scoring Worksheet

When the Item Captain has applied the factor weight to the factor rating, he will enter the Factor Score in the appropriate blank at the bottom of the scoring worksheet. The area co-chairman will enter the results of rescoring, based upon DR responses, in the space entitled "Rescore" at the bottom of the scoring worksheet. If the rescoring did not result in changing a particular Factor Score, the original Factor Score value should be entered in the "Rescore" space. The output of the scoring model for the management and logistics areas will be presented in the same format as that for the technical and operational areas (as shown in Figures 28, 29, and 30, pages 217 and 218).

Technical/Operations and Logistics/ Management Scoring

The resultant scores for the technical and operations areas are based upon criteria related to technological and operational requirements of the air vehicle hardware. The process used in deriving the scores is based upon an integrated risk assessment of the potential strengths and weaknesses of each individual attribute. The importance of the attributes in terms of impact on the primary objectives of the weapon system is integrated into the proposal score by applying factor weights to the individual attributes.

The resultant scores for the logistics and management areas are based on criteria very similar to the present SSEB scoring system. The criteria requires that an evaluator assess the over-all and combined impact of all the attributes identified in a factor, and select a single factor rating value. The importance of the factor rating in terms of the impact on the primary objectives of the weapon system is integrated into the proposal score by applying factor weights to the factor ratings.

It is seen that the fundamental differences in the two scoring processes are the criteria upon which to base the score, and the approaches used to establish the Initial Factor Score (technical and operations) and the Factor Rating (logistics and management). The feature common to both processes is the application of factor weights to incorporate a measure of the relative importance of proposal strengths and weaknesses in terms of the primary objectives of the weapon system. The reader may at first consider it an inaccurate procedure to combine the resultant scores of these two processes to obtain an over-all proposal score. If it were necessary that 10 points of the technical/operations area score be equivalent to 10 points of the logistics/management area score it would be an inaccurate procedure to attempt to combine the scores. The two scores are not equivalent for the following reasons. First, in the technical/operations area a factor with no attributes identified would meet the minimum requirements of the standard but the Initial Factor Score and Adjusted Factor Score would be zero, regardless of the weight of the factor. In the logistics/management area, a factor with no attributes identified would meet the minimum requirements of the standard but the factor rating would be 50. The factor rating would be multiplied by the appropriate factor weight (say it was 3) to derive a Factor Score of 150. The second reason is that in the technical and operations areas, the Initial Factor Score is determined by summing the individual attribute degree of risk values; whereas, in the logistics and management areas, the Factor Rating is determined by a qualified assessment of the over-all and combined impact of all the attributes which is expressed in a single numerical value.

The differences in the criteria and scoring processes for the technical/operations and logistics/management areas do not preclude combining the two sets of scores to derive an over-all proposal score, if one is necessary. The algebraic sum of the two scoring process resultants will provide a relative measure of the degree to which the proposals satisfy the program requirements and the primary objectives of the weapon system. As long as each proposal is scored using the same scoring model and methodology, the system will be equitable and accurate. The SSAC may choose to weigh the importance of the individual area scores based upon the type of system hardware, the procurement approach, and the particular phase of the source selection action.

Technical and Cost Area Interaction

The major findings from the Source Selection

Questionnaire reveal that the communication and interaction between technical and cost area personnel should be increased for the following reasons:

(1) Cost data should reflect technical and other risks.

(2) Technical design people could assist in improving cost models and programs.

(3) Cost data does not adequately reflect design, materials, and manufacturing processes.

No attempt will be made here to discuss the methods or processes involved to establish contractor prices or independent cost estimates by the government. It is important to recognize, however, that in any discussion of costs one must first specify what kind of costs, whose cost estimates, and what type of contract are under study. For example, is the discussion focused upon the stated contractor price or the independent cost estimate by the Government, or both? Also, is the cost under investigation related to a firm fixed price contract, an incentive contract, or both? Further, is the cost under investigation the relatively short-term developmental cost, or does it include the production and/or total program costs? While the writer is far from knowledgeable in the area of Cost to the Government, the following remarks are considered to be consistent with major findings of this study.

Within the cost area, the Independent Cost Estimate (ICE) performed by ASD is an innovation which appears to the writer to offer the greatest opportunity for identifying and assessing cost risk, regardless of what kind of costs or type of contract is under study. Where wide variances exist between the ICE and the contractor proposed price a panel or team comprised of technical, management, logistics and cost personnel, as appropriate, should attempt to identify the reasons for the variances. Although the writer has no specific method to suggest, an acceptable range of costs (in terms of realism) should be established to "flag" price quotations that appear to constitute a wide variance from a realistic estimate.

Within the technical area, those attributes identified as having a substantial degree of risk should be referred to the above mentioned cost panel. The cost panel would attempt to assess the risk in terms of impact on the ICE, and the realism of the price quotation by the contractor.

The results of the findings by the cost panel relative to variances from the range of realism and the attributes with substantial degrees of risk would be included in SSEB report to the SSAC.

CHAPTER IX

CONCLUSIONS

The purpose of this chapter is not to summarize the entire study, but rather to stress the more significant conclusions and make some recommendations. In addition, to point out some areas which are worthy of further study.

The integrated risk assessment and scoring model developed in this study provides a system of scoring which is adaptable to any particular procurement or management approach selected for a program. While the study is tailored to the Aeronautical Systems Division of AFSC, the basic approach is applicable to any division of the AFSC, and could be adapted to other branches of the Armed Forces.

There will undoubtedly be those who feel that the model and methodology developed in Chapter VIII is too complicated and detailed; that the present scoring system should be simplified; and that this model is more complex rather than simple. The writer suggests that the major findings of the Source Selection Questionnaire (see Chapter VI), and the recommendations of the Air Force RFP Study Team (22) support the conclusions that:

(1) The output of the present SSEB scoring system is inadequate and does not justify the

resources expended to achieve it.

(2) Current DoD management concepts for increased prototype hardware development and testing, and minimum documentation will require more selective but increased emphasis on technical evaluations, risk assessment and cost effectiveness.

(3) The present SSEB scoring system should be changed so as to provide more definitive scoring, weighting, and risk assessment at the factor and item levels to more accurately reflect and synthesize the detailed evaluation effort.

The scoring system developed in this study is entirely consistent with the recommendations of the Air Force RFP Study Team, and incorporates the major findings of the Source Selection Questionnaire. In reality, the scoring system is straightforward and expedient to use. It focuses the risk assessment and scoring activity at the factor level and permits an evaluator to score individual attributes while the detailed evaluation is fresh on his mind. The proposal score is, therefore, established incrementally and the final output is definitive, comprehensive, incorporates an assessment of risks, and is easily traceable by the SSAC. Moreover, the system provides the capability to avoid scoring redundancies and to rescore proposals based upon DR responses. The specific advantages of the model are itemized earlier in the study (see p. 199).

The technical and operations areas appear to be most significant areas (in terms of technological risk) to consider in the Source Selection for a "Competitive Prototype Phase" option in the Validation Phase of a developmental program. The scoring system developed in this study concentrated on these areas in terms of risk assessment, and is, therefore, substantially tailored to the current DoD management philosophy. If risk assessment of the logistics and management areas is desired, the model must be slightly expanded to develop more specific and relatable criteria upon which to establish quantitative measures of the degree of risk in these areas. It is entirely possible that the SSAC will prefer to keep the area scores separate rather than combining the area scores into a total proposal score. The scoring model developed in this study is perfectly suited for this option by the SSAC.

The scoring system developed in this study requires that attributes identified in the technical and operations areas as having a substantial degree of risk, be reviewed to determine their impact on program schedules and cost estimates. While this is considered to be a necessary first step toward improved risk assessment, it is recognized that much more emphasis and study is needed in these areas. It is recommended that follow-on studies be accomplished to seek ways to improve the interaction and communication exchange between technical and cost personnel.

The integrated risk assessment and scoring model developed in this study is considered by the writer to be a substantial improvement over the present scoring system. It provides the capability of a more accurate and comprehensive quantitative measure of the detailed technical evaluation performed in accordance with the evaluation criteria and plan. The new system could be implemented using the same number of personnel required for a given level of effort with the present scoring system.

It is recommended that ASD investigate the possibilities for implementing the new scoring system. Although numerous policy changes would be necessary in order to implement the new system, this does not appear to be a major problem in view of the current DoD emphasis to update and improve existing policy and supporting documents. The major policy changes required by the new scoring system are discussed in Chapter VII of this study.

