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THE NASA SOURCE EVALUATION BOARD PROCESS: A DESCRIPTIVE ANALYSIS

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PREFACE

This report is part of a continuing program of management research sponsored by the National Aeronautics and Space Administration (NASA) Manned Spacecraft Center (MSC), Houston, Texas, and the Public Administration Center of San Diego State College, California. Mr. Nolan, a full-time graduate student at the college during the period of his research, was concurrently employed by MSC as a Graduate Research Assistant. The report was submitted to San Diego State College in partial fulfillment of the requirements for the degree of Master of Science in Public Administration.

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ABSTRACT

The National Aeronautics and Space Administration (NASA) utilizes a decentralized review process to aid top administrators in the selection of private firms for major contracts. Termed the Source Evaluation Board (SEB) process, it is probably the most indicative and researchable of the numerous NASA decision-making processes. To achieve a better understanding of this NASA decision-making technique, this study was undertaken. The aims of the study were to define more completely the foundations for SEB activity, the manner in which the process operates, and the ways in which SEB policies and procedures have been altered throughout NASA in general and at the Manned Spacecraft Center (MSC) in particular.

Numerous methodologies were employed in gathering the data necessary to reach conclusions about the SEB process. For example, a number of personal interviews were held with officials at NASA Headquarters in Washington, D.C., and at the Manned Spacecraft Center in Houston, Texas. The printed data which were available and reasonably related to the SEB process were also consulted, and this material varied from books and articles to on-site reports of SEB operations. The author's observations, which constituted a portion of the information, resulted from an examination of the SEB review process as applied to two contract competitions at MSC.

The data from this study indicate that the NASA/SEB process operates upon numerous and varied foundations. A number of benefits which accrue from SEB activities are not directly related to the goal of selecting the most competent contractor. For example, the SEB process is an effective measuring device used by the NASA Administrator to determine how well contractors are developing their capabilities and to guage the quality of the thinking of top NASA officials.

According to evidence obtained, the operational aspects of the process are basically sound. On the other hand, the major challenges to effective SEB operation lie in the choice of evaluation criteria, in the

emphases applied to these criteria, and in the proper preparation of the Request for Proposal (RFP).

Finally, the SEB process is a "social" process and therefore subject to change. Changing issues throughout NASA--such as the Harbridge House Study, the Executive Privilege Issue, and NASA's transition to incentive/award-fee contracts--have provided the background for SEB process changes at the various Field Centers. At the MSC, evidence has shown that basic SEB changes occurred in preparation of the RFP, in emphases placed upon certain evaluation criteria, and in techniques applied to scoring proposals. The author recommends not only the continued utilization of SEB review procedures but also an investigation of the advantages to be derived from increased SEB activity by reducing the contract dollar amount above which SEB procedures came into effect.

INTRODUCTION

BACKGROUND

Prior to 1900, American industrial growth was based primarily upon standardized procedures and inventions, and efforts to explore basic scientific questions were considered secondary to satisfying the recurring demands for essential products. Industry was best able to maximize its profit position by employing the results of a relatively slow pace of technological development. Thus, private enterprise was generally unconcerned about making great advances in scientific areas. The effect of this attitude left only a small portion of the national potential concerned with new discoveries in science and technology.

The Growth of Research and Development

A number of significant world occurrences since the 1920's have created a new climate for economic growth and development. The demand for new products and services made the existing technology obsolescent and the need for new research mandatory. The result has been a revolution in scientific advancement and technological application. World conflicts, nuclear discoveries, and excursions into space have had a primary influence on the growth of research and development (R&D). One indication of this growth is the number of people engaged in R&D. In 1921 only 9000 people were employed by industry as research scientists and engineers, but by 1940 their number had increased 550 percent to 60 000. In the period from 1940 to 1957 an 800 percent increase was experienced, and the number of research employees rose to 728 000. By

1964 the figure rose another 51 percent to total almost 1 100 000 people (ref. 1).

In R&D expenditure increases, significant indicators of strong emphasis on scientific discovery, the Federal Government continues to lead. The Government, which spent in the 1940 fiscal year only $74 million for R&D is expected to spend in the 1966 fiscal year approximately $15.5 billion--an increase of more than 207 times the 1940 amount. Whereas the 1940 R&D figure represented an outlay of less than one percent of total Federal budget expenditures, the expenses for such activities are expected to rise during fiscal year 1966 to 15.5 percent of the total budget (ref. 2).

While the increased magnitude of these figures is of obvious significance, the purposes and trends of the expenditures are of no less importance. Large allocations of resources for R&D are required for defense, atomic energy, and space exploration--areas in which the Federal Government is principally concerned. As a result, the Department of Defense (DOD), the Atomic Energy Commission (AEC), and the National Aeronautics and Space Administration (NASA) are the primary dispersing agencies for such outlays. Although the trends are generally higher in all cases, each agency is characterized by its own expenditure pattern (table I). Thus, the expected R&D expenditure by the DOD of approximately $6.9 billion during fiscal year 1966 will represent an increase of 88 percent over its 1958 outlay, but a substantial reduction as compared with a previous high in 1964. According to estimates, the AEC expenditure for R&D will be 94 percent larger during fiscal year 1966 than in 1958, even though its 1966 proposed expenditures also show a decline. In contrast NASA has, during recent years, assumed substantially increased responsibilities in the areas of space exploration. The augmented dollar allocations for these responsibilities have caused NASA to exhibit an abnormal growth pattern. From a relatively meager $89 million expenditure in 1958 (the major portion of which was spent in aeronautical research) to a proposed $5.1 billion outlay by the Federal Government in 1966 represents a greater than 5000 percent advance, with no decrease in the estimated 1966 figure for NASA. Because of the drastically increased emphasis on new objectives and varied programs, NASA has experienced immense but abnormal growth in its R&D efforts during the past 8 years as compared with the growth of other Federal agencies primarily concerned with similar efforts.

The Management of Research and Development Programs

Formidable challenges to management increase rapidly with the advances in program dollar amounts and technological complexity. Consequently, the proper utilization of scientific and technological abilities

TABLE I.- FEDERAL RESEARCH AND DEVELOPMENT EXPENDITURES BY AGENCIES

FISCAL YEARS 1958-66

(Millions of dollars)

[Reference 3]

Agencies	1958	1959	1960	1961	1962	1963	1964	Estimated 1965	Estimated 1966
Department of Defense	$3 664	$4 183	$5 653	$6 618	$ 6 812	$ 6 849	$ 7 517	$ 7 222	$ 6 881
Atomic Energy Commission	804	877	986	1 111	1 284	1 336	1 505	1 571	1 560
National Aeronautics and Space Administration	89	146	401	741	1 251	2 540	4 171	4 900	5 100
Other	433	597	698	808	1 026	1 263	1 501	1 679	1 896
Total	$4 990	$5 803	$7 738	$9 278	$10 373	$11 988	$14 694	$15 372	$15 437

depends upon effective program management. As stated by Fremont E. Kast (ref. 4):

> Over the years it has become increasingly important to integrate advancing scientific and technical knowledge in industrial applications through the managerial functions. These functions have become even more critical in coordinating national efforts over the past decade, particularly for evolving defense and space programs.

However, an important but often neglected element of capable and technologically oriented program management is the art of decision-making. In fact, many students of the administrative process would maintain that administration is too often discussed in the context of "getting things done," with strong emphasis being placed on management processes and methods. They feel that too little concern is given to the process which precedes all administrative action--decision-making: the act of determining what is to be done, rather than the actual doing. According to Herbert A. Simon (ref. 5):

> Even though any practical activity involves both deciding and doing, it has not commonly been recognized that a theory of administration should be concerned with the process of decision as well as the process of action. This neglect stems from the notion that decision-making is confined to the formulation of over-all policy. On the contrary, the process of decision does not come to an end when the general purpose of an organization has been determined. The task of deciding pervades the entire administrative organization quite as much as does the task of doing--indeed, it is integrally tied up with the latter.

Moreover, the fact that program management functions as a group activity must be realized. When the responsibilities inherent in a goal grow to the point at which the activities of many persons are required to achieve that goal, then processes must be developed for the application of organized effort to the group task. The techniques which facilitate this goal achievement lie in the administrative processes which are, in and of themselves, decisional processes. "Decision-making," then, becomes synonymous with "managing" (ref. 6).

Any treatment of decision-making and the management of R&D programs by a Government agency, such as NASA (or any other Federal unit primarily engaged in R&D activity), must concern itself with the implications inherent in the current policy of heavy employment of private contractors

for these efforts. Therefore, to establish the effective Government-contractor ties which are critical for R&D program success, management must initially assure the use of a reliable decision-making process to select the most suitable contractor for the respective effort. Even the most efficient management procedures will not insure the achievement of program goals if the contractor selected is incapable of performing the required tasks.

This aspect of the NASA management or decision-making process, contractor selection for major programs, is the subject of this report. The process is probably the most indicative and researchable of the numerous decision-making processes applied by NASA to complex technical, administrative, and policy-oriented problems.

The special characteristics of NASA procurements make contractor selection a demanding task. Technological complexity, tight time schedules, unusual reliability requirements, a general absence of quantity, and little follow-on production, all are indicative of NASA programs (ref. 7). A contractor selection technique must permit as many firms as possible to compete, but simultaneously limit the competition to those capable of fulfilling the terms of the procurement.

For these reasons NASA, displaying considerable originality, employed a decentralized process to aid top administrators in selecting contractors for major NASA procurements. The process of contractor review, as undertaken for each project contract in which the cost is expected to exceed $1 million, is accomplished by a Source Evaluation Board (SEB). This ad hoc group is formed (ref. 7):

> ...to provide a sound basis on which an informed and objective judgment can be made by the Source Selection Official, insuring thereby the selection of the contractor having the highest probability of best performing the specific contract tasks.

The SEB, then, employs a variety of techniques to insure selection of the most suitable firm. These SEB teams undertake an established but flexible company-review approach which includes the evaluation of written proposals as well as of other factors which might portray a company's capability. Furthermore, SEB activity is a management tool utilized by the Administrator and other NASA officials for purposes other than those directly concerned with contractor selection.

PURPOSE AND ORGANIZATION

The NASA SEB process, as implemented at the NASA Manned Spacecraft Center (MSC), warrants study as a decision-making and, therefore, as a management technique. After the following brief description of the research approach, the foundations upon which the SEB process rests are discussed in greater detail. A comprehensive description of the typical phases of the current process is presented. Included next are: a literature search; an interview survey; and a case study comparison of a number of award-fee and incentive-award-fee contract competitions to determine what significant changes have occurred in the SEB process both throughout NASA and particularly at MSC. A final analysis of the technique comprises a summary of the study, conclusions about the SEB process at NASA MSC, and some recommendations on how the process might be improved.

RESEARCH APPROACH

A review was made of the printed data (books, articles, manuals, studies, records, and management instructions) which were available and reasonably related to the SEB process. This material was, however, supplemented heavily with interview information to give more meaning to some sections of the paper--especially those lacking in printed data. Interview information was gathered from sources both at MSC in Houston, Texas, and at NASA Headquarters in Washington, D.C.

The author was given the opportunity to observe the SEB procedures applied to two of the competitions used in the case study section of this paper, and a number of the observations made throughout the study are a product of this experience. Because of the sensitivity of the data reviewed, no reference is made to the specific procurements, to the year in which they were competed, or to the companies engaged in the competition.

FOUNDATIONS OF THE SEB PROCESS

The thorough study of the SEB decision-making procedure requires a discussion of some of the foundations which originally provided for its use by NASA. In this report section are presented, therefore, the results of a literature search undertaken to ascertain the rationale which was the basis for utilization of this process within NASA.

Shortly after the formation of NASA, its officials realized that a policy of private contractor utilization necessitated a review method

for contractor proposals and final selection which would afford the following assurances: careful selection of the best contractor; stimulation of contractor competition; impartial consideration; review flexibility; consistency of top management final determination and of decentralized considerations; competency in dealing with the complex technology; and evaluation of how well the contractors develop their capabilities.

CAREFUL SELECTION OF THE BEST CONTRACTOR

The successful and timely completion of manned space objectives depends heavily upon the effectiveness and discriminating ability of the review system utilized for contractor proposals and selection. As selection of the most competent proposer is in all probability the most fundamental and important need upon which the SEB process is based, this process has been incorporated into NASA management procedures as a capable company review mechanism.

Because the legal foundations for NASA procurement procedures rest in the Armed Services Procurement Regulations, NASA officials originally turned to these standards for direction in the development of a proposal review system. NASA's speedy transition from the $100-million-a-year National Advisory Committee for Aeronautics (NACA) to a multibillion dollar agency compelled it, however, to "ad lib" much of the development of its SEB mechanisms. As a result, industry has felt the effects of gradual but significant changes made subsequently by NASA in contractor selection techniques in order to meet the distinctive needs of NASA procurements.