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APPENDIX A

SOURCE SELECTION QUESTIONNAIRE

This appendix includes the letter requesting ASD to distribute and retrieve the Source Selection Questionnaire, the ASD letter of transmittal, and the actual Source Selection Questionnaire.

Lt Colonel Thomas

Source Selection Questionnaire

ASD/SD

1. The undersigned is presently working to complete a PhD in Operations Research under the AFIT program at Oklahoma State University. My dissertation will attempt to develop an improved methodology for assessing risk in the Source Selection Evaluation Board (SSEB) process.

2. In order to obtain useful and needed information relative to the SSEB, I have prepared the attached questionnaire. The specific purposes of the questionnaire are:

a. To investigate the existing SSEB process to assist in developing an improved and integrated methodology for risk assessment.

b. Obtain a better understanding of the influence that the Parallel Undocumented Development (PUD) concept for minimum documentation and hardware (prototype) development has on current SEB process.

3. If you approve of the questionnaire and its intended use, I propose the following:

a. I will prepare an adequate number of copies of the attached cover letter and questionnaire for widest possible dissemination among those personnel who have experience with the SSEB process (including PUD concepts).

b. Request your office distribute and retrieve the questionnaires to avoid detailed and time consuming administrative procedures.

c. Upon notification by your office I will pick up the questionnaires (or copies of same).

EVERETT L. THOMAS, JR, Lt Colonel, USAF
443-30-4127

1101 N. Jefferson
Stillwater, Oklahoma 74074
Telephone: AC 405 377-2880

2 Atchs
1. ASD Cover Letter
2. Questionnaire

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AERONAUTICAL SYSTEMS DIVISION (AFSC)
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

REPLY TO ATTN OF: SD

13 October 1970

SUBJECT: Source Selection Questionnaire

TO:

1. ASD is exploring ways and means of improving the Source Selection Process. Some of the actions underway include:

a. More realistic definition of data requirements including specific limitations.

b. Risk assessment beyond that previously performed.

c. Risk avoidance trade-offs.

2. Preliminary plans are underway to conduct a symposium on this subject to permit objective discussion of the more important considerations. Additionally, we are fortunate in that AFIT has approved work in this area for a dissertation leading to a Ph. D. Support of this effort is strongly endorsed in that we can benefit from the analysis to be performed, as well as the identification of ideas for the forthcoming symposium.

3. It is requested that you provide support by completing the attached questionnaire and returning it to the undersigned within five work days after receipt.

4. The following is requested relative to the questionnaire:

a. In responding to any of the questions attached, be especially careful not to divulge sensitive source selection information. Be guided by the requirements of Paragraphs 7 and 8, AFR 70-15.

b. Answer questions objectively and candidly.

c. Carefully read the notes preceding each question.

d. Do not hesitate to include constructive comments or remarks which you feel are appropriate to the area in question.

e. Your response need not be typed.

f. Use additional paper as required, but be sure to carefully reference the question you are addressing.

5. Responses to this questionnaire will be used to evaluate some ways in which the Source Selection process may be improved, particularly in the area of risk identification and assessment. It is important that you give us the benefit of your candid thoughts, ideas, and experience.

J. ARTHUR BOYKIN, JR.
Technical Director/Weapons Systems
Deputy for Systems Management

Atch
Source Selection
Questionnaire

SOURCE SELECTION QUESTIONNAIRE

NOTE: For Question 1, fill in the blanks as appropriate. Be sure to state the area, item or factor description (not code) for the level in the SSEB.

1. My participation in the Source Selection process has been:
   a. Approximate years experience is ____ years.
   b. Level and frequency (approximate) of participation.

Level	No. of Programs
SSAC	________
SSEB	
Chairman	________
Co-Chairman (Area ______)	________
Item Captain (Item ______)	________
Factor Member (Factor _____) . . .	________
Contract Definition	________
Cost to Govt	________

NOTE: Question 2 is designed to get your views on how the minimum documentation concept has affected the difficulty level of technical evaluation, as compared to your experience with other programs where more specific data requirements existed. If this is your first SSEB, answer the question based upon comparing the available data with what you consider minimum acceptable data. Circle the word in brackets which you feel most accurately completes the statement and put a check mark in the blanks by the statement or statements which are reasons for your answer. Do not hesitate to check the last blank and provide other reasons you feel are applicable.

2. As currently applied, the PUD concept for minimum documentation has made the SSEB technical evaluation (more/equally/less) difficult because:

______ Too much latitude allowed in technical data requirements.
______ Technical data generally better in all respects.
______ Technical data not significantly influenced by PUD.
______ Variance in data submittal formats between proposals.
______ Variance in the depth of technical data between proposals.
______ Standards too general and hard to apply.
______ Standards too detailed and restrictive.
______ Standards satisfactory.
______ Technical risks easier to identify and assess.
______ Technical risks harder to identify and assess.
______ Other reasons (provide comments below).

NOTE: Question 3 is designed to get your views on the differences, if any, between evaluating proposals for prototype hardware and proposals for paper study output; i.e., what is difference in data requirements to adequately evaluate? Also, is the job of evaluating proposals for hardware basically more difficult? If your experience is limited, answer to best of your ability. Do not hesitate to identify other reasons.

3. Compared to evaluating proposals for "paper" studies, the technical evaluation in the SSEB process is (more/equally/less) difficult when proposals are responsive to RFP for prototype hardware development because:

______ It is necessary to obtain and review more data.
______ Data requirements and review are the same.
______ Less data review is required for hardware proposals.
______ Level of evaluation effort always greater with hardware.
______ Level of evaluation effort less with hardware.
______ Level of evaluation effort the same.
______ More emphasis on technical risk with hardware proposals.
______ Emphasis on technical risks the same.
______ Other reasons (provide comments below).

NOTE: Question 4 is designed to get your views on the SSEB scoring process in general. Answer question candidly and to best of your ability regardless of your experience level. Do not hesitate to identify other reasons.

4. The SSEB scoring process at the factor and item level (should/should not) be modified because:

______ Present system is adequate and preferred.
______ Present system is absolutely superior.
______ Present system tends to force scores toward average.
______ Upward flow of evaluation information is constrained.
______ More definitive ranking/scoring of proposals needed at factor level.
______ Less definitive ranking/scoring of proposals needed at factor level.
______ Technical risk too difficult to integrate into score.
______ Present scoring system tends to compromise the motivation for professional excellence in the evaluator.

_____ Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as against standards.
_____ Scoring and weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system.
_____ Other reasons (provide comments below).

NOTE: Question 5 is designed to get your views on ways to which technical considerations should be integrated into the cost estimates and cost risks. Answer the question to the best of your ability. Do not hesitate to provide other reasons you feel are applicable.

5. The communication and interaction between cost and technical design personnel should be (increased/no change/decreased) because:
_____ Current system is adequate and preferred.
_____ Cost data should be divorced from technical design.
_____ Cost data does not adequately reflect design, material, and manufacturing processes.
_____ Cost data should in some way reflect technical and other risks.
_____ Technical design people could assist in improving cost models and programs.
_____ Other reasons (provide comments below).

NOTE: Question 6 should be answered in your own words based on the following assumptions:

Assumption 1: A prototype aircraft is a system which is expected to demonstrate the operational flight characteristics and performance requirements specified in the RFP. Emphasis here is on flying qualities.
Assumption 2: You will be responsible for an adequate technical evaluation of contractor proposals for the prototype A/C in your particular area.
Assumption 3: Minimum data required for evaluation of the proposal in your area is that data which you will need to adequately evaluate a prototype aircraft as defined in Assumption 1. That is, minimum data is data you need and will use now.
Assumption 4: Deferred data is that data which will, or may, be needed later on in the program but is not

minimum data. That is, deferred data is data you do not need now to specifically evaluate a prototype aircraft as defined in Assumption 1.

6. In your specific area, what do you consider to be minimum data? (Be as specific as you can. What is the minimum amount of information you can give the contractor in terms of data requirements and expect a qualified bidder to respond with adequate data for evaluation in your area.)

NOTE: Answer Question 7 in your own words.

7. What influence and impact on the SSEB evaluation process does the Contractor Inquiry and Deficiency Report have on:

a. Technical Evaluation?

b. Risk Assessment?

c. Scoring?