Immense costs associated with the development and production of spacecraft systems and components, the limited follow-on production (the entire Gemini program consisted of only 12 flight spacecraft), and the need for utmost reliability in both products and services--all of these convinced NASA officials initially that the conventional "low bidder" advertised approach to contractor selection was obsolete for NASA purposes. By definition, R&D contracting is characterized by the lack of detailed statements of work and technical specifications. Because of this lack, NASA (like the military services) discovered that in conducting its R&D programs it could not rely on traditional procurement methods associated with advertising. As a result, NASA awarded only $474.3 million by advertised procurement methods (to the lowest bidder for delivery to pre-established firm specifications, drawings, and requirements) during fiscal years 1962-1965. In addition, MSC awarded only $20.3 million by advertising during the same period; and this amount was less than one

percent of total awards to private firms (ref. 8).* Such figures should not be interpreted as faulty procurement procedures. William Parker, Deputy Chief of Procurement for MSC, notes (ref. 8):

> The concept of advertised procurement, while having a preferred status when applicable, is not always appropriate in the major program involvement in an agency such as the National Aeronautics and Space Administration and must be used with judgment.

Thus the nature of the NASA mission and the objective of achieving a careful judgment system to insure selection of the best contractor apparently required that competition be based both upon cost and upon other considerations. Various areas became important for review, such as technical experience, technical competence, subcontract arrangements, labor relations experience, and key personnel. These considerations became features of the subjective SEB judgment process and represented a basic change in the factors evaluated to determine a contractor's capability. The aim had changed: from one of granting awards primarily upon a more objective and absolute low bid basis--to one in which the importance of overall contractor capability and program achievements were emphasized.

STIMULATION OF CONTRACTOR COMPETITION

Because the quality of "best" contractor choice is only relative to the caliber of the firms competing for an award, the method of contractor selection used by NASA cannot inhibit any qualified firms from making a proposal. Indeed, the review mechanism should stimulate as many firms as possible to compete for a contract. This is an established goal, as reflected in NASA policy, to enable small but qualified firms to compete. The Space Act provides that (ref. 9):

> To the maximum extent practicable, and consistent with the accomplishment of the purpose of this act, such contracts, leases, agreements and other transactions shall be allocated by the administrator in a manner which will enable small business concerns to participate equitably and proportionately in the conduct of the work of the administration.

In addition, Evert Clark has quoted the words of Ernest Brackett, former NASA Procurement Director: "NASA is bending over backwards to see that every company with a capability has a chance" (ref. 10).

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*Refer to Appendixes A and B for further information on this subject.

These stated efforts to stimulate competition are reflected in NASA SEB policy. To create a favorable atmosphere for competition, one established SEB goal has been to discourage the belief that large expenditures of resources by contractors in proposal preparation were necessary. In other words, "brochuremanship" tactics and unnecessarily costly proposal preparation were formally discouraged to avoid overtaxing the resources both of the firms and of the evaluators.

Moreover, the SEB process encourages competition among firms to take advantage of the creative capabilities of a wide number of contractors. The technologically complex goals of NASA cannot be deprived of the efforts of especially suitable contractors who might refuse to propose if the selection mechanism was reputed to be arbitrary and biased. The use of the SEB process as a positive review mechanism by NASA not only stimulates an atmosphere of competition and removes concern that the system is preferential, but also thereby encourages creativity and innovation among private firms.

IMPARTIAL CONSIDERATION

Closely related to the SEB goal of stimulating industry competition is the ideal of providing a fair and impartial means of contractor proposal review. As already implied, few companies will propose if they fear that the selection process applied to their offers will be partial or prejudiced. Therefore, the SEB method of review was incorporated to create a situation in which the value judgments, concerning the criteria and emphasis upon which proposals will be scored, can be formalized prior to the actual review process. Clear evidence exists to stress the importance of preserving the competitive process:

1. All evaluation criteria and weightings (to give relative importance to criteria) are developed prior to the receipt of contractor proposals.

2. All evaluators and Board members are appointed prior to receipt of proposals.

3. Individual evaluators are not made privy to the weightings, as these are reserved for Board use only.

4. Evaluators are given specific instructions, prior to the receipt of proposals, which outline what they should be reviewing; and guidance is provided on scoring philosophy.

5. Each evaluator and Board member at MSC is cleared by the Security Office and the Personnel Division to assure that no adverse information or conflict of interest may damage the integrity of the evaluation.

6. Each evaluator and Board member must certify in writing that he does not have a conflict of interest which might influence his evaluation.

7. Any inquiries made by industry or others to any evaluator or Board member regarding the competition must be reported, regardless of the innocence of the inquiry. This provision lessens the opportunity of any company to acquire privileged data.

These intensive efforts toward evaluation impartiality have proven advantageous. Most NASA authorities maintain that they have never been placed in a position of awarding a contract to a firm which lacked the capabilities to perform adequately the terms of the procurement (ref. 11).

The heavy emphasis placed upon impartiality in the examination of offers is also reflected in stated SEB guidelines governing the scoring system applied to the firms. In an effort to achieve a thorough and objective approach, especially in the earlier stages of evaluation, scoring systems are utilized on a standardized basis to grade each component portion of the proposal. The Source Evaluation Board Manual states (ref. 7):

> A scoring system, once devised, must be impartially applied by the Board to each proposal in competition. Any departure from the established system which is prompted by judgment factors outside the system is proper only insofar as the same treatment is extended on an impartial basis to other qualified proposals.

REVIEW FLEXIBILITY

The components of the overall NASA mission are numerous and varied. Because many of these goals require diverse technological approaches and capabilities to be implemented by private contractors, a source selection mechanism had to be employed which could be constructed around existing procurement regulations; simultaneously, this mechanism had to remain flexible enough to render certain extra consideration to those contractors who showed greater suitability to undertake the respective technological responsibilities. Fortunately, the NASA SEB process has remained sufficiently flexible for the review personnel to be able to establish the various criteria and criteria emphases (depending upon the terms of the particular procurement), and to employ these choices in their evaluations. Evert Clark has noted that (ref. 10):

> To meet the challenges in the procurement area, NASA is relying chiefly upon flexibility and the great use of existing procurement regulations and agencies wherever possible.

Flexibility must also be maintained so that the talents of different personnel can be utilized in the review process. One individual rarely has all three of the following capabilities: a comprehensive grasp of the requirements of the contract; experience in contract regulations and SEB procedures; and specialized knowledge in a particular area which would be useful to the Board in its review. The SEB policy of utilizing a staff composed of personnel with differing backgrounds in the management and technical areas to achieve a review capability in each of these three areas has, therefore, eliminated the hazards which would be inherent in a series of established review teams with assignments restricted to proposal review.

The philosophy behind maintaining such flexibility by means of the source selection process thus becomes the ideal that the contractor selected; and the funds allocated should act, not as limiting elements, but as dynamic tools for reaching goals. This ideal, in turn, permits the tempering of dollar allocations along lines of contractor technical capability and of other considerations which vary greatly depending upon the needs of the respective procurement.

CONSISTENCY OF TOP MANAGEMENT FINAL DETERMINATION AND OF DECENTRALIZED CONSIDERATION

Executive coordination and centralization of responsibility require that top management officials in any organization have the final determination in source selection where large dollar allocations are awarded to contractors or subcontractors. NASA is no exception, in that the SEB process was conceived to permit top officials the examination and testing of the individual and collective contributions of the review bodies and, in turn, to arrive at the final source selection. The NASA Administrator, James E. Webb, has commented on the advantages of such a procedure (ref. 12):

> We thus formed our own personal judgments, based on a great deal of personal involvement, as to the validity of board findings. We deeply immersed ourselves on a daily basis in very complete analyses of the main factors, within NASA and at the plants of our contractors, on which our projects depend for success, and the views, approaches, and analytical judgments of our senior personnel.

Simultaneously, however, the large number of contracts written by NASA (well over 100 000 in the fiscal year 1962) necessitated creating

a review procedure which could be initiated in the appropriate field installation responsible for the management of a particular project. For this reason, the bulk of SEB review is accomplished in the field, with results being presented to the Headquarters level for final selection of proposers for contracts involving amounts over $5 million. In addition, a SEB policy permits the center director of the appropriate field installation to review board results and make the final source selection on procurements which range from $1 million to $5 million.

An additional objective served by decentralized SEB activities is the maintenance of a broad base of sources. By being able to maintain and stimulate the expansion of its own lists of bidders and suppliers, each center can conduct its own competitions for equipment, construction, and R&D from a wide number of contractors. The advantages of having such a broad pool of readily available, competent contractors are, of course, obvious.

COMPETENCY IN DEALING WITH THE COMPLEX TECHNOLOGY

An investigation by the Harbridge House has reported (ref. 13):

> The technological breakthroughs that have been made in the past few years have drastically diminished the effectiveness of the traditional source-selection techniques such as price and design competition.

NASA work requirements are frequently so complex that, in many instances, the techniques to be employed by the contractor to meet the terms of the contract are not known at the time of the award. As a result, there is rarely a strong foundation upon which to judge the merits of alternative proposals. Instead, the response is the one already mentioned--industry attempts to compensate for the abstract nature of the contract by emphasizing "brochuremanship" the preparation of elaborate and glowing proposals.

The challenges to source selection because of technical complexity can be reflected in yet another way, as exemplified in a study of source selection techniques as related to the acquisition of complex weapons systems (which parallel the technical complexities of many NASA systems). In this case, Peck and Scherer noted that, if detailed specifications hold constant the variables of time and quality as in advertised bidding procedures, the choice of a firm is relatively simple; the firm offering the lowest price is the obvious winner. However, when cost, time, and quality are all variable within the limits of the relevant requirements, and when the accuracy of individual predictions is subject to question, then the choice of an optimal proposal becomes much more difficult (ref. 14).

Hence a clear need existed for the SEB mechanism. This process was adopted because it offered the most satisfactory method of evaluating those criteria which best determine a contractor's competence and likelihood of producing a reliable product.

EVALUATION OF HOW WELL CONTRACTORS DEVELOP THEIR CAPABILITIES

Because of a heavy dependence upon private industry, an important consideration of NASA officials is the progress that companies are making in the development of their scientific and technological capabilities. Obviously, sluggish advancements by private firms in their business and technical areas reduce chances for success and increase problems in the achievement of NASA goals. The SEB process, with its intensive emphasis on measurement of contractor competence, has proved to be the most suitable method of assessing industry progress. Administrator Webb maintains (ref. 12):

> In this process we were able to evaluate how rapidly the organization and its contractors were developing their capabilities, and how effective our effort to get nine-tenths of NASA's work done by contractors was proving.

Various bases (as previously explained) exist for the employment of the SEB process within NASA, and not all of these bases are directly associated with contractor selection. The process makes possible every opportunity to assess company proficiency as a foundation for selection of the most desirable firm. At the same time, Source Boards encourage competition among firms by endeavoring to provide impartial treatment for all proposers. The process avoids a stale approach to contractor selection by maintaining a high level of flexibility; and it allows a decentralized review of proposals in appropriate field installations, with the final choice being reserved for top management. Source Boards can also be designed to deal effectively with the complex technological nature of many NASA work requirements. Moreover, the SEB process grants NASA officials the opportunity of evaluating the business and technical developments achieved by sources.

THE NASA SEB PROCESS

The SEB mechanism is utilized in NASA on all negotiated procurement actions above $1 million, in accordance with NASA procurement regulations. For procurements in the $1 million to $5 million range, the Director of the appropriate Field Center appoints the SEB; but the SEB's for contract

actions over $5 million are appointed by NASA Headquarters. Because these dollar guidelines apply to the total estimated cost of the effort being procured, the SEB process is an often used tool of NASA management.

Initial action for SEB appointment at MSC generally commences at the ground level in the Procurement and Contracts Division. This unit develops an overall procurement plan in cooperation with the responsible technical manager outlining the item, service, or study to be accomplished and the other pertinent facts surrounding the effort, such as the proposed method of contracting and the sources to be solicited. At this time, if the action to be taken is in excess of $1 million and is a negotiated procurement, the procurement plan cites the need for a formal SEB in accordance with existing regulations and attaches a proposed SEB appointment letter for appropriate execution. As the approval level for procurement plans and the appointment authority for SEB's is the same, the official giving final approval to the procurement plan also approves the appointment of the SEB.*

SEB MEMBERSHIP

The membership of a SEB varies with the size, complexity, and sensitivity of the procurement itself. However, commonly those senior technical and professional personnel who become SEB members will be given key assignments on the project to which the procurement is directed, and are therefore responsible for successful program completion after the contractor has been selected. Thus, Board membership generally takes on a cross-disciplinary composition.

The technical and business management aspects concerned with the evaluation are not only attacked by a variety of personnel from the appropriate Field Center but also, for procurements in excess of $5 million, by a minimum of two members of NASA Headquarters personnel who are usually placed on the Board. This Headquarters influence is provided because, on larger procurements, the final selection decision is made by the Administrator at the Headquarters level.

Committees and Panels

The SEB team is then generally divided into technical and business committees to accomplish the initially detailed work of evaluation; and,

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*Statements by William A. Parker, Deputy Director of Procurement and Contracts Division, NASA Manned Spacecraft Center, during an interview in his office, April 6, 1967.

again, committee membership is decided with the aim of placing in committee assignments those members with appropriate experience. Previously, panels of specialists (such as experts in guidance systems or facilities) were extensively used--especially in a military source evaluation which has employed numerous Board subsystems to evaluate details. According to NASA experience, however, large numbers of people working in small specialized groups tend to confuse evaluations; and therefore multiple or numerous panels are not frequently used now (ref. 15).

Status of Members

The appointed Chairman of the SEB is responsible for the procedural approaches and policy aspects of all Board activities. In fact, because of the centralized responsibility of this position, some NASA officials claim that the quality of results achieved is directly related to the ability of the Chairman.* Certainly, he must force the pace of the review and take full accountability for Board results.

The Chairman and other voting Board members make up the official pool of rating officials on the SEB. However, the Board will also call upon the services of ex-officio (non-voting) personnel, such as the Director of the Field Installation and the cognizant Program or Staff Director. These individuals will act as senior advisers for the Board in that they attend Board meetings, state views, and contribute to the discussions, but will not participate in the actual rating process. To maintain even further evaluation adaptability, additional personnel may be designated as "advisers" or committee members when their services are necessary and available. They must adhere to the regulations governing conflict of interest and nondisclosure of information but are not, in fact, Board members.

Size of SEB's

Regulations governing Board activities require that "the Board voting membership will be kept small in size, normally not to exceed seven members, including the Chairman" (ref. 7). However, research** in this area has indicated that the median size of past NASA SEB's has been approximately nine members:

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*Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

**Joseph Fernandez: The Origin, Evolution and Operation of the NASA Contractor Source Evaluation Board Process (unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, 1966), p. 16.

It is apparent that the organizations involved either disregarded the SEB Manual or decided that there is some relation between SEB size and time lapse between RFP issuance and award date, i.e., the larger boards took a shorter time period to evaluate proposals than the smaller boards. The relationship, however, is due to one organization's score and, therefore, is quite tenuous.

The Decision of Who Serves

Interviews with various NASA officials revealed that one of the most critical steps in the SEB process is the decision about who is to serve on the Board. Although level and grade of personnel do not necessarily establish review capability, the quality of SEB findings is directly dependent upon the caliber of personnel utilized by the Board. Both formal and informal mandates exist to obtain those individuals who have comprehensive knowledge of technical and management capabilities, and who can place essential review factors in a correct perspective. The selection of top quality, senior personnel for SEB service almost certainly will mean that essential technical and administrative talent will be absent from regular program responsibilities.* Often, however, these individuals are the only personnel with sufficient expertise (such as experts in labor relations or propulsion systems) to be capable of reviewing contractor capabilities. In fact, an SEB competition, presented in the case study portion of this report, utilized substantial amounts of time from four top officials at MSC whose salaries average $17 600 annually.

An obvious solution to this dilemma is the creation of a pool of review personnel whose only function is the examination of proposals in various contract areas. Nevertheless, every official questioned on this subject refuted the idea of an on-going pool of SEB members. The policy of maintaining SEB membership adaptability enables experts in particular subjects to serve on those SEB's which are evaluating proposals in their area of expertise. A "pool" of SEB members could not provide this degree of adaptable expertise. In fact, one official claimed that such an arrangement would not only stimulate stereotyped attitudes and preconceived notions, but also inhibit the flexibility needed by SEB's to deal with changing technology and management systems. Each contract demands a

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*Statements by Charles Statz, Chief, Technical Support Procurement Section, NASA Manned Spacecraft Center, during an interview in his office, April 27, 1967.

different approach to evaluation, and permanent members would be attuned to past procedures.*

Colonel Lawrence Vogel, the Executive Officer at NASA Headquarters, noted in an interview in his office on May 1, 1967, that top management within NASA would never approve of an official SEB. In fact, the overtone benefits derived from the SEB experience may make impossible the restriction of such an instructional opportunity to an official pool.

Overtone Benefits of SEB Service

The Administrator employs the process as a management technique with motives over and above those concerned with contractor selection.** The SEB process compells senior NASA officials to use good judgment and to substantiate their findings with sound data and logic. By endeavoring to understand the basic thought processes rather than the mechanical quantification and justification of results presented by Board members, the Administrator is thus enabled to test the quality of the thinking of personnel he can seldom observe in a work situation. Thus SEB provides a way in which total agency competency is brought to bear against a particular challenge.

Other than the SEB process, no procedures currently exist which permit an equally desirable degree of interface between top officials. One official explained that the process is an important device in which participants can expect to raise the level of their thinking and understand more fully the nature of the procurement undergoing competition. He further stated that source evaluation might certainly be classed as one of the essential information gathering systems of senior NASA management.***

By coming to Headquarters to present Board findings, MSC officials also have the opportunity to experience the environment in which the Administrator and Headquarters' Departments operate. Thus, the SEB process has advantages other than those directly associated with contractor selection. Although these side effects are admittedly intangible, they are

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*Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

**Statements by Lawrence Vogel, Executive Officer, NASA Headquarters, during an interview in his office, May 1, 1967.

***Statements by Wesley Hjornevik, Director of Administration, NASA Manned Spacecraft Center, during an interview in his office, May 24, 1967.

considered by many agency personnel to be as important as the formal objectives of the process.

DEVELOPMENT OF CRITERIA AND WEIGHTS FOR EVALUATION

When a Board is established, SEB members must sign statements certifying that they have neither stocks nor vested interests in the competing companies; for such holdings might hamper an unbiased attitude in their evaluation. All proceedings come under tight security controls. The SEB minutes and papers are treated as "sensitive," and certain security precautions preclude the leaking of any evaluation data, because a leak might upset the competitive atmosphere. Any contact, even if apparently insignificant, between the evaluators and the competing firms during evaluation must be reported immediately. For any reported incident of this type a Board decision must then be made regarding the possible effects on the integrity of the proceedings (ref. 7).

The initial duties of the newly appointed Board are to determine which sources will be solicited and which subject areas will be used as criteria for contractor comparability and evaluation. The Board judgment is based upon its determination of standards known respectively as: qualification criteria, and evaluation criteria.

Qualification Criteria

As already noted, established NASA SEB policy promotes maximum competition among contractors. Minimum standards (in the form of qualification criteria) must, however, be promptly defined by the SEB so that firms which lack the minimum requisite abilities and resources are discouraged from incurring the expenses of submitting a proposal. To achieve this purpose without limiting meaningful competition, the Board must work closely with program and procurement staff elements to establish promptly the qualification criteria and, in turn, the source list. This list is composed of the names of those contractors who can meet the minimum levels of acceptability as defined in the qualification criteria and who are believed to be interested in submitting a proposal.

The objective of qualification criteria is, therefore, not to restrict competition among qualified resources but only to discourage expensive proposal submissions from sources which could not possibly win the award. These criteria consist of minimal levels of acceptability in such areas as experience, personnel, facilities, and/or other factors which are considered essential to effective performance of the procurement terms. Therefore, SEB regulations stipulate that (ref. 7):

> In establishing "qualification criteria," care must be exercised to restrict them to those essential to the successful completion of the contract work. Stated otherwise, they are "go-no-go" criteria which will reflect minimum requirements for a particular procurement.

Evaluation Criteria

The standards, termed evaluation criteria, must be as meticulously tailored to the respective requirements as the qualification standards. Generally, the subject areas of these criteria for a firm are: (1) understanding of the requirement, (2) approach to the task, (3) potential for completing the job in terms of the procurement requirements, and (4) comparative competitive status.

The selection of evaluation criteria is probably the most critical Board function (ref. 7). Those criteria selected must gain the best view of the acceptability of a firm in those areas where capability is essential for a timely and satisfactory completion of the contract.

Care must be taken to achieve the correct balance in the nature and numbers of evaluation criteria. These standards can become so general that they fail to offer any meaningful discriminatory ability, even as criteria can become so numerous and specific that they point up relatively unimportant differences in company potential.* Therefore each evaluation criterion is accompanied with a narrative definition--a requirement which forces the identification of those criteria which overlap or are too abstract in nature. These definitions thus permit both the redrafting of defective criteria and, at the same time, the identification of those Board personnel who will be evaluating the criteria involved.

Criteria Weights for Evaluation

The Board assigns to the selected evaluation criteria the weight or emphasis each merits depending upon its importance for achieving the specific objectives of the procurement. The importance of these emphases or weights placed upon selected criteria is equivalent to that of their subject matter or content. For example, difficulties arise often in achieving a means of discrimination among contractor capabilities for

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*Statements by Bernard Moritz, Deputy Assistant Administrator for Industry Affairs, NASA Headquarters, during an interview in his office, May 1, 1967.

non-personal services contracts in which a tangible piece of hardware is not to be purchased. Often there are few objective bases to which discriminatory criteria can be applied in the evaluation of firms for these types of procurements. As a result, the measure of a good non-personal services contractor depends heavily upon the discriminatory ability achieved by the relative emphases of those subject matter evaluation standards deemed important for contractor selection.*

Nevertheless, because of the technological nature of most NASA and DOD procurements, technical criteria have been in the past more heavily emphasized than business management concerns. This fact is reflected in a case study, by Edward B. Roberts, of two DOD contracting organizations (fig. 1).** In Organization A, 36 contracts out of a possible 41 went to the highest technically ranked company. In Organization B, 41 out of a possible 49 awards went to the highest technically ranked company. The data indicate that not all the awards went to the highest technically ranked company, thus showing that other criteria (such as cost and business management) are meaningful considerations. Even here a fact often overlooked is that a firm must be appraised as technically acceptable before any consideration of criteria, such as cost or business management, can be undertaken.

This fact is an important consideration. As noted by Roberts, however, although the technical evaluation itself appears to determine many contract awards, the formal evaluation takes place after proposals have been solicited from among those companies that the technical initiator had in mind for doing the work. Of course, the possibility exists that the initiator's list will be modified when the formal Source List is approved by the SEB; but, as shown in figure 2, the position of a firm's name on the suggested Source List originally prepared by the technical initiator is a good indication of the initiator's preferences. Roberts concludes:**

> It is apparent that the determinants of awards of research and development contracts are influences on the initiator-evaluator prior to the preparation of the procurement requests, not during the period of time of formal proposal solicitation, proposal preparation, and

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*Statements by Daniel Linn, Director of Procurement Management, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

**Edward B. Roberts: Questioning the Cost/Effectiveness of the R&D Procurement Process (unpublished working paper of the Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, 1965), pp. 10-19.

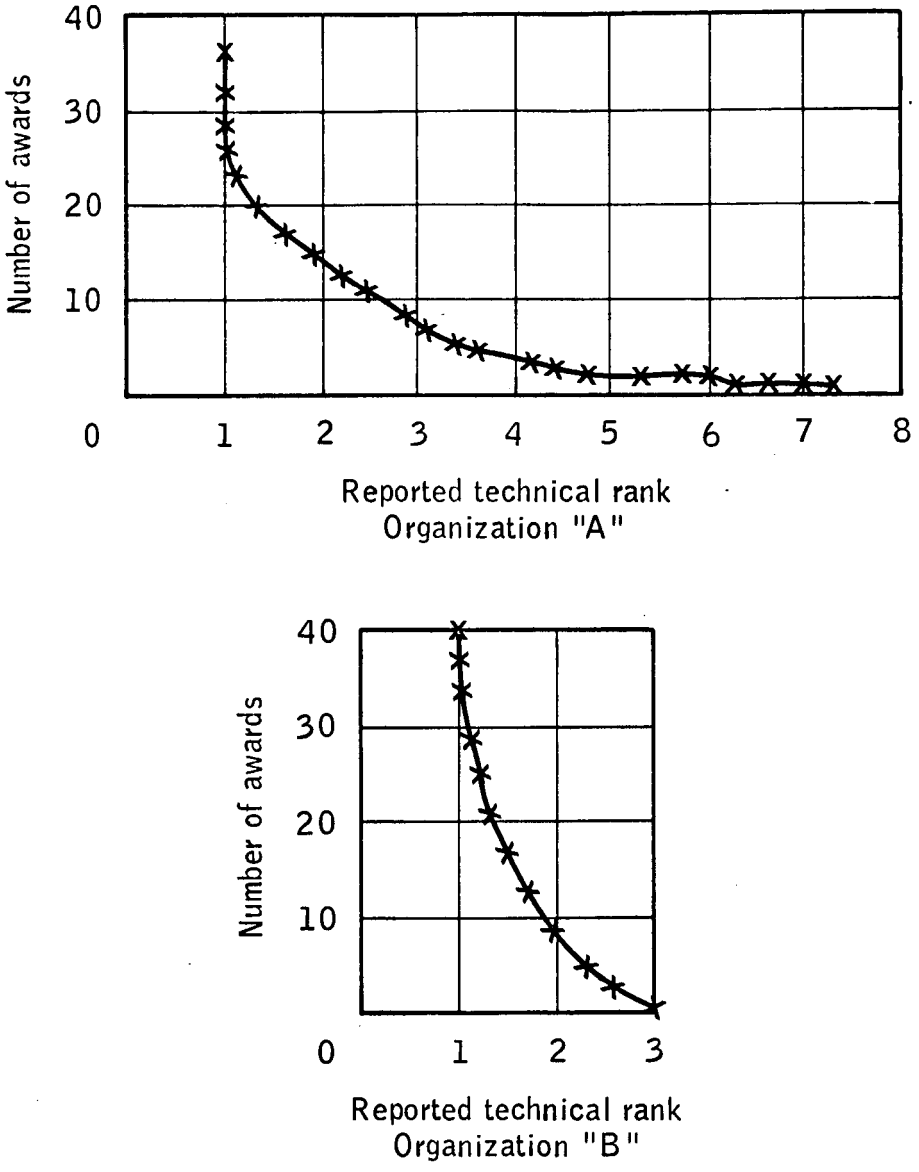
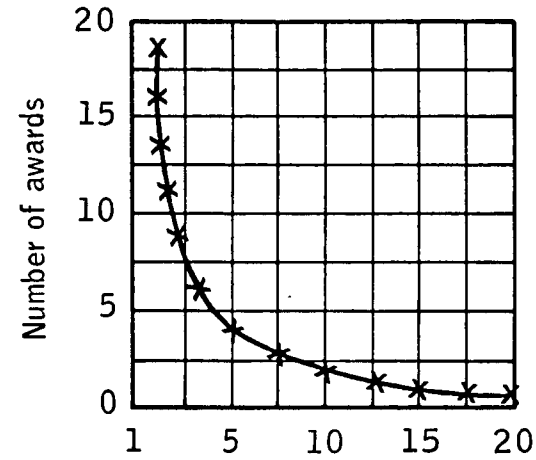


Figure 1.- Awards as a function of technical rank.