SOURCE SELECTION QUESTIONNAIRE distributed 20 October 70 to following:

SD (Systems Management)

Col. E. M. Stringer	SD-3
E. L. Gentit	SD-3
P. B. McKee	SD-3
O. Z. Brenning	SD-10
J. S. McCollom	SDU
R. C. Murrin	SD-65
C. W. Kuehne	SDQ
D. M. Young	SDQP
Col. J. E. Hildebrandt	SDX
G. W. Altherr	SDX
J. D. Pierson	SDMC
S. A. Tremaine	SDMC
T. J. Cox	SDMC
Col. G. E. Brunsman	SDQH

PP (Procurement & Production)

E. J. Trusela	PP
Col. C. K. Dunlap	PP
Mr. R. E. Wallace	PP

XR (Development Planning)

G. W. Estepp
E. A. Langleban
R. C. Lenz, Jr.
K. P. Schlosser
H. P. Stachowski
R. R. Stalder

SM (Subsystems Management)

R. A. Bittner
Col. J. M. DuBois

YA (C-5A)

M. C. Chase
Col. K. N. Beckman

YF (F-15)

Paul Staadt
R. E. Maloney
F. T. Rall
Col. H. L. Orthman
Col. L. M. N. Wenzel

YG (AGM-69)

R. C. Johnston

YH (B-1)

Colonel Hippert
J. B. Trenholm
A. L. Sea
Paul Hockman
R. M. Reinhardt
P. R. Doty
Col. R. L. Miner
Col. Roccaforte (AFLC)

EN (Engineering)

Col. R. P. Daly
L. J. Charnock
W. L. Sullivan
J. H. Hausmann
B. Levine
H. W. Sprague
W. M. Roberts
B. B. Kingman
W. D. Wall
J. W. Carlson
T. S. Liu
H. S. Brown
A. Puslat
D. C. Norman
P. A. Simmons
W. M. Stowe
R. C. Perdzock
A. M. Friedman
W. M. Stowe
B. L. Paris
H. W. Schmidt
B. B. Mishkind
D. J. Wallick

Comptroller (AC)

H. F. Weiler
C. W. Adams
Col. M. Collier

Air Force Aeropropulsion Laboratory

E. C. Simpson AFAPL/TB

APPENDIX B

ANALYSIS OF THE SOURCE SELECTION QUESTIONNAIRE

Introduction

Forty-four respondents completed and returned the Source Selection questionnaire in Appendix A. Question number one was designed to obtain information relative to the experience level of the respondents. This objective and quantifiable information was necessary to validate the qualifications of the respondents so as to establish the credibility of using the questionnaire answers to derive meaningful conclusions. Questions 2 and 3 address the problem of assessing the difficulty level of technical evaluation in the SSEB process using the "minimum documentation" and "prototype hardware development" concepts of the current DoD management philosophy. Questions 4, 5, and 7 address the problem of assessing the adequacy of the current SSEB rating/scoring system presently in use by ASD. Question 6 was designed to obtain information which would permit an evaluation of what constitutes minimum documentation on a prototype hardware developmental program.

The problem areas addressed in this questionnaire are, by nature, very difficult to express in quantitative terms. For this reason, the writer attempted to design the questions 2 through 5 such that key alternative answers could be selected by a respondent, based upon his experience and judgment. While this approach did not permit a sophisticated quantitative analysis of the answers, it did make a credible analysis and evaluation feasible.

The approach used for questions 2 through 5 was to ask the respondent to select a condition which best fit the situation posed in the question. For example, in question 2 the respondent was asked to select one of the following conditions: more difficult, equally difficult, or less difficult. Next, the respondents were asked to check alternative answers which they felt best supported their selection of a particular condition. The analysis consisted of determining the percentage of respondents which selected each condition and alternative answer. In this analysis, the respondent answers were evaluated as a total group, and by several different categories according to experience levels.

The approach used for question 6 was to ask each respondent to narratively describe "minimum data" required to satisfy the assumptions given. The answers given by the respondents were excellent, but could not be analyzed or evaluated in any meaningful way. The most frequent and best substantiated answers given by the respondents are summarized in this analysis.

The approach used for question 7 was to ask each respondent to narratively describe the impact of the

Contractor Inquiry (CI) and Deficiency Report (DR) on technical evaluation, risk assessment, and scoring in the Source Selection process. The answers by respondents were similar enough to allow a meaningful analysis. The answers were divided into several categories and the percentage of respondent answers in each category determined.

Analysis of Question Number 1:

Experience Level

Question number 1. My participation in the Source Selection process has been:

a. Approximate years experience is _____ years.

b. Level and frequency (approximate) of participation.

Level	No. of Programs
SSAC	______________
SSEB	
Chairman	______________
Co-Chairman (Area _____)	______________
Item Captain (Item _____).	______________
Factor Member (Factor _____).	______________
Contract Definition	______________
Cost to Govt.	______________

1. General

The questionnaire was designed to obtain answers which would permit analysis of the respondents by total years experience within the Source Selection process, and by frequency of participation in Source Selection actions at different functional levels. The following paragraphs show various analyses of the respondents' experience by time and functional level.

2. Respondents Experience by Years

(a) Average Years Experience

All 44 respondents represented 472 years experience. This averages 10.72 years per respondent.

(b) Years Experience Versus Number of Respondents

The total years Source Selection Experience of respondents ranged from less than one year to 31 years. Table XXXII shows approximately one-third of the respondents had 0-5 years experience, one-third had 6-10 years experience, and one-third had 11-31 years experience.

TABLE XXXII

YEARS EXPERIENCE BY NUMBER OF RESPONDENTS

Years Experience	Number of Respondents
0- 1	6
2- 3	4
4- 5	3
6-10	16
11-15	4
16-20	5
21-31	6
	44 respondents

The average experience level (10.72 years) falls in the upper extreme of the 6-10 year group which makes up the middle third of the population of respondents. The cause for this was the wide spread of years experience in the upper third of the population of respondents. For example, 11 of the 15 respondents in the upper third had 16-31 years experience.

(c) Civil Service Versus Military

Of the 44 total respondents, 36 were Civil Service and 8 were military employees.

Number	Respondents	Average Years Experience
36	Civil Service	12.10
8	Military	4.50
		10.72

(d) Years Experience by Functional Level

Table XXXIII categorizes respondents by the highest functional level of the SSAC/SSEB in which they have served, and shows the average years experience level for each category.

The single respondent whose highest functional level was as a member of a cost team is hardly a representative sample. For this reason, the cost area will not be considered a significant part of this analysis effort. The most likely reason for the relatively low average experience of SSEB Chairmen is that the Chairman is usually the SPO Director. The SPO Director of major weapon system programs is almost always an experienced, high-ranking, and relatively-transient Air Force Officer. The 10 to 14 years average experience level for the SSAC, Co-Chairman, Item Captains, and Factor Member respondents tends to strengthen the validity of any analysis made using these categories.

TABLE XXXIII

YEARS EXPERIENCE BY FUNCTIONAL LEVEL

Highest Functional Level	Number Respondents	Total Years	Average Yrs. Experience
SSAC	13	141	10.85
SSEB Chairman	8	36	4.0
SSEB Co-Chairman	12	161	13.41
SSEB Item Captain	6	86	14.32
SSEB Factor Member	4	43	10.75
Cost to Govt. Team	1	6	6.0

3. Respondents Experience in Source Selection Activities

(a) Total Source Selection Activities by Functional Level

This analysis shows the total number of different Source Selection activities participated in by all respondents according to functional area served in.

This total of 235 does not represent 235 separate Source Selection programs. It is the total number of separate Source Selection functions performed in Source Selection programs. In this analysis, only respondents which have served on the SSAC could perform the 50 SSAC activities, but these respondents could also have performed some of the subordinate functions. SSAC and SSEB Chairmen are the only respondents who could have performed the 20 Chairman Activities, etc., etc.

TABLE XXXIV

TOTAL ACTIVITIES BY FUNCTIONAL LEVEL

Functional Level	Total Number of Source Selection Activities
SSAC	50
SSEB Chairman	20
Co-Chairman	47
Item Captain	43
Factor Member	53
Contract Definition	10
Cost to Government	12
Total	235

Table XXXIV shows that the collective experience of the 44 respondents in specific Source Selection activities is substantial. This is particularly true for the SSAC, Co-Chairman, Item Captain, and Factor Member Activities.

(b) Source Selection Activities by Highest Functional Level

This analysis, shown in Table XXXV, gives the number of specific Source Selection activities performed by functional level, by the highest functional level in which respondents served. For example, it shows above the diagonal, a breakout of how many different activities, by functional level, were performed by the 13 respondents who had served as members of the SSAC. The number below the diagonal is the average number of these specific activities that were performed by each of these 13 SSAC members.