[Source - Edward B. Roberts: Questioning the Cost/Effectiveness of the R&D Procurement Process (unpublished working paper of the Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, 1965), pp. 10-12.]



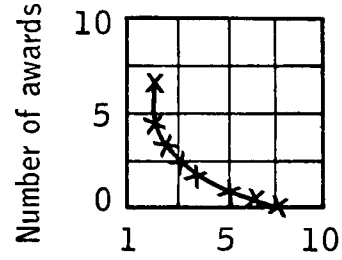


Figure 2.- Awards as a function of a preference indicator on original source lists.

[Source - Edward B. Roberts: Questioning the Cost/Effectiveness of the R&D Procurement Process (unpublished working paper of the Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, 1965), pp. 10-12.]

proposed evaluation. The proposal solicitations, preparation, and evaluation are responses to a decision by the technical initiator to undertake a set of technical acts under contract. It is clear that he generally enters into that set of acts already committed, at least in his own mind, to one or two companies.

THE REQUEST FOR PROPOSAL

The development and approval of the Request for Proposal (RFP) by the SEB is, as a general rule, the step which follows the establishment of the qualification and evaluation criteria, the narrative definitions, and the preliminary source list. As this document is not only an invitation for contract proposals but also the standard blueprint used by firms for their proposal, the quality of the RFP will directly determine the likelihood of receiving pertinent, comparable information from competing companies. Because of NASA's policy of evaluating contractors as thoroughly as possible, the RFP makes explicit the objective of obtaining for review (in addition to the written proposal) as much supplementary information as is reasonably available from industry.

RFP Requirements

The SEB regulations basically require that the RFP will: (1) identify qualification criteria in order that unqualified sources will not needlessly submit an offer; (2) request firms to submit adequate information in proper form so that evaluation criteria can be graded punctually in the evaluation process; (3) include a general indication of relative importance of SEB areas of interest to center company attention on the more significant areas for evaluation; (4) incorporate a complete and accurate description of the work to be performed; (5) require proposing firms to submit a list of Government agencies having on-site plant cognizance in which the proposer intends to perform the work--or, in absence of such cognizance, the Government agency office having cognizance over such plant(s) for factors such as contract administration, industrial relations, and personnel security; and (6) provide preproposal conference details (including time, place, the limitations or number and qualification of attendees, and other administrative details) as may be deemed necessary (ref. 7).

RFP Styles

Within this regulatory framework, however, NASA has employed several methods of requesting information from offerers (ref. 15). In the past,

most major NASA procurements have been awarded on the basis of detailed proposals which included technical, business, and cost information. Through these complete proposals, two or more companies are selected with which to negotiate a contract. The chief reason for the utilization of this method is that it saves lead time in putting the contractor on the job; but, on the other hand, preparation of this type of proposal requires a significant outlay of resources and takes a greater evaluation time than any other method.

Another RFP approach is to ask of the firm a series of relevant questions in pertinent areas to measure capability without requesting detailed models or designs. This approach was utilized to gain proposals from firms for the design and development of the Lunar Module, the vehicle in which astronauts will land on the moon. Firms which underwent that competition indicated that this type of proposal approach was one of the best they had experienced.

A third RFP style is the two-phase proposal. The first phase requests either a technical or business proposal which will provide complete information in one of these areas. After evaluation of these data, the top companies which are closely competitive are asked to submit a complete proposal in both technical and business terms. This approach saves Government effort in evaluation as well as company effort and expense in proposing, but generally requires 3 months longer to evaluate than would the complete detailed proposal.

The fourth RFP approach is the request for a design study competition. Those two or three contractors who submit the leading designs for accomplishing the proposed effort are compensated financially for their designs up to an imposed Government ceiling on the amount. From among these leading designs, the most competent one is then selected and the appropriate company awarded the contract for the hardware development. The chief disadvantage to this proposal method is, of course, that it can be employed only for solicitation of tangible product or hardware oriented proposals.

Challenges to Effective RFP Preparation

Many officials have stated that the key to a successful SEB is the manner in which the Board asks for and gains meaningful information through the RFP instrument. Current RFP philosophy calls for the inclusion of explicit instructions to proposers to cause firms to respond with information in a comparable format and in sufficient quantity and

detail to serve as a basis for standardized evaluation and negotiation after selection.*

The amount of detail requested when proposals are solicited therefore becomes a primary consideration in RFP preparation. On one hand, the provision of normative standard bases upon which to standardize considerations of proposers appears to be the basic rationale behind the current emphasis on obtaining explicit information in a pre-determined format from the firms. On the other hand, some officials feel that the emphasis on a detailed proposal format does not stimulate a creative atmosphere for originality and actually hampers private contractor imagination and creativity. The challenge to RFP preparation, then, is to arrive at a proposal format which permits a creative approach by the offerer in a form sufficiently standardized to achieve comparability.**

Another challenge to RFP preparation for procurements in the support areas is not often obvious to participants in source evaluation: How can it be made clear by means of the RFP instrument that the Government is not necessarily satisfied with the incumbent firm?*** Even if the incumbent's performance has been less than acceptable, this fact cannot be reported in the RFP. As a result, many prospective firms may start with the assumption that the contractor currently under contract is the firm desired. Thus, a real challenge to RFP preparation is the creation of a sense of equal opportunity for gaining the effort among sources in absence of any subjective comments concerning the quality of performance of the incumbent company.

THE PREPROPOSAL CONFERENCE

The preproposal conference is generally convened after the RFP has been approved and mailed to prospective concerns. These firms are invited to attend this gathering which is usually held at the site on

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*Statements by J. P. Harris, Chief, Center Support Procurement Branch, NASA Manned Spacecraft Center, in an interview in his office, April 24, 1967.

**Statements by Paul Cotton, Director, Management Operations, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

***Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

which the proposed effort is to take place. Not only does the conference grant prospective concerns the opportunity to gain a better understanding of the procurement terms, but it also gives the Board a chance to reiterate the qualification criteria so that each firm can judge for itself whether or not to incur the costs inherent in submitting a proposal.

The SEB Chairman is the agent responsible for insuring that the necessary conference arrangements are made by coordinating the efforts of Board members as well as the professional staff concerned with the procurement. In accomplishing these efforts, the Board keeps in mind also the objectives of furthering competition and obtaining the most suitable proposals by providing as much information as possible to the proposer.*

At least one NASA official refers to the preproposal conference as a supplementary device to put the RFP message across accurately, obtain good responses, eliminate confusion, and fix the responsibilities of work.** Other benefits of the conference include: (1) prospective concerns, having been permitted a view of the work area and the staffing necessary, may offer efficiencies in the form of alternate approaches to the effort;*** (2) conversations among company representatives may provide each firm with a better opportunity to evaluate its competition; (3) joint ventures (with resultant economies) may be formed among firms which appear at the conference; (4) the formation of firms at the conference raises questions which should be answered for the benefit both of evaluators and of proposers.

Therefore, the preproposal conference gives more meaning to the RFP by granting contractors a view of the facilities and a chance to clear up hazy areas in the RFP--especially when the procurement is extremely technical. An essential function of the SEB process is that it enables companies to submit more realistic and informative proposals.

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*Statement by Charles Statz, Chief, Technical Support Procurement Section, NASA Manned Spacecraft Center, during an interview in his office, April 27, 1967.

**Statements by Philip Whitbeck, Deputy Director of Administration, NASA Manned Spacecraft Center, during a Preproposal Conference rehersal, March 8, 1967.

***Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

THE EVALUATION PROCESS

Convening the Committees

The receipt of proposals by the SEB marks the first phase of formal evaluation, and this initial phase generally involves the convening of the established SEB Committees. Each committee chairman is responsible for obtaining from the Board the approved scoring systems, criteria factors, and instructions appropriate to the expected function of the committee.

Most SEB Committees function as fact-finding teams for the Board. After a detailed examination of all proposals the committee must comparatively rate, in accordance with the Board's approved scoring system, those evaluation criteria for which it is responsible. A written report covering these evaluations is then submitted to the Board.

Reconvening the Board

When the reports of committees and involved Board members finally become available, the Board is reconvened to review committee findings. Thus, to establish a preliminary ranking of each proposal, the Board will not necessarily accumulate the committee scores; instead it will evaluate committee results by taking note of any reservations or qualifications and by reranking the proposals in each criterion judiciously. In addition, if committee action has delineated any proposal(s) as unacceptable, the Board will review this situation for appropriate action.

A complete evaluation of every proposal results in a tentative ranking of each proposal remaining in competition, either by totaling numerical scores assigned to evaluation criteria or by a numerical range established by an adjective scoring system. The proposals will be further reviewed to narrow down the number of sources with which further discussions would be of benefit--those which have a reasonable chance of being selected for negotiation. In other words, when proposals below a justifiable "breakpoint" are not suitable for contention, they may be withdrawn from further evaluation. The justification for such removal, however, must be fully documented for examination by the Source Selection Official.

Evaluation Beyond Written Proposals

The grouping of firms above the established breakpoint places these companies within a competitive range, and SEB regulations require that

this grouping must be made up of at least two but no more than 10 proposals. The Board's objective with these firms is to go beyond the written proposals by conducting written and oral discussions with each company and by making plant visits to and contracts with previous employees in order to verify company capabilities. As explained by Ernest Brackett (ref. 15):

> The NASA board usually inquires of other Government agencies, chiefly the military departments, what their experiences have been with companies which have submitted proposals. Some of the questions are as follows: Did the company have technical difficulties? How did the company solve technical problems? Was there a cost over-run? Were deliveries made on time? Was the company cooperative? Is its management efficient? How is its overhead rate running? and so forth. A company's reputation depends upon the answers.

The result of these efforts is a final rating, accomplished by an appropriate adjective rating such as "acceptable" or "above average," of those concerns within the competitive range. All other proposals are filed as part of Board records.

Challenges to Evaluation

A serious challenge to proposal evaluation is the question of how to deal with proposals which are prepared in an overly elaborate format. These tactics, previously referred to in this report as "brochuremanship," are sometimes employed by contractors to gloss over the fact that the offer is either weak in a particular area or deficient in general. Huge leather-bound volumes have often been submitted, and the evaluators have then had difficulty finding information essential for judgment. Under such conditions, evaluators are faced with the task of digging out the significant data.

Some subject areas of review, such as cost, pose an especial challenge to evaluators. A number of contractors feel that very low estimates on cost elements will help win the award; but, evaluators generally maintain that a proposer with an unrealistically low cost estimate may not fully appreciate the complexities and demands of the effort, and such an estimate may be considered a minus rather than a plus factor. On the other hand, an unreasonably high estimate is usually grounds for reduction of a company's score. The challenge is to select, for various cost elements, a reasonable range within which firms have to propose to receive the highest scores.

Another challenge to the evaluation process is that of achieving simultaneously an overall view of each company's capability and special scrutiny of particular subject areas. To achieve this dual goal, scoring teams must devise methods in which each evaluator can initially score and attach values to specific areas, but later meet with other evaluators to reach a team consensus on the overall proficiency of the contractor.*

The SEB members are often in close working contact with incumbent contractors; or, if the evaluation is for a new effort, evaluators may have detailed knowledge of the capabilities of a number of companies which have offered proposals. Thus, in order to remain consistent in scoring efforts, another definite challenge to evaluation is to suppress preconceived notions which evaluators may have about proposers. This action is essential, because the Source Selection Official demands extensive justification of scoring results.

To maintain the adaptability required in source evaluation, evaluators also endeavor to resist the temptations inherent in standardized, static review systems and processes. This challenge necessitates creating an atmosphere in which the Board can make innovations in evaluation techniques. This goal should be obtainable if SEB's are granted basic freedoms in determining their evaluation formulas. Such freedoms are essential, for blind conformance to an established system might well lead to the selection of the wrong company.

BOARD RESULTS AND FINAL SOURCE SELECTION

The SEB Report

The findings of the SEB are presented in a report which reflects either a consensus of the Board or the composite scores, depending on the rating system used. As an indication of their collective opinion, all members sign the report as confirmation of the results. If, however, any Board member takes serious exception to any portion of the results which might affect the ranking of proposals and cannot be resolved, these reservations are made an annex of the Board Report.