In the right-hand column, the total number of activities (at all functional levels) accomplished by that functional level group is given above the diagonal. For example, the 13 SSAC members performed a total of 100 separate Source Selection Activities at various functional levels. The number below the diagonal in the right-hand column is the average number of activities (at various levels) performed by the respondents in that "highest functional level" group. For example, the average number of combined activities performed by the SSAC members is 7.7.

The bottom "Total" row is simply the same analysis as in paragraph 3(a) above. The percentages at the bottom of Table XXXV are the percentages of this total performed by "highest functional level" groups.

This analysis clearly shows that the 13 SSAC respondents are far more experienced in Source Selection

TABLE XXXV

SOURCE SELECTION ACTIONS PERFORMED BY HIGHEST FUNCTIONAL LEVEL EXPERIENCE OF RESPONDENTS

HIGHEST FUNCTIONAL LEVEL / NUMBER OF RESPONDANTS	NUMBER OF SOURCE SELECTION ACTIVITIES															
	SSAC		SSEB													
			CHAIRMAN		CO-CHAIRMAN		ITEM CAPTAIN		FACTOR MEMBER		CONTRACT DEFINITION		COST TO GOVERNMENT			
	ACT.*	AVG.*	ACT.	AVG.	ACT.	AVG.	ACT.	AVG.	ACT.	AVG.	ACT.	AVG.	ACT.	AVG.	TOTAL	AVG.
SSAC	50	3.85	6	.46	7	.54	15	1.15	15	1.15	5	.38	2	.15	100	7.7
SSEB CHAIRMAN			14	1.75	4	.50	3	.37	2	.25	0	0	0	0	23	2.9
SSEB CO-CHAIRMAN					36	3.0	10	.84	3	.25	2	.16	8	.66	59	4.9
SSEB ITEM CAPTAIN							15	2.5	10	1.65	1	.16	0	0	26	4.3
SSEB FACTOR MEMBER									23	5.75	2	.5	0	0	25	6.2
SSEB COST													2	2.0	2	2
TOTAL	50		20		47		43		53		10		12		235	

PERCENTAGES OF ACTIVITIES PERFORMED BY HIGHEST FUNCTIONAL LEVEL		SSAC	CHAIRMAN	CO-CHAIRMAN	ITEM CAPTAIN	FACTOR MEMBER	CONTRACT DEFINITION	COST TO GOVERNMENT	TOTAL
	SSAC	100%	30%	15%	35%	28.3%	50%	16.5%	42.5%
	CHAIRMAN		70%	8.5%	9.7%	3.7%	0%	0%	9.8%
	CO-CHAIRMAN			76.5%	20.3%	5.6%	20%	67%	25%
	ITEM CAPTAIN				35%	19%	10%	0%	11.1%
	FACTOR MEMBER					43.4%	20%	0%	10.6%
	COST							16.5%	1.0%
		100%	100%	100%	100%	100%	100%	100%	100%

*ACT. = ACTUAL NUMBER OF ACTIVITIES PERFORMED BY RESPONDANTS
*AVG. = AVERAGE NUMBER OF ACTIVITIES PERFORMED BY RESPONDANTS

activities than all other respondents, accomplishing 42.5% of the total (235) activities and averaging 7.7 activities per respondent. In every functional level below SSAC, the SSAC respondents were second best qualified in terms of average number of activities per respondent, except for the "Cost to Government" function. In every case, the best qualified in a particular functional level, in terms of activities per respondent, was the group of respondents whose highest functional level was that particular functional level. That is to say, the "best qualified" as Chairman was the group of 8 respondents whose highest functional level was SSEB Chairman. The "best qualified" as Item Captain was the group of six respondents whose highest functional level was SSEB Item Captain, etc. While the four factor members had not worked above that level, they had the second highest average of activities per respondent (6.2), but only accounted for 10.6% of the total (235) activities. Next to the SSAC members, the SSEB Co-Chairman (12 respondents) were most widely experienced, accounting for 25% of the total (235) activities performed and averaging 4.9 activities per respondent.

The eight respondents making up the SSEB Chairman group were the "least qualified" in every functional level except their own (Chairman) level. "Least qualified" refers only to the average number of Source Selection activities per respondent. This should come as no surprise, for it is very consistent with the years experience analysis (paragraph 2(d) above) and the type of individuals (Military SPO Directors) used as SSEB Chairmen.

Analysis of Question Number 2:

Minimum Documentation

Question Number 2. As currently applied, the PUD concept for minimum documentation has made the SSEB technical evaluation (more, equally, less) difficult because:

_____ Too much latitude allowed in technical data requirements.
_____ Technical data generally better in all respects.
_____ Technical data not significantly influenced by PUD.
_____ Variance in data submittal formats between proposals.
_____ Variance in the depth of technical data between proposals.
_____ Standards too general and hard to apply.
_____ Standards too detailed and restrictive.
_____ Standards satisfactory.
_____ Technical risks easier to identify and assess.
_____ Technical risks harder to identify and assess.
_____ Other reasons (provide comments below).

1. General

This question was designed to obtain answers relative to the difficulty of technical evaluation in the SSEB evaluation process as a result of the minimum documentation concept within the current DoD management philosophy. Several respondents were not familiar with the term "PUD". Others were familiar with PUD, but had not been associated with a program to which the minimum documentation concept, per se, was applied. The following analysis will present the answers of respondents as a total group, and by several different aspects of experience level. The "other reasons" provided by respondents will be summarized at the end of each section. The same analysis approach used for question 2 will also be used in the sections for questions 3, 4, and 5.

2. Answers by Highest Functional Level

Table XXXVI shows respondent answers as a total group and also by the highest functional level in which each respondent has served. The highest functional level of 13 of the 44 respondents was the SSAC. The highest functional level of 8 of 44 respondents was SSEB Chairman, etc. The questionnaire alternative answers are abbreviated here for convenience only.

These data are presented by percentage of respondents in the next paragraph.

(a) Percentage of Respondents by Answer Given

This analysis, summarized in Table XXXVII, shows the percentage of total respondents that marked each alternative answer to question 2. In addition, it shows the percentage of respondents, by highest functional level, that marked each alternative answer to question 2. These data are essentially the same as that presented in Table XXXVI. The difference is that the data are expressed as a percentage of the total respondents in a category that marked each alternative answer. For example, 29.5% of the 44 respondents gave no response to question 2. Of the 13 SSAC

TABLE XXXVI

ANSWERS TO QUESTION 2 BY HIGHEST FUNCTIONAL LEVEL

Respondent Answers	Total Respondents	Highest Functional Level of Respondents					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
	(44)	(13)	(8)	(12)	(6)	(4)	(1)
No response	13	3	3	4	3	0	0
More difficult	17	5	2	3	2	4	1
Equally difficult	8	3	1	4	0	0	0
Less difficult	3	2	0	0	1	0	0
Too much latitude	8	3	2	0	1	2	0
Tech Data better	2	1	0	0	1	0	0
Tech Data not influenced	3	2	0	1	0	0	0
Variance in formats	7	2	2	0	1	2	0
Variance in depth	16	5	3	3	1	4	0
Standards too general	7	2	0	1	1	3	0
Standards too detailed	1	1	0	0	0	0	0
Standards satisfactory	4	2	0	0	1	1	0
Technical risk easier	3	2	0	0	1	0	0
Technical risk harder	11	5	0	0	2	4	0
Other reasons	19	5	5	5	1	2	1

TABLE XXXVII

PERCENTAGE OF RESPONDENTS BY ALTERNATIVE ANSWERS TO QUESTION 2

Alternative Answers	Total Respondents	SSAC	Chairman	Co-Chairman	Item Captain	Factor Member	Cost
No response	29.5	23.0	37.5	33.3	50.0	0	0
More difficult	38.0	38.5	25.0	25.0	33.3	100.0	100.0
Equally difficult	18.2	23.0	12.5	33.3	0	0	0
Less difficult	6.8	15.4	0	0	16.7	0	0
Too much latitude	18.2	23.0	25.0	0	16.7	50.0	0
Tech data better	4.5	7.7	0	0	16.7	0	0
Tech data not influenced	6.8	15.4	0	8.3	0	0	0
Variance in formats	15.9	15.4	25.0	0	16.7	50.0	0
Variance in depth	36.4	38.5	37.5	25.0	16.7	100.0	0
Standards too general	15.9	15.4	0	8.3	16.7	75.0	0
Standards too detailed	2.3	7.7	0	0	0	0	0
Standards satisfactory	9.1	15.4	0	0	16.7	25.0	0
Technical risk easier	6.8	15.4	0	0	16.7	0	0
Technical risk harder	25.0	38.5	0	0	33.3	100.0	0
Other reasons	43.2	38.5	62.5	41.6	16.7	50.0	100.0

respondents, 23% of them gave no response to question 2.

3. Comparison of Answers by SSAC and SSEB

This analysis compares the percentage of SSAC respondents marking each alternative answer to question 2 with the percentage of SSEB respondents marking each alternative answer. Of the 44 respondents, 13 were members of the SSAC and 31 were members of the SSEB. This data is shown in Table XXXVIII.

TABLE XXXVIII

PERCENTAGE OF ALTERNATIVE ANSWERS (QUESTION 2) BY SSAC AND SSEB

Alternative Answers	SSAC (13)	SSEB (31)
No response	23.0	32.3
More difficult	38.5	38.8
Equally difficult	23.0	16.1
Less difficult	15.4	3.2
Too much latitude	23.0	16.1
Tech data better	7.7	3.2
Tech data not influenced	15.4	3.2
Variance in formats	15.4	16.1
Variance in depth	38.5	35.5
Standards too general	15.4	16.1
Standards too detailed	7.7	0
Standards satisfactory	15.4	6.5
Technical risk easier	15.4	3.2
Technical risk harder	38.5	19.3
Other reasons	38.5	45.2

4. Comparison of Answers by Years Experience of Respondents

There were 13 respondents with 5 years or less Source Selection experience, 16 respondents with 6 to 10 years experience, and 15 respondents with 11 to 31 years experience. Table XXXIX shows how these three groups selected the alternative answers to question 2. The left column under each experience category shows the percentage of respondents in that category that selected that alternative answer. The right column under each experience category shows, for that particular category, the percentage of the total number of respondents selecting that answer.

5. Summary of "Other Reaons"

This section summarizes the other reasons given by respondents to support saying that the technical evaluation is more, equally, or less difficult due to minimum documentation. The numbers in parentheses adjacent to the reasons refer to the numbered reasons in Table XXVII of Chapter VI.

(a) Reasons Technical Evaluation More Difficult

(1)	SSAC	(2)	Evaluator reluctant to draw conclusions from minimum data
		(2)	State-of-art areas not addressed are scored down for lack of response
(2)	SSEB Chairman	(1)	Lack of specific guidance in RFP
		(2)	Lack of Source Selection

TABLE XXXIX

RESPONDENT ANSWERS (QUESTION 2) BY YEARS EXPERIENCE

Alternative Answers	Experience Level					
	5 yrs or less (13 respondents)		6 to 10 yrs (16 respondents)		11 to 31 yrs (15 respondents)	
No response	30.8	30.8	37.5	46.2	20.0	23.0
More difficult	38.5	29.5	31.2	29.5	46.7	41.0
Equally difficult	7.7	12.5	12.5	25.0	33.3	62.5
Less difficult	15.4	67.0	6.2	33.0	0	0
Too much latitude	30.8	50.0	0	0	26.7	50.0
Tech data better	15.4	100.0	0	0	0	0
Tech data not influenced	0	0	12.5	67.0	6.7	33.0
Variance in formats	30.8	57.2	0	0	20.0	42.8
Variance in depth	46.0	37.5	25.0	25.0	40.0	37.5
Standards too general	15.4	28.6	12.5	28.6	20.0	42.8
Standards too detailed	0	0	6.2	100.0	0	0
Standards satisfactory	7.7	25.0	6.2	25.0	13.3	50.0
Technical risk easier	15.4	67.0	6.2	33.0	0	0
Technical risk harder	23.0	27.3	12.5	18.3	40.0	54.4
Other reasons	53.8	36.8	43.7	36.8	33.3	26.4

			procedures specifically addressing PUD concept
		(1)	Lack of specific procedures allows latitude in data which may result in reduced data submittal in areas where contractor is deficient -- but this is hard to determine
(3)	SSEB Co-Chairman	(1)	Benefits of PUD overshadowed by importance of RFP. Not felt that PUD will significantly influence data
(4)	SSEB Item Captains	(1)	Amount of data required is directly related to level of evaluation desired. Minimum documentation gets minimum evaluation
(5)	SSEB Factor Members	(1)	Even though minimum data is submitted, higher level management requires detailed evaluation and answers
		(2)	Difficult to treat each contractor equally with minimum documentation
		(1)	High quality evaluation requires high quality and sufficient quantity data. Lack of data and methods creates a risk in evaluation.

(b) <u>Reasons Technical Evaluation Equally Difficult</u>

(1)	SSAC		Disengagement concept of PUD resulted in identification of a minimum of design deficiencies, and their correctability could only be estimated. From a strictly technical viewpoint, technical evaluation not influenced by PUD - but over-all evaluation is.
(2)	SSEB Chairman	(1)	Specifying exact data needed would simplify evaluation but create big

problem in RFP. Better to clearly define minimum data with latitude to expand.

(3) SSEB Co-Chairman - Does not feel PUD will significantly influence data.

(1) RFP data requirements must be consistent with level of evaluation desired

(1) Factors that increase need for data are: (a) Requirements that are broad in scope, unclear, or complex in defining operational needs, (b) Extent of documentation required to fully structure definitive contract, (c) system technical complexity.

(c) <u>Reasons Technical Evaluation Less Difficult</u>

SSAC - PUD forced contractors to "think".

(1) Technical evaluation under PUD allows concentration on important issues and to leave out trivia.

(d) <u>Other Remarks Where More/Equally/ Less Difficult Was Not Specified</u>

(1) SSEB Chairman - Not familiar with PUD - but B-1 approach was good.

- Suggested a data matrix in RFP to be specific on data requirements, plus allow adequate time for CI/DR replies. Sees PUD simply delaying major evaluation effort until after prototype phase.

(2) SSEB Co-Chairman

(1) Difficulty level related to how well RFP establishes data requirements

consistent with desired
level of technical
evaluation.

Analysis of Question Number 3: "Paper" Versus Hardware Studies

Question Number 3. Compared to evaluating proposals for "paper" studies, the technical evaluation in the SSEB process is (more, equally, less) difficult when proposals are responsive to RFP for prototype hardware development because:

- _____ It is necessary to obtain and review more data.
- _____ Data requirements and review are the same.
- _____ Less data review is required for hardware proposals.
- _____ Level of evaluation effort always greater with hardware.
- _____ Level of evaluation effort less with hardware.
- _____ Level of evaluation effort the same.
- _____ More emphasis on technical risk with hardware proposals.
- _____ Emphasis on technical risks the same.
- _____ Other reasons (provide comments below).

1. General

This question was designed to obtain data which would allow assessment of differences, if any, in the difficulty level of technical evaluation of "paper studies" versus prototype hardware. As used in this question, "paper studies" refer to competitive Source Selection for which the immediate objective and product of the winning contractor will be a complete engineering, design, and management proposal which will be periodically reviewed and approved prior to development and production of hardware. Prototype hardware development refers to Competitive Source Selection for which the immediate objective and product of the winning contractor(s) will be the development and fabrication of prototype hardware in accordance with detailed engineering and design approaches evaluated and approved in the Source Selection process.

This analysis follows the same pattern established in the analysis of question number 2 of the questionnaire.

2. Answers by Highest Functional Level

Table XL shows respondents' answers as a total group and also by the highest functional level in which each respondent served.

(a) Percentage of Respondents by Answer Given

This analysis is the same type as that performed in Table XXXVII and is shown in Table XLI.

(b) Comparison of Answers by SSAC and SSEB

This analysis was performed in the same manner as described in previous sections. The results are shown in Table XLII.

(c) Comparison of Answers by Years Experience of Respondents

This analysis was performed in the same manner as described in previous sections. The results are shown in Table XLIII.