The Report discusses all proposals in descending order of competitive rank under regular descriptive classifications in summary form. These summaries include a narrative statement of the merits and demerits

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*Statements by William A. Parker, Deputy Director of Procurement and Contracts Division, NASA Manned Spacecraft Center, during an interview in his office, April 6, 1967.

of each proposal and, with respect to those proposals in the competitive range, the correction potential of significant deficiencies will also be discussed. Again, the fact is emphasized that conclusions must be documented with observable facts (ref. 7).

The Presentation of Results

The SEB Report is supplemented by an oral presentation of SEB findings to the Source Selection Official. The SEB Chairman is responsible for conducting this presentation, and his duty is to convey concisely and accurately the results of Board deliberations in a way which aids in an objective, informed selection of the best source. A preliminary presentation by the Board to the appropriate Program Director generally precedes presentations to the Source Selection Official. In both cases, the deliveries not only follow the same format and include the written Board Report plus an oral briefing, but also undergo examination for clarity, judgment, conciseness, and effectiveness of graphic and illustrative material.

For a Board at Headquarter's level, the Program Director may direct the Board to reconvene to remedy procedural omissions or to revise the presentation method. A significant fact, however, is that this official cannot alter the criteria, the established weights and scoring systems, or the proposal rankings. If the Program Director feels the presentation is in suitable review form for the Source Selection Official, the Program Director arranges the time and place of the presentation and determines, after recommendation by the Chairman, the representatives who will attend.

Some officials questioned by the author noted that a tendency exists to make SEB presentations unnecessarily detailed and elaborate. Such efforts probably result from the emphasis upon sound justification of the evaluation results. By-products of this concern with detail are often a defensive attitude on the part of the evaluators and presentations which are ostentatious.*

Another point concerning the presentation of detailed SEB results should be noted. The concern with minutiae for justification purposes often makes it difficult to present the findings of the evaluation in such a manner that a recommendation by the Board is not, in fact, the result.**

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*Statement by L. V. Lindley, Contracting Officer, Center Support Procurement Branch, NASA Manned Spacecraft Center, during an interview at his office, May 3, 1967.

**Statement by Charles Statz, Chief, Technical Support Procurement Section, NASA Manned Spacecraft Center, during an interview in his office, April 27, 1967.

Final Source Selection

After receiving the presentation of the SEB and consulting with his principal staff officers, the Source Selection Official will choose a source, or sources for negotiation. He then prepares a Selection Statement for initiation of final contract negotiations. This statement includes: (1) a description of the procurement; (2) the names of concerns solicited and of concerns that submitted proposals; (3) a discussion of the relative strengths and weaknesses of the competitively ranked concerns; and (4) the concern(s) selected for initiation of contract negotiations and the reasons therefor.

The choice of a company for negotiation is not necessarily an award of the contract. Unless satisfactory terms can be reached during negotiations, the first chosen company will not receive the award. In fact, if two or three companies exist in a close competitive position, negotiations may be conducted with these firms before a final selection is made (ref. 7).

Until the winner is announced, the choice is a closely guarded secret. The company which is selected generally receives a telephone message from NASA top management. At the same time, telegrams are sent to the unsuccessful firms expressing thanks for their proposals; and, shortly thereafter, a news release is issued.

Defeated companies will occasionally request a disclosure of the rationale on which their proposals were considered deficient. Ernest Brackett states (ref. 15):

> NASA policy is to consider any written request for such a debriefing; if it is decided that it will help a company in preparing future proposals, arrangements are made to have a few key members of the NASA staff, usually technical representatives, explain the deficiencies which were found. The staff members will not compare the successful proposal with the unsuccessful or reveal information which another proposal contained.

The Winners of Research and Development Contracts

The SEB process has now been described. However, a significant question remains: Who are the winners of R&D contracts as selected by the SEB process?

Although his case study research is not directly based upon SEB action, Edward Roberts has indicated that more R&D contract winners than

losers: (1) had performed contractual work for the particular technical initiator or his group prior to the issuance of the RFP; (2) had experience in areas of immediate technical relevance to the subject procurement, prior to the receipt of the RFP; (3) maintained much closer contact with the Government technical group, exchanging ideas by formal and informal means; (4) felt the procurement belonged to their own firm; (5) had better personal relationships with Government technical initiators; (6) had an advantage over a hypothetical company of equal technical competence whose knowledge of customer requirements was limited solely to information contained in the RFP; (7) thought the prospective jobs were important to their Government customers and that contracts would in fact be awarded (rather than lost in the red tape) and result in significant follow-on effort; (8) stated they designed the technical approach of their proposals to satisfy known technical preferences of the customer; (9) directed the content of their proposals toward particular individuals in the Government agency; and (10) paid less attention to formal aspects of proposal preparation.*

THE VARIABLE NATURE OF THE NASA SEB PROCESS

Both the foundations of the SEB process and the SEB procedures exist only to achieve an end product--a decision. In any system which is a decision-making process, the outstanding feature is its "social character." A mechanism such as the NASA SEB process contains all the ingredients of a working social system: (1) Board members represent a variety of roles and statuses; (2) a series of values and norms are applied to scoring and evaluation techniques; and (3) primary and secondary groups develop among Board members.

Social systems are not static entities; their social character makes alteration an expected occurrence. The identification of the NASA SEB process as a social system would therefore imply that the process has been altered since its use was initiated. For this reason the author undertook a case study comparison of three, early 1960, MSC SEB competitions with the three more recent MSC SEB re-competitions, all having basically the same work requirements. He supplemented the study with interviews of NASA officials to: (1) determine if any significant changes have occurred in the MSC SEB process; (2) identify the principal NASA agency-wide issues responsible for the environment within which MSC changes occurred (if, in fact, alterations took place); and (3) cite

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*Edward B. Roberts: Questioning the Cost/Effectiveness of the R&D Procurement Process (unpublished working paper of the Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, 1965), pp. 4-8.

the chief areas of change and the apparent reasoning for these alterations.

This research and resulting information are discussed in this report section.

NASA AGENCY-WIDE BACKGROUND ISSUES

Both the case study and interviews clearly indicated that certain fundamental changes had occurred in the MSC SEB process. The more specific rationale for these alterations will be described as each area of change is identified. First, however, relevant information is presented concerning some of the events and trends, occurring in the background throughout the NASA agency, which directly and indirectly contributed to SEB process alterations at MSC.

The Executive Privilege Issue

A NASA memorandum dated October 1, 1958, one of the earliest references to NASA contractor source selection, initiated events which eventually had a significant impact on SEB philosophy. This instrument referred to the preproposal conference at NASA Headquarters involving the contract for the $1\frac{1}{2}$ million-pound-thrust single-chamber engine. The heart of this document was a discussion between NASA and Congress concerning the distribution and availability of contractor source evaluation information--one of the initial events in what has been termed by one writer the "Executive Privilege Issue."*

On June 15, 1959, Dr. T. Keith Glennan, the NASA Administrator, gave the following response to a request by the House Committee on Science and Aeronautics for details of the SEB report on contractor competition for the $1\frac{1}{2}$ million-pound-thrust single-chamber engine contract:*

> This document contains the personal evaluations and recommendations of certain officials of NASA whom I consulted to aid me in reaching my decision on the selection of a prospective contractor. Since this document discloses the personal judgment of subordinates made in the course of preparing recommendations

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*Joseph Fernandez: The Origin, Evolution and Operation of the NASA Contractor Source Evaluation Board Process (unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, 1966), pp. 9-11.

> to me, I am sure you will agree with me that it would not serve the interests of efficient and effective administration for such a document to be reviewed by anyone outside NASA.

The issue of executive control of the release of such SEB results arose again when the House Committee was denied a request for access to the SEB report on competition for the Mercury Capsule contract. Joseph Campbell, the Comptroller General of the United States, objected strongly to this situation. On August 19, 1959, he stated:*

> In the course of our work we have been denied access to certain documentation which we consider essential to our review of the award of contract NAS W-16 (Mercury Capsule). Specifically, the report of the Chairman of the Source Selection Board has been removed from the files, and an oral request that we be permitted to examine this report has been denied by the Director of the Procurement and Supply Division and by the General Counsel.

Glennan held firm on the issue, however, and further summarized his position on January 29, 1960, in testimony before the House Committee. He noted that effective administration depended upon employees of the Executive Branch of the Government being fully candid in advising each other on official matters, and that effective policy formulation was dependent upon the availability of the broadest range of individual opinions and advice. However, at the same time Glennan stated that the disclosure of communications, documents, or conversations in a diffused manner which embodied such opinions and advice would impair reporting and the operation of the decision-making process. He added that, for these reasons, such disclosures have been forbidden in the past as being contrary to the national interest and to the effective and orderly operation of the Executive Branch of the U.S. Government.

This constitutional/statutory dispute was never formally settled; but, in an attempt to improve relations between the Executive and Legislative Branches of the Government, the new administration discouraged in late 1960 the use of Executive Privilege by Cabinet-level officers.* In an attempt to comply with this policy and, at the same time, protect the staff level integrity of the SEB process, NASA revised SEB policy in a fundamental area. Board practice was no longer to <u>select</u> or <u>recommend</u>

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*Joseph Fernandez: The Origin, Evolution and Operation of the NASA Contractor Source Evaluation Board Process (unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, 1966), pp. 9-10.

contractors, but only to evaluate potential sources and order rank the findings. The final source selection decision was to be made solely by the NASA Administrator, and the foundations for his decisions were to be presented in a document entitled "Statement of Findings." This document could then be made available to the committees of Congress.

The Harbridge House Study

During the period in which the Executive Privilege Issue was being disputed, the various methods employed to review and evaluate contractors' proposals culminated in (August 26, 1959) document outlining the formal procedures for selecting the recipients of very large NASA contracts. Because of a reflection of the eventual compromise over the Executive Privilege Issue, however, a second edition of this procedural document was published in February 1961.* This second edition emphasized the role of the SEB evaluation of proposers rather than Board recommendations of sources to the Source Selection Official.

The procedural document presently in use was published, in August 1964, principally as the result of an investigation by the Harbridge House, Inc.--a special study group employed to undertake a comprehensive study of the SEB process.** The motives behind the study were varied (ref. 13):

1. Increasing expenditures were being required in proposal preparation.
2. Management officials were concerned with the poor quality of some Board presentations and results. Many authorities complained that SEB procedures were too sketchy, general and presupposed considerable knowledge on the part of the Board of how to evaluate proposals and prepare reports most effectively.
3. There was little uniformity in SEB reports. The reports varied from voluminous collections of unessential data to sparse documents lacking sufficient information for rational conclusions.

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*In 1960 there were two minor revisions in SEB procedure which did not warrant an edition change. See 25 F.R. 403, January 19, 1960, and 25 F.R. 2100, March 12, 1960.

**This NASA procedural document (NPC 402) is currently under review for additional revision.

4. Scoring systems were poorly understood and technical and business criteria often duplicated or overlapped themselves.

A number of reports (citing information gathered from various NASA centers, from DOD and AEC installations, and from approximately one dozen NASA contractors by Harbridge House investigators) concluded that referring to a single source selection process was misleading in that various approaches to source selection had evolved. The study noted, however, that the basic policy of Agency decentralization and delegation of authority was in harmony with the fact that NASA Headquarters had provided only the broadest guidelines for source evaluation practices and procedures. This fact, in turn, permitted all centers the wide latitude and flexibility in SEB methods which resulted in considerable diversities in practice between and, at times, within the respective centers.* Therefore, the study group could find nothing intrinsically wrong with basic SEB philosophy. Robert Rosholt notes (ref. 12):

> Neither the Harbridge House study nor the draft manual advocated any dramatic changes in NASA's source evaluation and source selection procedures. Rather they favored refinements in agencywide uniformity (within a framework of discretionary freedom of local action), and slight changes in emphasis in existing policies and procedures.

NASA's Transition to Incentive/Award-Fee Contracts

While adjustments to the Executive Privilege Issue and recommendations of the Harbridge House study were having an impact on SEB operations, NASA was making a basic change in its contract philosophy which has directly influenced contractor evaluation. This philosophical change amounted to a basic transition from cost-plus-fixed fee (CPFF) remuneration of contractors to cost-plus-incentive/award-fee (CPI/AF) arrangements for contractor payment.

Early NASA experience witnessed the application of CPFF contracts in which the level of effort was unknown, or in which the products were so unlike previous ones that insufficient knowledge existed as a basis for a fixed price. In addition, the urgency of early NASA goals required

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*Joseph Fernandez: The Origin, Evolution and Operation of the NASA Contractor Source Evaluation Board Process (unpublished Master's thesis, Massachusetts Institute of Technology, Cambridge, 1966), p. 12.

the Federal Government to maintain close control over the contractor's effort and to provide frequent technical redirection. The CPFF arrangements seemed best suited to fill these needs.

Under the CPFF method, both parties first reach agreement on an estimated cost and then upon a fee which is felt to be mutually fair. This fee does not change when the requirements of the procurement are fulfilled, regardless of the relation between the actual cost of performance and the originally estimated cost--the initial basis for establishing the amount of fee.

This fact, however, creates serious disadvantages when the CPFF method is employed; for timely completion and minimum cost are often subordinated to considerations of elaborate and unnecessary improvements in equipment or services. The contractor has no real inducement to be positively concerned with contract performance and cost because, under CPFF, his fee cannot be altered. Jerry Gonzales, a Contract Negotiator at MSC, has stated:*

> Despite its advantages, there was no obvious incentive in the CPFF method for the contractor to perform efficiently or to reduce costs below the estimate. Allowable but avoidable costs were often incurred (i.e., overtime and overhead expense). Due to the structuring of CPFF contracts, the emphasis of the Armed Services Procurement Regulations on "allowable cost," <u>total price</u> was often forgotten until such a time as a cost overrun was imminent.

In absence of any real incentive formula or system to hold costs to a minimum, constant scrutiny became necessary in the review and approval of expenditures. The fact became apparent that as many future contracts as possible should be written on some type of award/penalty provision based upon the contractor's ability to hold down costs and to perform adequately.

NASA's trend toward incentive contract arrangements began in earnest in the early 1960's. Hal Taylor reported in September of 1961 (ref. 16):

> NASA has begun a review of its contracting procedures amid indications that the space agency will make use of incentive-type contracts for the first time. The

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*Jerry S. Gonzales, Results of a Limited Survey of Incentive Contracts at the Manned Spacecraft Center (unpublished research paper prepared for the Manned Spacecraft Center, Houston, 1967), p. 11.

review was ordered by Administrator James E. Webb in an effort to cut R&D costs. Some firm results can be expected in the next few months.

By November 1963, NASA had 13 firms obligated to 17 active incentive contracts in which the total value was $256.6 million (ref. 17). Moreover, incentive features were gradually incorporated into existing contract arrangements to encourage better planning and definition of programs and to achieve a more thoughtful consideration of procurement changes by both NASA and the contractor. The CPI/AF arrangements were felt to be a positive method of urging Government and industry toward improved performance, on-schedule deliveries, and lower program costs.

The broad incorporation of incentive arrangements has had a significant impact on source evaluation. Proposed incentive plans are often good measures of both the management commitments and the monetary risks that the contractor is willing to make in relation to the proposed effort.* However, award/penalty remuneration methods are typically characterized by a complex interrelationship of performance, cost, and fee variables; the decision as to which proposed combination is the most desirable is often quite difficult. Unlike fixed-fee methods in which the proposed remuneration plan is generally evaluated only in terms of estimated cost (direct and indirect) and fee, incentive plans may contain elaborate formulas correlating numerous factors. The result is often the receipt of a wide variety of incentive formulas which offer no basis for comparability or means of determining which is best for the Government's interest.* Thus, evaluators have had to experiment with numerous approaches and techniques to arrive at reliable rankings of proposed incentive plans, and incentive fee structures are gradually receiving a greater review emphasis.**

MSC PROCESS CHANGES

Novel social processes and systems change as participants react to changing needs, experiences, and issues (such as those already discussed). The SEB members have generally attempted to improve various areas of the SEB process by benefitting from prior experiences. Therefore, this evaluation mechanism has become a more professional management tool. Field

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*Statements by Wesley Hjornevik, Director of Administration, NASA Manned Spacecraft Center, during an interview in his office, May 24, 1967.

**Statements by Lawrence Vogel, Executive Officer, NASA Headquarters, during an interview in his office, May 1, 1967.

Boards have gradually become more sensitive to the questions and influences extended by NASA Headquarters. In fact, the NASA Administrator is notably concerned with what SEB changes have been accomplished and what alterations should be made.*

In that the SEB process is a management scheme, it has become altered correspondingly with parallel management developments and influences within NASA and MSC. In fact, improvements and changes in the SEB process have actually been encouraged by MSC management, in the knowledge that such innovations are rewarded through better contractor selections and pre-planning of goals. For these reasons, the SEB process at MSC has undergone alteration principally in three areas: (1) RFP preparation, (2) criteria emphases, and (3) scoring techniques.

A case study comparison of three MSC competitions for nonpersonal services contracts undertaken in the early 1960's (here referred to as A-1, B-1, and C-1) will be made with the more recent re-competitions (here referred to as A-2, B-2 and C-2) for basically the same efforts to portray these changes. When examining the following section, the reader must note that the A-1 competition is the earliest of the three early coded competitions (A-1, B-1 and C-1); and, consequently, the A-2 re-competition is the earliest of the three most recent re-competitions (A-2, B-2 and C-2) studied for comparison. This coding system is necessary because the sensitivity of the opinions expressed by the evaluators concerning contractor's proposals does not permit specific reference to the identity of the evaluators, the contractors, the year of the competition, or the requirements of the contract being competed. In brief, each subject competition is for nonpersonal services at MSC and employs either a cost-plus-incentive-award-fee or cost-plus-award-fee remuneration method. The data were obtained from the Source Evaluation Board Reports and the RFP's of the various competition examples.

RFP Preparation

Substantial evidence shows that the basic philosophy behind RFP preparation at MSC has undergone significant change. The general tendencies in early RFP's were to use general terms, to provide somewhat limited information about the terms and requirements of the efforts, and to request general information from proposers. The broad nature of these documents often resulted in proposals containing meaningless generalities in a variety of formats. Although some specific information was both

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*Statements by James E. Webb, NASA Administrator, during a presentation of an SEB Report at NASA Headquarters, May 1, 1967.

provided and received through early RFP's, the procedures did not evoke from all proposers the concise and comparable information which would facilitate valid comparisons. Many proposals thus offered a weak basis for comparison or for accurate conclusions. In addition, broad or vague RFP's encouraged a similar response from Industry. Because no standardization or limitation features had been cited in the RFP, numerous data were received which could not be used in a common evaluation.

This broad RFP philosophy further compounded the difficulties associated with the uncertain nature of cost reimbursement contracting. If the quantity and quality of services desired cannot normally be predicted with accuracy, the manner in which the contractor interprets the Government requirements will determine the scope and nature of his proposals. Accordingly, the less than specific description of contract needs, as stated within the RFP, will often result in responses which have misinterpreted the needs of the impending effort.

This situation was formally attacked in September 1966 in a NASA Management Instruction (ref. 18). The document issued specific instructions relative to the future preparation of RFP's from support services: (1) future RFP's were to set forth available data concerning the quantity and quality of services and supplies required; (2) if the support services to be provided had not yet been placed under contract, the NASA estimate in terms of man-hours of identifiable categories of labor (including experience and related qualifications) and in terms of quantities of supplies were to be set forth in the RFP--exclusive of costs; (3) if the effort was currently under contract, the existing operating procedures and the experience of the incumbent contractor for past periods in terms of man-hours of identifiable categories of labor and quantities of supplies consumed, all exclusive of costs, were to be provided within the RFP.*

This basic RFP policy change to include more information in a more specific format was not intended to restrict the offerer's approach to successfully performing the terms of the procurement with maximum economy (including any innovations which the contractor might wish to offer) but only to describe accurately the effort estimated according to the Government's experience and projections of that experience. In other words, the greater the amount of information which not only can be provided about the product or service required but also can be gained from the

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*The NASA policy letter of September 1967 was issued following the MSC/NASA SEB for facility maintenance and operation at the White Sands Test Facility. In this action much of the philosophy contained in the NASA instruction was implemented by a Field Center well in advance of NASA Headquarter's policy direction in the area.

proposer in a specified format through the RFP instrument, then the greater the likelihood that the most competent contractor with an adequate performance capability will be selected.*

Results of RFP Preparation Case Study

A comparison of the RFP prepared for a more recent subject contract competition (A-2) with its earlier counterpart (A-1) exemplifies the trend in RFP preparation already presented. The most significant additions and changes in the more recent A-2 RFP are:

1. Data in three specific areas were requested from offerers: Cost, Experience and Performance, and Work Plans. (On the other hand, the A-1 RFP requested information from the contractor not in specified areas but in Technical and Business categories.)

2. The staffing arrangements of the current contractor, the prevailing wage rates of the Blue Collar force, and the union agreements currently in effect were also provided.

3. A specific cost proposal format was provided for presentations of cost data. In fact, to reduce guesswork, one figure in a specific cost area (Material and Equipment) was given on the form.

4. A form was also included on which to report company experience. To avoid glowing descriptions of company background, this form required that experience be noted not in terms of lengthy statements but by checking the appropriate categories of work described on the form. In addition, a specific format was provided for telephone checks of reported experience and references.

The following changes and additions appeared in the B-2 and C-2 RFP's as compared with their earlier counterparts (B-1 and C-1) and with the A-2 RFP (re-competed at a slightly earlier date than the B-2 and C-2 instruments):

1. The B-2 and C-2 RFP's were organized for easier reference into eight specified sections. General and specific instructions to proposers were treated separately.

2. These RFP's requested data from offerers in five specified areas, including Organization and Operating Plans, Key Personnel, Experience

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*Statements by J. P. Harris, Chief, Center Support Procurement Branch, NASA Manned Spacecraft Center, in an interview in his office, April 24, 1967.

and Past Performance, Cost, and Certification and Other Data. Note especially that, unlike in the earlier A-2 RFP, Key Personnel and Certifications and Other Data are in separate sections.

3. This more specific breakdown of general information request sections in the B-2 and C-2 RFP's is complemented by the fact that the sections themselves request data in more specific terms. For example, the Organization and Operating Plan section asks for a coded organization chart with all related operating plans. A proposer's functional plan, manning plan, phase-in plan, and labor relations plan were therefore specifically related to the offerer's planned organization.

4. Both the B-2 and C-2 RFP's required that information relating to the key personnel (for example, the current and proposed salaries of key employees) offered by the contractor be reported in a specific format.

5. The B-2 and C-2 RFP's both employed a detailed cost proposal format similar to that of the A-2 request. However, an interesting fact is that more extensive cost information is provided for and requested from the contractor in the even more recent B-2 and C-2 RFP's. Whereas the A-2 RFP provided only a Material and Equipment figure, the B-2 and C-2 RFP's provided, in addition to Material and Equipment dollars, the total number of man-hours and base overtime percentage upon which to bid. Moreover, instead of requesting a single award-fee figure, the B-2 and C-2 RFP's asked for a series of award-fee figures at various levels of performance.

6. Finally, an entire section of the B-2 and C-2 RFP's was devoted to providing a variety of specialized information to proposers. In addition to the data for proposers, as provided in the A-1, B-1, C-1 and even A-2 RFP's, these most recent instruments added: estimated manning requirements; minimum qualifications for labor categories; typical material and supply requirements; inventory of material currently on hand; current on-site/off-site functions and on-site facility availability; and on-site/off-site support provided by MSC.

Criteria Emphases

One MSC official indicated that, although SEB's have always based their evaluations of contractor suitability upon fundamentally the same kinds of standards, the emphases applied to certain criteria areas have undergone significant changes.* These alterations have been the result

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*Statement by Charles Statz, Chief, Technical Support Procurement Section, NASA Manned Spacecraft Center, during an interview in his office, April 27, 1967.

of NASA experience rather than of any formal administrative directive. In addition to emphases changes of criteria based upon their ability to measure contractor suitability, the case study shows that the weights of evaluation standards have been altered to fit the nature and terms of the particular procurement evaluation. Criteria emphases flexibility had to be maintained when a variety of goods and services, each with different requirements, must be purchased. As time passed, then, both the objectives of the nature of the work undertaken and the measuring ability of the criteria became better defined to permit the recognition and changes of important evaluation standards.

Results of Criteria Emphases Case Study

In the competitions examined, the evaluation criterion of Key Personnel underwent a significant change in emphasis. The quality of the top management talent that the proposer is willing to commit to the effort has recently been recognized, according to MSC officials, to be one of the best measures of a contractor's capability to perform efficiently.* Certainly a firm's success in achieving program goals is directly related to the abilities of those responsible for meeting the terms of the contract.

The Key Personnel criterion is especially important in the review of proposals for nonpersonal services contracts in which exists an established work force with defined objectives. If the incumbent contractor should be replaced on such a contract, the majority of the existing labor force would probably remain with the new firm. In this eventuality, therefore, one of the most significant changes which will occur with a new contractor will be the inclusion of a new group of key managers.

Hence the total points allotted the Key Personnel criterion on the three subsequent re-competitions (A-2, B-2 and C-2) exceeded by 120 those on the earlier competitions (A-1, B-1 and C-1) (table II). With one exception, each of the subsequent competitions allotted more weight to Key Personnel than its earlier counterpart.

On the other hand, the emphasis on the past experience of a firm as a measure of capability has been greatly reduced. At first glance, such a reduction in weight seems illogical because of the importance attached to a firm having a background in the type of work to be performed. However, an MSC official indicated that, as evidenced by prior evaluations: having experience in a particular work area was not necessarily an indication of a firm's capability (ref. 8); and, unless a company brings the

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*Statements by Wesley Hjornevik, Director of Administration, NASA Manned Spacecraft Center, during an interview in his office, May 24, 1967.

TABLE II.- TOTAL POINTS APPLIED TO SUBJECT CASE STUDY CRITERIA AREAS EXPERIENCING A SIGNIFICANT CHANGE IN EMPHASES[a]

Criteria	Competition			Re-competition		
	A-1	B-1	C-1	A-2	B-2	C-2
Key Personnel	75	75	210	80	200	200
Company Experience	150	250	105	80	75	75
Performance	--	--	105	100	100	100
Composite Cost Elements	100	100	75	350	200	200
Fee	--	--	20	35	50	50
Indirect Costs	--	--	--	20	[b]100	[b]100
G&A Costs	--	--	--	35		
Labor Relations Plan	--	--	--	20	100	100
Phase-In Plan	(c)	(c)	(c)	90	50	50

[a]The number of points listed for each criterion is the value of that criterion compared to all others which, when added, equal 1000 points in every competition.