TABLE XL

ANSWERS TO QUESTION 3 BY HIGHEST FUNCTIONAL LEVEL

Respondent Answers	Total Respondents	Highest Functional Level of Respondent					
		SSAC	Chairman	Co-Chairman	Item	Factor	Cost
	(44)	(13)	(8)	(12)	(6)	(4)	(1)
No response	5	1	0	2	1	0	1
More difficult	25	9	5	6	3	2	0
Equally difficult	7	1	1	2	2	1	0
Less difficult	7	2	2	2	0	1	0
Obtain and review more	14	7	1	1	4	1	0
Data requirements same	4	1	1	0	1	1	0
Less review required	3	1	2	0	0	0	0
Level greater	19	8	2	4	3	2	0
Level less	2	0	2	0	0	0	0
Level same	4	0	1	2	1	0	0
More emphasis on risk	20	7	2	5	4	2	0
Emphasis on risk same	2	1	0	0	1	0	0
Other	21	5	5	6	3	2	0

TABLE XLI

PERCENTAGE OF RESPONDENTS BY ALTERNATIVE ANSWERS TO QUESTION 3

Alternative Answers	Total Respondents	SSAC	Chairman	Co-Chairman	Item Captain	Factor Member	Cost
No response	11.4	7.7	0	16.7	16.7	0	100.0
More difficult	56.8	69.2	62.5	50.0	50.0	50.0	0
Equally difficult	15.9	7.7	12.5	16.7	33.3	25.0	0
Less difficult	15.9	15.4	25.0	16.7	0	25.0	0
Obtain and review more	31.8	53.8	12.5	8.4	66.6	25.0	0
Data requirements same	9.1	7.7	12.5	0	16.7	25.0	0
Less review required	6.8	7.7	25.0	0	0	0	0
Level greater	43.2	61.5	25.0	33.3	50.0	50.0	0
Level less	4.5	0	25.0	0	0	0	0
Level same	9.1	0	12.5	16.7	16.7	0	0
More emphasis on risk	45.5	53.8	25.0	41.6	66.6	50.0	0
Emphasis on risk same	4.5	7.7	0	0	16.7	0	0
Other	47.7	38.5	62.5	50.0	50.0	50.0	0

TABLE XLII

PERCENTAGE OF ALTERNATIVE ANSWERS (QUESTION 3)
BY SSAC AND SSEB

Alternative Answers	SSAC (13)	SSEB (31)
No response	7.7	16.1
More difficult	69.2	51.6
Equally difficult	7.7	19.3
Less difficult	15.4	16.1
Obtain and review more	53.8	22.6
Data requirements same	7.7	9.7
Less review required	7.7	6.5
Level greater	61.5	35.4
Level less	0	6.5
Level same	0	12.9
More emphasis on risk	53.8	41.9
Emphasis on risk same	7.7	3.2
Other	38.5	51.7

TABLE XLIII

RESPONDENTS ANSWERS (QUESTION 3) BY YEARS EXPERIENCE

Alternative Answers	Experience Level					
	5 yrs or less (13 respondents)		6 to 10 yrs (16 respondents)		11 to 31 yrs (15 respondents)	
No response	7.7	20.0	12.5	40.0	13.3	40.0
More difficult	53.8	28.0	62.5	40.0	40.0	32.0
Equally difficult	23.0	43.0	6.2	14.0	20.0	43.0
Less difficult	15.4	28.5	18.7	43.0	13.3	28.5
Obtain and review more	30.8	30.0	25.0	30.0	40.0	40.0
Data requirements same	15.4	50.0	6.2	25.0	6.7	25.0
Less review required	7.7	34.0	6.2	33.0	6.7	33.0
Level greater	38.5	26.0	43.7	37.0	46.7	37.0
Level less	7.7	50.0	0	0	6.7	50.0
Level same	15.4	50.0	0	0	13.3	50.0
More emphasis on risk	30.8	20.0	43.7	35.0	60.0	45.0
Emphasis on risk same	7.7	50.0	0	0	6.7	50.0
Other	53.8	33.0	56.2	43.0	33.3	24.0

5. Summary of "Other Reasons"

This analysis summarizes the "other reasons" given by respondents to support saying that the technical evaluation was more, equally, or less difficult with prototype hardware development.

(a) Reasons Technical Evaluation More Difficult

(1) SSAC

- (1) Greater visibility with hardware; therefore, a closer look at risk. Dollar risks greater and schedule risks more important.
- (2) Proposals for hardware concentrate on performance promises.
- (2) Greater depth of detailed review required

(2) SSEB Chairman - Hardware requires more definitive data, not necessarily more data

- (2) Easier to set standards but more rigorous evaluation
- (2) Effort increased because both prototype and production configurations, as well as relationships between them, must be considered. Effort reduced because some considerations can be deferred until after prototype, and are not essential to initial selection.
- (2) Effort increased since committed to a configuration sooner.

(3) SSEB Co-Chairman

- (1) Consequences of hardware greater
  - End product more precise, judgment of adequacy more difficult, and RFP does

not adequately establish requirements.

(2) More rigorous evaluation/ defense at highest management levels.

(4) SSEB Item Captain — (2) Increased order of difficulty if RFP considers production hardware compared to prototype.

(5) SSEB Factor Captain — (1) Cost of failure greater with hardware.

(b) Reasons Technical Evaluation Equally Difficult

(1) SSEB Chairman - Level of effort is essentially dependent upon type of contract.

(2) SSEB Co-Chairman - Cannot compare since looking at different things

(3) SSEB Item Captain - Paper studies require less data but both equally difficult

(c) Reasons Technical Evaluation Less Difficult

(1) SSAC - Hardware easier due to quantifiable measures.

(2) SSEB Chairman - If RFP is structured to clearly limit response of technical team, addressing only high risk areas of technical concern, evaluation would require less total volume of data and be less difficult.

(3) SSEB Co-Chairman - In prototype hardware more data required but evaluation easier since standards can be more precise.
- Less difficult by nature of more definitive data.

(4) SSEB Factor Member - Level of responsibility for prototype hardware is critical in cost area and, therefore, requires more accurate technical evaluation and

accuracy in contractor response.

Analysis of Question Number 4: SSEB Scoring Process

Question Number 4. The SSEB scoring process at the factor and item level (should/should not) be modified because:

_____ Present system is adequate and preferred.
_____ Present system is absolutely superior.
_____ Present system tends to force scores toward average.
_____ Upward flow of evaluation information is constrained.
_____ More definitive ranking/scoring of proposals needed at factor level.
_____ Less definitive ranking/scoring of proposals needed at factor level.
_____ Technical risk too difficult to integrate into score.
_____ Present scoring system tends to compromise the motivation for professional excellence in the evaluator.
_____ Emphasis should be placed upon factor and item evaluators to rank proposals against each other as well as against standards.
_____ Scoring <u>and</u> weighting should be accomplished at the factor and item level consistent with the primary objectives/requirements of the weapon system.

1. General

This question was designed to obtain data which would allow an evaluation of the adequacy of the present SSEB rating/scoring process which is applied to all developmental programs. The question was not intended to compare the adequacy of the scoring system applied to different management/contract approaches. This analysis follows the same pattern established in previous sections.

2. Answers by Highest Functional Level

Table XLIV shows respondent answers as a total group and also by the highest functional level in which each respondent has served. See paragraph (2) under the section for analysis of question number 2 for further explanation.

(a) Percentage of Respondents by Answer Given

This analysis was performed in a manner described in previous sections. The results are shown in Table XLV.

(b) Comparison of Answers by SSAC and SSEB

This analysis used the approach established in previous sections. The results are shown in Table XLVI.

(c) Comparison of Answers by Years Experience of Respondents

This analysis used the approach described in previous sections. The results are shown in Table XLVII.

3. Summary of "Other Reasons"

This section summarizes the other reasons given by respondents to support saying that the rating/scoring system should or should not be modified. The numbers in parenthesis refer to the numbered order of reasons in Table XI of Chapter VI.