[b]The points assigned to General and Administrative and to Indirect Costs areas were combined in the B-2 and C-2 competitions.

[c]Because the A-1, B-1, and C-1 competitions were for new efforts, no phase-in plan was required.

experience to the job in the form of key personnel, its true impact is not felt. As shown in table II, therefore, 475 more points were allotted the Company Experience criterion in the three earlier competitions than in re-competitions A-2, B-2 and C-2--or approximately three times as many points. Individually, the later competitions each applied less emphasis to considerations of experience than did earlier examples.

One of the primary justifications for the reduced concern in this case appears to be the feeling among evaluators at MSC that experience records are not especially meaningful when the performance of a contractor while gaining this experience was deficient or only satisfactory. The nature of the NASA mission requires that both service and product contractors perform efficiently and effectively, and mere experience in a category of effort will not necessarily satisfy these conditions. The result has been a substantially increased emphasis applied to a proposer's past performance in source evaluation. Hence the Performance criterion in re-competitions A-2, B-2 and C-2 received a total of three times as many points as in the A-1, B-1 and C-1 competitions (table II).

Considerations of cost and cost elements have also undergone significant changes in emphases as evaluation criteria. The number of points applied to the Composite Cost Elements criterion in the three earlier competitions is, in each case, smaller than the number applied to this composite criterion in the later examples.

An examination of what made up the A-1, B-1 and C-1 Composite Cost Element criterion supplies the rationale for the change. As foundations for the Composite Cost Elements criterion, the earlier examples used comparative status, completeness, supporting schedules, and cost controls, whereas the A-2, B-2 and C-2 re-competitions considered such elements as labor rates, additive costs, fringe benefits, general and administrative costs, and fee.

The heavier evaluation emphasis more recently applied to cost in general apparently results from these newer elements of cost consideration. In table II is shown how three of these newer cost elements have changed in emphasis. Fee as a cost element was given no consideration in either the A-1 or B-1 examples, and only a 20-point emphasis in competition C-1. Re-competition A-2, however, provided a 35-point emphasis for Fee; and the most recent B-2 and C-2 competitions gave a 50-point consideration to a proposed Fee.

The other cost elements, Indirect Cost and General and Administrative Costs (G&A), have increased somewhat more rapidly in emphasis. All three of the earlier competitions applied no points to either of these criteria. However, these cost elements both received, in the A-2 re-competition a total of 55 points, and, in the B-2 and C-2 examples, almost twice as many emphasis points as in 1966.

The more rapid increase in emphasis of the Indirect and G&A Cost Elements as compared with that of the Fee Cost element is easily explained. MSC representatives stated that experience has proved potential dollar outlays for costs of a general and administrative and indirect nature often to be much greater than outlays for the firm's earned profit--Fee. The result has been a gradually increasing emphasis of these elements compared to that of fee considerations. In the C-1 example, Fee Cost was given a 20-point emphasis and Indirect and G&A Costs were not considered. Later, in the A-2 competition, Indirect and G&A Costs received a greater emphasis than Fee; and, most recently, in the B-2 and C-2 studies, these elements received twice as much emphasis as did Fee. Because Indirect and G&A costs often require twice as heavy a dollar outlay as do Fee payments, this revised emphasis seems logical. One NASA official stated that these cost elements are being increasingly emphasized because of their value in indirectly portraying a proposer's organization and operations.*

The importance of a sensible and effective relationship existing between company management and the labor force directly responsible for the effort has been more recently recognized by evaluators. The complex array of labor organizations with varying degrees of power and representation among the workers employed by NASA contractors has required that a proposing contractor offer a reasonable plan for dealing with labor representatives to assure a stable work force for the effort. Board evaluators are giving more weight and, consequently, better scores to those contractors who can provide NASA with an enviable record of dealing with labor and can assure NASA that their companies will be able to conduct operations without creating major problems with other contractors and their personnel.

As shown in table II, none of the three earlier competitions gave any direct consideration to a Labor Relations Plan. Their subsequent counterparts, however, weighed labor considerations more heavily. A slight weight was placed on the Labor Relations Plan criterion in the A-2 competition; but, in the most recent examples, both the B-2 and C-2 evaluators give a 100-point weight to the proposer's Labor Relations Plan--or one-tenth the firm's total score.

Another criterion area, which is closely related to labor relations and which appears to have undergone an emphasis change, is a proposer's Phase-In Plan. When an existing contract is ready for re-competition, the proposer is asked for an outline of how he will phase-in his company's personnel and utilize the existing labor force. According to

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*Statements by Bernard Moritz, Deputy Assistant Administrator for Industry Affairs, NASA Headquarters, during an interview in his office, May 1, 1967.

table II, all three of the earliest subject competitions, because they were new efforts, did not require a phase-in plan. Somewhat later, however, the A-2 example shows a heavier emphasis (90 points) in this area than most recent B-2 and C-2 competitions, thus indicating that a reduced emphasis on phase-in plans is being applied by evaluators.

Evaluators claim that, while the importance attached to an effective phase-in plan has not undergone a substantially reduced emphasis, the means by which effective phase-in can be attained have increased in emphasis. These means include heavier weights for such considerations as Labor Relations (the increased emphasis of which is shown) and Wage Rate Reasonableness. The greater emphasis on these criteria, as being more indicative of a contractor's ability to integrate himself into an effort, have resulted in decreased weight applied to that criterion directly labeled "phase-in."

Scoring Techniques

Obviously, emphasis is imperative for those criteria areas deemed meaningful in contractor selection. To become fully effective means of evaluation, however, the responses to these areas must be scored in an effective manner. The case study examination further revealed certain basic changes in the techniques utilized to score proposals.

Results of Scoring Techniques Case Study

The final scores and relative rankings applied to the respective proposers in each of the subsequent case study re-competitions (table III) show a significantly greater spread between themselves than do the scores applied to the proposers in competitions A-1, B-1 and C-1. When the scoring approaches of these competitions are examined, the bases for the trend in the spread scores become apparent.

In competition A-1, a proposer's response to a criterion could receive one of the following adjective ratings and corresponding point scores:

1.	Outstanding	7
2.	Excellent	6
3.	Very Good	5
4.	Good	4
5.	Satisfactory	3
6.	Fair	2
7.	Poor	1
8.	Not Acceptable	0

TABLE III.- FINAL SCORES APPLIED TO COMPETING COMPANIES IN EACH CASE STUDY COMPETITION

Competition			Re-competition		
A-1	B-1	C-1	A-2	B-2	C-2
5.0	5.05	802	780	860	933
4.5	4.92	761	731	774	745
4.4	4.47	723	677	733	531
4.2	4.15	716	624	585	328
4.1	4.03	715		578	248
	3.41	701		531	
	3.04	700		428	
	2.88	670		383	
	2.61	670		264	
	2.59	668			
	2.34	638			

The result was an extremely compact grouping of scores ranging only from 4.1 to 5.0. On the other hand, a proposer's response to a criterion area in re-competition A-2, (competition A-1's later counterpart) could receive only one of the following adjective ratings and corresponding point values:

1.	Excellent	100
2.	Good	80
3.	Satisfactory	60
4.	Fair	40
5.	Marginal	20
6.	Unsatisfactory	0

The relatively greater spread among proposers in re-competition A-2 is consequently reflected in table III.

Competition B-1 employed an even finer line of distinction in its scoring technique than did competition A-1. The scores applied to the various criteria in this example were, in fact, fractions of one point:

1.	Outstanding	2.10
2.	Excellent	1.80
3.	Very Good	1.50
4.	Good	1.20
5.	Satisfactory	.90
6.	Fair	.60
7.	Poor	.30
8.	Unacceptable	.00

The remaining earlier competition, C-1, utilized a somewhat greater spread in its scoring approach than did A-1 and B-1; but it, too, showed a relatively close distinction between possible scores:

1.	Excellent	100
2.	Very Good	90
3.	Good	80
4.	Satisfactory	70
5.	Fair	60
6.	Poor	50
7.	Not Acceptable	0

An interesting fact, in this instance, is that a response to a particular criterion area which is considered poor would nevertheless receive one-half the number of points possible for that area.

The most recent B-2 and C-2 re-competitions employed the same scoring techniques; and they show a greater tendency (even compared with the

A-2 example) to force a spread in scoring. In these examples, only one of five scores could be applied to a contractor's response to a particular standard:

1.	Excellent	100
2.	Good	80
3.	Satisfactory	50
4.	Marginal	20
5.	Unsatisfactory	0

Consequently, the utilization of this scoring technique produced a greater spread among proposer's scores in these most recent competitions than in any other example (table II). In fact, with 11 companies receiving scores in the B-1 example, a 2-place movement of the decimal point showed that a 471-point spread existed between the highest and lowest ranked company. However, the spread of points between the highest and lowest ranked company in B-2 (B-1's later counterpart) was 596 points. Only nine companies (rather than 11) took part in this re-competition.

This trend toward separated scores appears to be based somewhat upon a desire among MSC evaluators to move away from the specialized rating approach of earlier competitions. One official noted that past SEB scoring techniques had heavily emphasized mechanical, numerical quantification in scoring because the validity of such scores was more difficult to question.* However, the movement away from scoring methods using fine lines of distinction indicates the application of a more integrated and overall scoring philosophy.

The case study also showed that certain criteria elements, such as proposed Fee Cost elements, are being scored in a revised manner. For example, in competition B-1, a fee scoring formula was utilized in which the total base fee (or guaranteed profit) and the maximum award fee for perfect performance were added together to form a dollar amount. The lowest proposed dollar amount actually received the highest evaluation score in that particular category.

More recently, the A-2 re-competition showed a revised fee scoring method designed to stimulate performance. Under this technique, the total base-fee was added to one-half the maximum award-fee at 100 percent performance, and the lowest proposed result among companies was required to receive the highest evaluation score. By reducing by one-half

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*Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

the amount of award-fee to be considered, this method penalizes more heavily those contractors who proposed higher guaranteed profits in the form of large base-fees.

Re-competitions B-2 and C-2 exhibit the most recent fee scoring techniques employed at MSC. This technique adds the proposed base fee, not to one-half of the maximum award-fee (100 percent performance), but to an amount determined by an average of the award fee proposed within the range of performance which the contractor is most likely to perform: i.e., an average of the amount of dollars to be awarded at 80, 85, and 90 percent performance. The lowest dollar amount determined by this tabulation receives the best score.

Officials explained that the rationale for this approach lies in the fact that it is more realistic to score a fee proposal within the range which is acceptable and desirable and within which the contractor is likely to perform, rather than at a 100 percent performance level which the contractor would probably never attain.

In figure 3, a hypothetical example of this more recent fee scoring technique, are shown the number of fee dollars desired by five different companies (A-E) at various levels of performance. Also shown is the reason for the necessity of scoring the average of fee dollars proposed within the desirable performance range of 80 to 90 percent rather than within a wider range of scores. If a contractor realizes that he will probably perform within the 80 to 90 percent range, he may attach his highest performance fee payments within this range and drastically lower his proposed compensation at other levels of performance. The contractor's objective here is to lower his overall performance/fee average dollar amount and thereby increase his score.

Company E (figure 3) is a good example of this approach. By proposing only a $50 000 compensation at 75 percent performance but substantially higher compensation amounts within the 80 to 90 percent range, Company E would receive the best fee evaluation score if the approved scoring technique were to average the proposed award fee compensations at the 75, 80, 85, and 90 percent levels. This situation would occur because the extremely low fee compensation proposed at the 75 percent performance level would cause Company E to have the lowest overall award fee proposal average ($225 000). However, if the fee proposals were averaged at the 80, 85 or 90 percent levels, Company E would receive the highest overall award fee proposal average ($283 000) and consequently receive the lowest evaluation score. In this particular case, Company E would receive the lowest award fee score whereas Company B would be granted the highest rating.

A basic policy conflict exists in the scoring of fee proposals. Conversations with various NASA officials revealed, on one hand, some

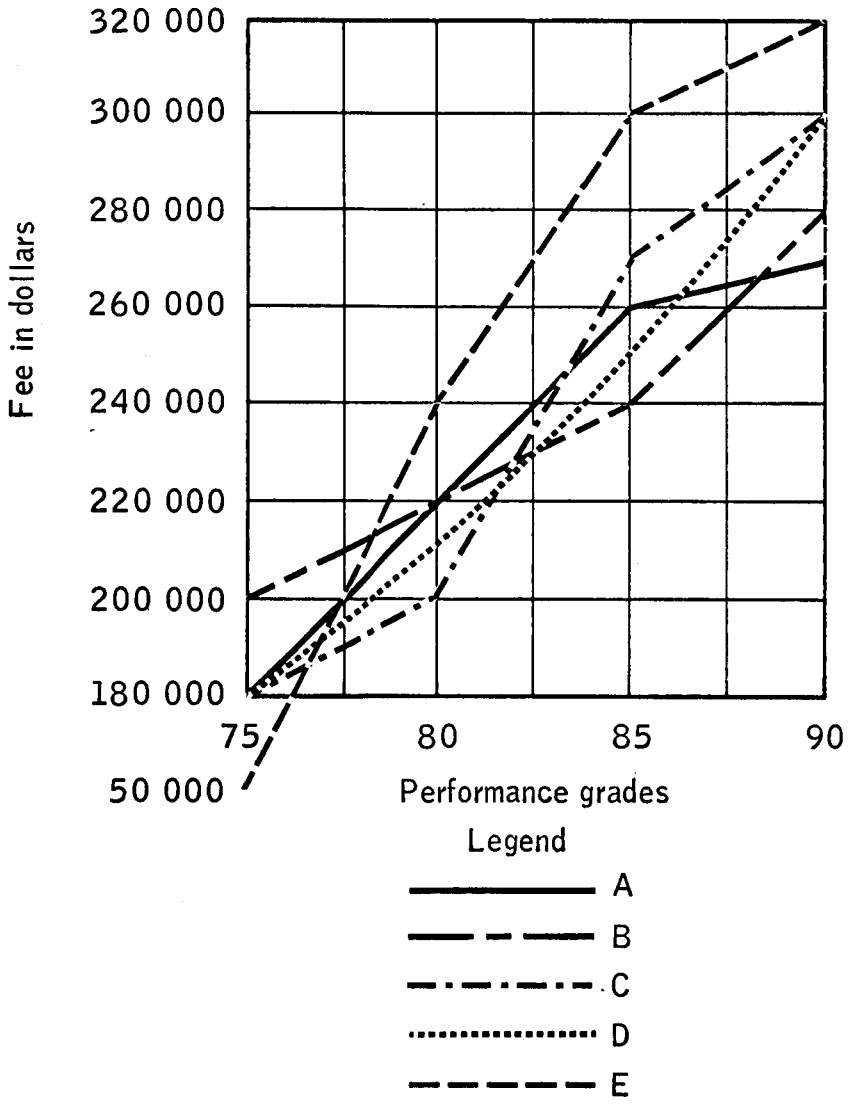

Figure 3.- Fee scoring techniques.

feel that a principal objective in any procurement in which a fee is involved is to hold costs to a minimum, and that the lowest fee proposal is the best. On the other hand, many officials claim that the principal procurement objective is the stimulation of performance, and that this goal can be reached only by awarding gainful amounts of fee for respectable performance. The real objective appears to be the attainment of a desirable medium between the two.

Finally, a comparison of the A-1 and A-2 competitions showed that a revised approach to applying scores to proposed fringe benefit policies has been undertaken by evaluators. In Competition A-1, proposed Fringe Benefits were carried as a part of the figure offered for Overhead. This meant that an important ingredient of a firm's proposed employee plans was scored with the "lowest is best" philosophy (already described). Evaluators in Competition A-2, however, realized the defects inherent in granting higher scores to those firms which offered low fringe benefit proposals--a dangerous policy when a primary objective on any contract is to maintain a series of personnel policies which will stimulate and motivate the work force. Fringe benefit proposals were therefore removed from their association with overhead and were scored independently. Those proposals which contained the most reasonable fringe benefit plans (i.e., not too high or low) were given the highest scores.

According to one official, earlier evaluation teams tended to operate under the impression that accountability of evaluation results required that SEB's fix their mode of operation. Any type of change was therefore deeply suspect.* The more recent emphasis on SEB flexibility has altered this philosophy, and the evolutionary changes in the SEB process throughout NASA and at the MSC are evidence of this change. Certainly, an equation of the NASA SEB process as a decision-making and, therefore, a social process confirms the fact that many aspects of this review mechanism will be progressively perfected in the future.

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

This report, on the NASA/MSC Source Evaluation Board process as a decision-making technique, is concerned especially with: an identification of the foundations upon which the process is based; the operation

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*Statements by Charles Bingman, Chief of Management Programs, Office of Manned Spaceflight, NASA Headquarters, during an interview in his office, May 1, 1967.

of the process itself; and the basic changes which the process has experienced throughout NASA and, in particular, within MSC. From the case study, the attitudes and viewpoints of those interviewed, and the available literature, certain basic conclusions about the NASA/MSC SEB process can be drawn.

CONCLUSIONS

1. The SEB process is a decision-making and, therefore, a management technique for selecting contractors because of rapidly increasing dollar amounts for research and development within NASA and the growing complexity of the various NASA programs.

2. A variety of bases, not all of which are directly associated with contractor selection for major procurements, exist for utilization of the process.

a. Source Boards ensure careful evaluation of the capabilities and proposals of contractors, and thereby selection of the best contractor in terms of NASA objectives.

b. SEB policies and procedures stimulate competition among private contractors. This method of contractor review has been formulated in order that no qualified firm can be inhibited from making a proposal.

c. To insure a competitive atmosphere, SEB procedures provide a fair and impartial means of contractor proposal review.

d. The wide variety of procurement objectives within NASA has required its company review method to remain adaptable to the terms of differing contracts. SEB procedures insure review flexibility.

e. As a management technique, the SEB process grants NASA top management the opportunity of final contractor selection. At the same time, procedures require that the greatest portion of proposal review be accomplished in the appropriate field installation responsible for the management of the particular effort. Top management final determination is then consistent with a decentralized mode of operation.

f. Many NASA work requirements are technologically complex in nature. Evidence shows that NASA Source Boards are not only the most satisfactory means of dealing with technology but also of determining a contractor's competence and likelihood of providing a reliable product or service.

g. NASA SEB's have proved themselves to be important devices for measuring how well contractors are developing their capabilities. This function is essential because of the heavy employment of private firms within NASA.

3. SEB procedures pace and formalize the decision-making process. Among the possible conclusions concerning selected operational and procedural aspects of the SEB review technique are the following:

a. The position of SEB Chairman is vitally significant. The appointment of an incapable chairman will probably result in a poor evaluation.

b. The length of time involved in SEB service creates an extreme talent drain on top quality, senior personnel within NASA. The creation of an on-going pool of SEB experts to release higher officials from SEB duty is not, however, viewed as a desirable solution to this dilemma.

c. Various observational and instructional overtone benefits, other than those directly associated with selection of competent contractors, are derived from SEB activities by both the evaluators and the NASA Administrator.

d. The selection of correctly emphasized evaluation criteria is probably the most critical function of the SEB.

e. The SEB process demands significant monetary outlays for both the proposers and the evaluators.

f. The preparation of the RFP is a real challenge to Board Members. The quality of the proposals received will reflect the quality of the RFP upon which the proposals are based. The greatest challenges lie in achieving an effective RFP format and in clarifying the point that the Government is not necessarily satisfied with the incumbent firm (if one exists). In addition, proper structure of the RFP not only reduces the proposal preparation effort and expense but also greatly simplifies evaluation by the Government.

g. The Preproposal Conference is a personal, first-hand means of supplementing written data provided within the RFP. The Conference enables firms to submit more realistic and informed proposals.

h. The most serious challenges to actual SEB evaluation occur in dealing with brochuremanship, in certain cost elements, in the maintenance of evaluation flexibility, and in efforts to achieve an overall view of each company's capability while, at the same time, gaining specialized scrutiny in particular subject areas.

4. The SEB process is a social process and therefore not a static entity. Largely because of the Executive Privilege Issue, the Harbridge House Study, and NASA's transition to incentive/award-fee contracts, basic SEB process changes have occurred throughout NASA and at the various Field Centers. As shown by the case study and other data, three basic SEB process changes have been experienced at MSC:

a. A basic policy change has been effected in the preparation of RFP's. The trend is toward the inclusion of more detailed information concerning the contract, and also toward the request for more detailed information from contractors in the RFP instrument.

b. The emphases applied to a number of evaluation criteria utilized by MSC SEB's have undergone significant alteration. This trend has been affected as the objectives of the work undertaken and the measuring ability of the criteria have become better defined.

c. More integrated and overall scoring techniques are being employed by MSC evaluators. These revised scoring methods are forcing a broader distinction between proposals and are scoring certain criteria elements in a revised manner. This trend will probably continue.

RECOMMENDATIONS

The objectives of this study were to ascertain why the NASA/MSC SEB process exists, how it operates, and the manner in which it has changed at MSC. The goal was not, therefore, to test the quality of the process. Nevertheless, the data indicate some general recommendations which might be made to improve some aspects of SEB technique.

1. Extreme care should be taken in the selection and weighting of evaluation criteria. These standards should be limited to the really significant and critical considerations which determine contractor suitability, and to those areas where greatest discrimination can be achieved.

2. It is suggested that an investigation be made of the feasibility of SEB's having, in some cases, the freedom to alter approved criteria and criteria weights <u>after</u> proposals are received. The objective here is not to create a means of providing preferential treatment to certain proposals, but to have the ability to alter evaluation standards in light of information not available at the time proposals were solicited and, more specifically, to redistribute weights from areas in which little discrimination has been possible.

3. Formalized SEB procedures should require that, at each Field Center, a selected individual with wide experience in SEB procedures be available to orient each new Board, to define the responsibilities of members, and to provide advice as needed.

4. Advantages would result if each Field Center had access to the improvements and changes made in SEB procedures at all NASA Field Centers. Therefore the suggestion is made that procedures be implemented to provide for an annual (perhaps even bi-annual) SEB Seminar at which those Field Center officials most closely connected with SEB activities could gather and exchange information. This seminar should expedite the overall improvement of the SEB process--improvement which, to date, has been only gradual and often sporadic.

5. Some officials feel that top management scrutiny over SEB procedures often does not come soon enough in the evaluation process. When possible, NASA management officials should enter the earlier phases of SEB activities--for example, in a definition of the functions and standards of the procurement in the Statement of Work.

6. The advantages in the trend towards consensus (or an overall scoring approach) may, in some cases, be compounded by selected use of SEB's which convene as "Committees of the whole." Rather than breaking the SEB into specialized evaluation teams, some SEB's could convene as comprehensive review units. Such a method would streamline processing time and force the Board to justify the results on its own analysis rather than on the efforts of subordinate evaluation groups.

7. Those industry representatives who were questioned stated that, in some cases, their companies could propose a variety of contract economies if a greater exchange of evaluation information between evaluators and proposers could be effected. That is, industry could best emphasize those areas which the Government feels more important. This action would result in a better allocation of industry time and effort during proposal preparation. Of course, the <u>amount</u> and <u>kind</u> of information to be made available is open to question; but the potential advantages lead to the recommendation that NASA re-evaluate its stringent position on the release of evaluation information.

8. Additional consideration should also be given to developing an equitable system of advising companies (out of the competitive range) during the early phases of the evaluation process, so that the proposed management teams could be reallocated to other programs. Industry feels that the current withholding of this information unnecessarily ties up numbers of key management on certain proposals.

9. Finally, advantages which accrue from SEB activity (both directly and indirectly associated with contractor selection) might warrant a

reduction of the contract dollar amount above which SEB procedures come into effect. The author suggests, then, that a study be made to determine if the advantages of such an increased degree of SEB activity would be equal to or greater than the necessary expenditures by both the Government and the contractors.

APPENDIX A

COMPETITION IN NASA AWARDS TO BUSINESS

FISCAL YEARS 1962-65

[Source - National Aeronautics and Space Administration, Annual Procurement Report Fiscal Year 1965]

Type of Action	1962	1963	1964	1965
	Net Value of Awards (Millions)			
Total	$1,030.1	$2,261.7	$3,521.1	$4,141.4
Competitive - Total	565.8	1,302.0	2,119.5	2,630.1
Advertised	64.1	106.6	134.4	169.2
Negotiated	501.7	1,195.4	1,985.1	2,460.9
Noncompetitive - Total	464.3	959.7	1,401.6	1,511.3
Follow-on After Competition	*	** 255.7	** 494.8	** 503.6
Other Noncompetitive	464.3	704.0	906.8	1,007.7
	Percent of Total			
Total	100	100	100	100
Competitive - Total	55	58	60	63
Advertised	6	5	4	4
Negotiated	49	53	56	59
Noncompetitive - Total	45	42	40	37
Follow-on After Competition	*	11	14	12
Other Noncompetitive	45	31	26	25

*Data not compiled, included in other noncompetitive.

**Follow-on after competition procurements of less than $25,000 are included in other noncompetitive procurements.

APPENDIX B

EXTENT OF COMPETITION

MANNED SPACECRAFT CENTER

FISCAL YEARS 1962-65

[Source - Manned Spacecraft Center, Annual Procurement Report Fiscal Year 1965]

	1962	1963	1964	1965
	Net Value of Awards (Millions)			
Total	$169.6	$560.8	$1,234.6	$1,280.5
Competitive	$119.0	$321.2	$ 851.4	$1,002.2
Negotiated	117.6	319.4	845.5	991.0
Advertised	1.4	1.8	5.9	11.2
Noncompetitive	50.6	239.5	383.2	278.3
Follow-on After Competition	*	200.0	53.2	168.4
Negotiated	*	39.5	330.0	109.9
	Percent of Total			
Total	100	100	100	100
Competitive	70	57.3	69.0	78.2
Negotiated	69	57.0	68.5	77.4
Advertised	1	0.3	0.5	0.8
Noncompetitive	30	42.7	31.0	21.8
Follow-on After Competition	*	35.7	4.3	13.2
Negotiated	*	7.0	26.7	8.6

*Data not available.

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