TABLE XLIV

ANSWERS TO QUESTION 4 BY HIGHEST FUNCTIONAL LEVEL

Respondent Answers	Total Respondents (44)	Highest Functional Level of Respondents					
		SSAC (13)	Chairman (8)	Co-Chairman (12)	Item (6)	Factor (4)	Cost (1)
No response	1	0	0	1	0	0	0
Should be modified	28	10	6	3	5	4	0
Should not be modified	13	3	1	8	1	0	0
Present system adequate	12	3	1	8	0	0	0
Present system superior	0	0	0	0	0	0	0
System forces to average	16	5	5	3	2	1	0
Upward flow constrained	5	2	1	1	1	0	0
More definitization needed	9	3	2	0	3	1	0
Less definitization required	2	1	0	1	0	0	0
Technical risk too difficult	9	3	2	2	1	1	0
Present system compromises	6	1	1	0	1	3	0
Emphasis on ranking	10	3	1	2	3	1	0
Scores/weighting by factor	9	4	1	0	2	2	0
Other	23	7	6	5	3	1	1

TABLE XLV

PERCENTAGE OF RESPONDENTS BY ALTERNATIVE ANSWERS TO QUESTION 4

Alternative Answers	Total Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Cost
No response	2.3	0	0	8.4	0	0	0
Should be modified	63.7	77.0	75.0	25.0	83.4	100.0	0
Should not be modified	29.5	23.0	12.5	66.6	16.6	0	0
Present system adequate	27.3	23.0	12.5	66.6	0	0	0
Present system superior	0	0	0	0	0	0	0
System forces to average	36.4	38.5	62.5	25.0	33.3	25.0	0
Upward flow constrained	11.4	15.4	12.5	8.4	16.6	0	0
More definitization needed	20.4	23.0	25.0	0	50.0	25.0	0
Less definitization required	4.5	7.7	0	8.4	0	0	0
Technical risk too difficult	20.4	23.0	25.0	16.7	16.6	25.0	0
Present system compromises	13.6	7.7	12.5	0	16.6	75.0	0
Emphasis on ranking	22.7	23.0	12.5	16.7	50.0	25.0	0
Scoring/weighting by factor	20.4	33.3	12.5	0	33.3	50.0	0
Other	52.3	53.8	75.0	41.7	50.0	25.0	100.0

TABLE XLVI

PERCENTAGE OF ALTERNATIVE ANSWERS (QUESTION 4) BY SSAC AND SSEB

Alternative Answers	SSAC (13)	SSEB (31)
No response	0	3.2
Should be modified	77.0	58.0
Should not be modified	23.0	32.0
Present system adequate	23.0	29.0
Present system superior	0	0
System forces to average	38.5	35.5
Upward flow constrained	15.4	9.7
More definitization needed	23.0	19.3
Less definitization required	7.7	3.2
Technical risk too difficult	23.0	19.3
Present system compromises	7.7	16.1
Emphasis on ranking	23.0	22.6
Scoring/weighting by factor	33.3	16.1
Other	53.8	51.6

TABLE XLVII

RESPONDENT ANSWERS (QUESTION 4) BY YEARS EXPERIENCE

Alternative Answers	Experience Level					
	5 yrs or less (13 respondents)		6 to 10 years (16 respondents)		11 to 31 years (15 respondents)	
No response	0	0	6.2	100	0	0
Should be modified	84.8	39	56.2	32	53.3	29
Should not be modified	7.7	8	31.2	38	46.7	54
Present system adequate	0	0	31.2	42	46.7	58
Present system superior	0	0	0	0	0	0
System forces to average	61.5	50	25.0	25	26.7	25
Upward flow constrained	7.7	20	6.2	20	20.0	60
More definitization needed	30.8	42	25.0	42	6.7	16
Less definitization required	0	0	12.5	100	0	0
Technical risk too difficult	23.0	33	6.2	11	33.3	56
Present system compromises	23.0	50	0	0	20.0	50
Emphasis on ranking	23.0	30	18.7	30	26.7	40
Scoring/weighting by factor	38.5	56	12.5	22	13.3	22
Other	53.8	30	62.5	48	33.3	22

(a) Reasons for Modifying Scoring System

(1)	SSAC	(9)	Present system fails to provide for corrected deficiencies.
		(8)	Should be simplified -- now have a bunch of meaningless, unrelatable numbers.
		(3)	After scoring first proposal there is a tendency to use it as the standard.
		(2)	Need larger point spread. Scores should be matched to system objectives (use weighted scores). Risk scores should be presented separately but comparable/relatable.
		(2)	Should eliminate multiple considerations of same problem.
		(5)	Need method to put technical, schedule, cost risks into perspective.
(2)	SSEB Chairman	(7)	Present system can mask points identified at factor level.
		(2)	Need greater point spread.
		(3)	Should distinguish between how well a proposal "meets standard" compared to others.
		(2)	Oppose the +, ✓, - system strongly.
		(9)	Present system scores on original submittals. Final selection is based upon proposals modified by CI's and DR's. Therefore, original weaknesses may be irrelevant in final selection. Scoring process needs to recognize and account for this.
(3)	SSEB Co-Chairman	(10)	Difficult to define properly inclusive but mutually exclusive areas for evaluation and scoring.
		(10)	Difficult to establish meaningful evaluation

			criteria to identify really important areas.
		(2)	Present system evaluates technical compromises and alternatives based upon individual merit instead of effect on total system.
(4)	SSEB Item Captain	(3)	Present system designed to divorce scoring or ranking between contractors but this is too difficult to do.
		(9)	Little or no penalty given to contractor who is not responsive.
		(4)	Precise definition of point score should be defined and explained prior to evaluation.
(5)	SSEB Factor Member	(2)	This respondent proposed a modified scoring system.
(6)	SSEB Cost Member	-	Cost System does not have scoring system, and properly so.

Analysis of Question Number 5: Cost and Technical Interaction

Question Number 5. The communication and interaction between cost and technical design personnel should be (increased/no change/decreased) because:

_____ Current system is adequate and preferred.
_____ Cost data should be divorced from technical design.
_____ Cost data does not adequately reflect design, material, and manufacturing processes.
_____ Cost data should in some way reflect technical and other risks.
_____ Technical design people could assist in improving cost models and programs.
_____ Other reasons (provide comments below).

1. General

This question was designed to obtain answers relative to the adequacy of present interactions between personnel in the cost and technical areas during Source Selection evaluations. Like question number 4, this question relates to the Source Selection evaluation process in general, and not to a particular management/contract approach, such as prototype hardware, "paper studies", etc. The analysis used for this question will follow the same approach developed in previous sections.

2. Answers by Highest Functional Level

Table XLVIII shows respondent answers as a total group and also by the highest functional level in which each respondent has served.

(a) Percentage of Respondents by Answer Given

The approach for this analysis is described in previous section. The results are shown in Table XLIX.

3. Comparison of Answers by SSAC and SSEB

The approach for this analysis is described in previous sections. The results are shown in Table L.

4. Comparison of Answers by Years Experience of Respondents

The approach for this analysis is described in previous sections. The results are shown in Table LI.

TABLE XLVIII

ANSWERS TO QUESTION 5 BY HIGHEST FUNCTIONAL LEVEL

Respondent Answers	Total Respondents (44)	Highest Functional Level of Respondents					
		SSAC (13)	Chairman (8)	Co-Chairman (12)	Item (6)	Factor (4)	Cost (1)
No response	0	0	0	0	0	0	0
Increase communication	35	10	8	9	4	3	1
No change	8	2	0	3	2	1	0
Decrease communication	1	1	0	0	0	0	0
Current system adequate	6	2	0	3	1	0	0
Divorce cost data	1	0	0	1	0	0	0
Does not adequately reflect	12	4	4	2	0	1	1
Should reflect risk	30	11	5	6	4	3	1
Technical could assist	21	4	5	6	1	4	1
Other	20	8	5	4	3	0	0

TABLE XLIX

PERCENTAGE OF RESPONDENTS BY ALTERNATE ANSWERS TO QUESTION 5

Alternative Answers	Total Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Cost
No response	0	0	0	0	0	0	0
Increase communications	79.5	77.0	100.0	75.0	66.6	75.0	100.0
No change	18.2	15.4	0	25.0	33.4	25.0	0
Decrease communication	2.3	7.6	0	0	0	0	0
Current system adequate	13.6	15.4	0	25.0	16.7	0	0
Divorce cost data	2.3	0	0	8.3	0	0	0
Does not adequately reflect	27.3	30.7	50.0	16.7	0	25.0	100.0
Should reflect risk	68.2	84.7	62.6	50.0	66.6	75.0	100.0
Technical could assist	47.8	30.7	62.6	50.0	16.7	100.0	100.0
Other	45.5	61.5	62.6	33.3	50.0	0	0

TABLE L

PERCENTAGE OF ALTERNATIVE ANSWERS (QUESTION 5) BY SSAC AND SSEB

Alternative Answers	SSAC (13)	SSEB (31)
No response	0	0
Increase communication	77.0	80.7
No change	15.4	19.3
Decrease communication	7.6	0
Current system adequate	15.4	12.9
Divorce cost data	0	3.2
Does not adequately reflect	30.7	25.8
Should reflect risk	84.7	61.3
Technical could assist	30.7	54.9
Other	61.5	38.8

TABLE LI

RESPONDENT ANSWERS (QUESTION 5) BY YEARS EXPERIENCE

Alternative Answers	Experience Level					
	5 yrs or less (13 respondents)		6 to 10 yrs (No respondents)		11 to 31 yrs (15 respondents)	
No response	0	0	0	0	0	0
Increase communication	91.5	34.3	87.5	40.0	60.0	25.7
No change	7.5	12.5	12.5	25.0	33.3	62.5
Decrease communication	0	0	0	0	6.7	100.0
Current system adequate	7.5	16.7	12.5	33.3	20.0	50.0
Divorce cost data	0	0	6.2	100.0	0	0
Does not adequately reflect	38.5	41.6	25.0	33.4	20.0	25.0
Should reflect risk	77.0	33.3	69.0	36.7	60.0	30.0
Technical could assist	53.8	33.3	50.0	38.0	40.0	28.7
Other	38.5	25.0	56.2	45.0	40.0	30.0

5. Summary of "Other Reasons"

This section summarizes the other reasons given by respondents to support saying that communication and interaction between cost and technical personnel should be increased, not changed, or decreased. The numbers in parenthesis in paragraph (a) below refer to the numbered reasons listed in Table XXII of Chapter VI.

(a) Reasons Communication Should Increase

(1)	SSAC	(3)	Cost data should be made available to technical people and assistance given in both directions. Earlier interaction needed for trade-off concepts.
		(3)	Cost people live in world of own -- rarely make cost information available. Must insure cost and performance is balanced. Must be cautious -- too much cost data can bias technical evaluation.
		(3)	Necessary between cost and all areas, not just technical.
(2)	SSEB Chairman	(3)	Would yield more realism in cost estimates.
		(3)	Cost evaluation suffers from oversensitive treatment and lack of technical input.
		(1)	Need to coordinate impacts on cost as changes occur and weaknesses/risks identified.
(3)	SSEB Co-Chairman	(3)	Cost panels should prepare cost spread sheet and look for variations beyond spread limits and refer those to technical teams for explanations.

-The suggestions by two respondents were considered excellent and are discussed briefly in Chapter VIII.

(4) SSEB Item Captain

(3) Particularly needed in areas of stringent requirements.

(3) Cost data submitted with proposal generally does not coincide with the technical design submitted in the technical proposal.

(b) Reasons for Making No Change

(1) SSAC - Adequate interaction

(2) SSEB Item Captain - Must score cost data to obtain realism

(3) SSEB Factor Member - Technical evaluation should be made independent of cost data, but cost data should include technical considerations.

(c) Reason Communication Should Decrease

SSAC - Cost models are often either non-existent or not credible; therefore, cost data is for most part useless exercise.

Question Number 6: Minimum Data Defined

Question Number 6. In your specific area, what do you consider to be minimum data: (Be as specific as you can. What is the minimum amount of information you can give the contractor in terms of data requirements and expect a qualified bidder to respond with adequate data for evaluation in your area.)

1. General

The purpose of this question was to obtain answers which would provide a better understanding of the nature, scope, and depth of data required to satisfy:

(1) The minimum documentation concept of current DoD management philosophy and

(2) The Source Selection evaluation of prototype hardware development.

Respondent answers to the question were generally good, but the question itself was too broad in scope. As a result, the respondent answers varied from broad management concepts to detailed data specifications for particular factors. The writer was not able to perform a meaningful analysis, nor reach any specific conclusions from the respondent answers. A more comprehensive and multidisciplined study would be required to determine whether or not specific guidance and procedures could be established relative to minimum documentation on prototype hardware developmental programs.

2. Summary of Respondent Answers

This section provides a summary of some of the most significant and frequent answers given by respondents.

(a) Minimum data varies with the following:

(1) Complexity of the weapon system

(2) Amount of knowledge and data available to evaluator before proposals are submitted.

(3) Type of bidders -- if all are United States manufacturers, data required by

evaluator to make rapid and accurate assessment of performance, handling qualities, weight, structural design, electrical power distribution and loading, etc., are well known.

(b) The data required is dependent upon the depth of evaluation desired and time available.

(c) Do not ask for detailed data in areas that are not critical to the evaluation criteria. Tailor the data to evaluate the operational characteristics which are most critical to the weapon systems over-all effectiveness.

(d) Should restrict the areas of data requested to those that are of significant technical risk.

(e) Data requested for management, logistics, and operational areas could be drastically reduced in prototype hardware developmental programs.

(f) Before it can be determined what data is needed there must be a clear understanding of what the requirements of the prototype system really are, relative to the operational system. Next, these requirements must be stated in the RFP. The evaluation criteria is then established and the data requirements determined from all the above.

(g) It is necessary that differences between prototype and final production configuration be clearly identified and adequately described.

(h) Minimum data can be obtained by using the "ASB Guide for Advanced Systems Planning Study Requirements" document, which is an abstract of the AFSC Work Statement Preparation Manual.

(i) Data should be requested in specified format to facilitate rapid and equitable evaluation of proposals.

Analysis of Question Number 7: CI's and DR's

Question number 7. What influence and impact on the SSEB evaluation process does the Contractor inquiry and Deficiency Report have on:

a. Technical Evaluation?
b. Risk Assessment?
c. Scoring?

1. General

This question was designed to obtain data which could be used to assess the usefulness of CI's and DR's to the Source Selection evaluation process. The poor design of the question resulted in wide variance in the answers, making it difficult to achieve a systematic analysis and evaluation. All of the respondents answers were recorded by highest functional level and compared. For the majority of answers, it was possible to group them into several major categories. When the respondent did not specify CI or DR, it was assumed that his comments applied to both. Tables LII through LVII provide the results of an analysis of the answers by highest functional level for technical evaluation, risk assessment, and scoring, for both contractor inquiries and deficiency reports.

2. Impact on Technical Evaluation

This analysis compares the respondents' answers relative to the impact of the Contractor Inquiry (CI) and Deficiency Report (DR) by highest functional level of the respondents. Table LII shows the most significant effects of the Deficiency Report on the technical evaluation. The numbers in the body of these tables reflect the actual number of respondents providing that particular answer.

3. Impact on Risk Assessment

This analysis compares the respondents' answers relative to the impact of the CI and DR by highest functional level of the respondents. Table LIV shows the most significant effects of the CI on risk assessment, and Table LV shows the most significant effects of the DR on risk assessment.

4. Impact on Scoring

This analysis compares the respondents' answers relative to the impact of the CI and DR by the highest functional level of respondents. Table LVI shows the most significant effects of the CI on the Source Selection Scoring process. Table LVII shows the most significant effects of the DR on the Source Selection Scoring process.

TABLE LII

CI IMPACT ON TECHNICAL EVALUATION

Answers by Respondents	Highest Functional Level					
	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Better evaluation possible through clarification	6	0	3	1	0	10
Essential to evaluation process	1	7	0	0	1	9
Create inequities in favor of contractor in question	1	2	0	1	1	5
Creats excessive delays, process should be improved	2	1	1	1	3	8
No effect on evaluation process	1	0	2	1	0	4
CI's should be sharply reduced or eliminated	1	0	2	1	1	5

TABLE LIII

DR IMPACT ON TECHNICAL EVALUATION

Answers by Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Essential for contract definition	2	2	1	1	0	6
Essential to evaluation	2	0	2	1	2	7
No effect on evaluation	1	4	3	0	1	9
Create inequities in favor of contractor in question	0	2	3	1	0	6
Creates excessive delays	1	1	0	1	1	4
Should reduce and/or restrict use of DR	0	0	2	1	0	3

TABLE LIV

CI IMPACT ON RISK ASSESSMENT

Answers by Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Assists in identifying and assessing risk	7	5	5	3	3	23
Tends to reduce risk	1	0	0	3	1	5
No effect on risk assessment	1	1	2	0	0	4

TABLE LV

DR IMPACT ON RISK ASSESSMENT

Answers by Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Assists in identifying and assessing risk	7	3	5	0	3	18
Tends to reduce risk	1	2	0	3	1	7
No effect on risk assessment	1	3	2	0	0	6
All major risks identified by DR	0	0	2	0	0	2

TABLE LVI

CI IMPACT ON SCORING PROCESS

Answers by Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Improves accuracy of scores	4	3	1	1	1	10
No effect on scores	4	1	4	1	0	10
Scores should reflect CI response	3	1	2	1	0	7
Leads to inequities in favor of contractor in question	0	2	3	0	2	7

TABLE LVII

DR IMPACT ON SCORING PROCESS

Answers by Respondents	SSAC	Chairman	Co-Chairman	Item	Factor	Total Respondents
Improves accuracy of scores	3	1	2	0	1	7
Cause higher probability of low score	0	1	2	1	0	4
No effect on scores	6	3	6	1	0	16
Scores should reflect DR response	2	1	2	1	0	6
Leads to inequities in favor of contractor in question	0	3	1	0	2	6

VITA

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