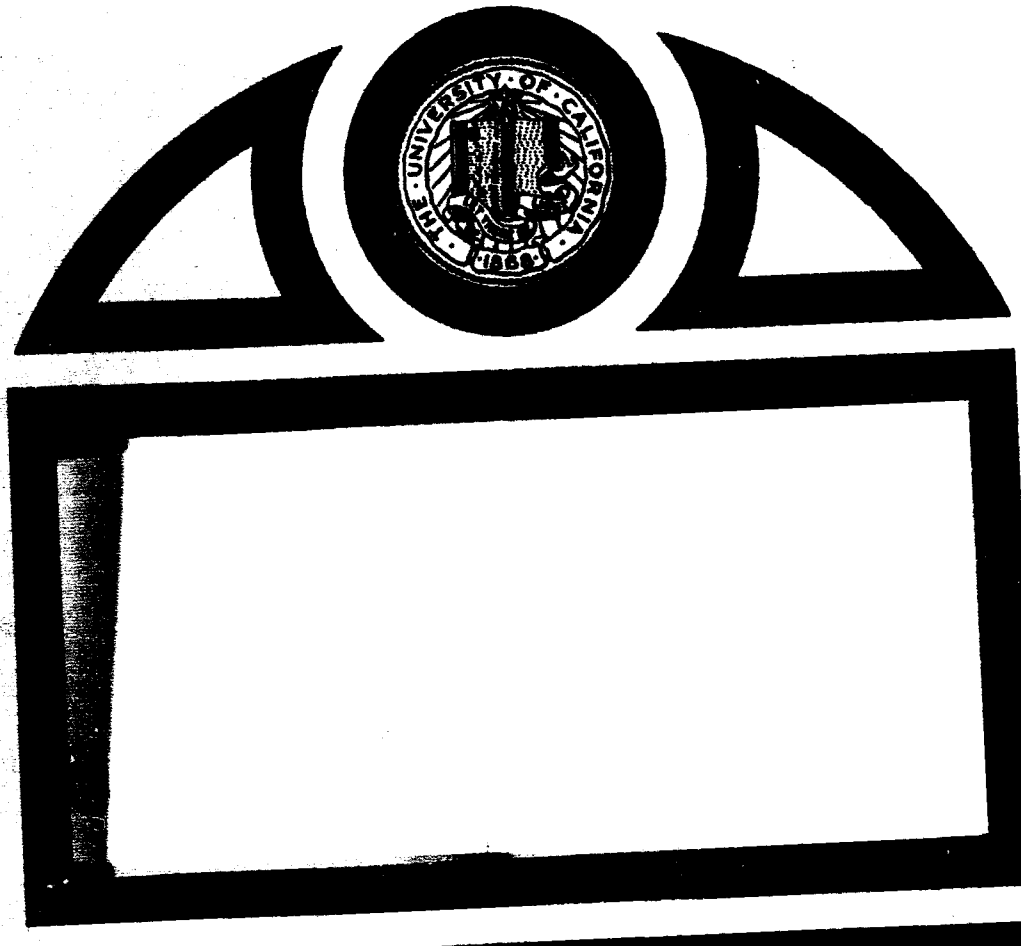

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THE PRE-SOLICITATION PHASE OF GOVERNMENT R&D CONTRACTING

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I

INTRODUCTION

The broad objective of this investigation is to ascertain the effects of early feasibility and design studies on the eventual outcome of R&D projects. This subject has assumed particular importance with the introduction by the Department of Defense of the "phased procurement" approach to the acquisition of major weapons systems. NASA has adopted a similar procurement procedure for space systems of significant proportions.

Although these recent actions have emphasized the importance of the feasibility and design study by formalizing and structuring the early phases of weapons or space system planning, advanced studies have for many years had important influence in shaping the direction of R&D efforts. Studies of technical and economic feasibility, whether they have been conducted as a company "marketing" activity or as a part of Government agency planning, have been pursued in response to the rising costs of R&D. These costs have made it necessary, prior to commitment of significant procurement funds, to evaluate carefully alternate approaches to project implementation in terms of technical feasibility, cost effectiveness, reliability, and timeliness.

These elements of evaluation define the scope of what is termed an advanced study in this investigation. It is different than "advanced development" of a particular instrument, sensor, or subsystem, but such developments may be a by-product of advanced studies. It is not preliminary design, which is restricted to the functional design of a system, but the advanced study must consider the effects of potential design problems and technical risks in project conduct. It is more than just a cost study, although it must cover cost as a measure of the economic feasibility of the technical options considered.

Since advanced studies are potentially so broad in scope, the approach to their initiation becomes an important decision for company and Government agency management. To understand the conditions and environment under which these early study activities are undertaken, studies were made of two major aerospace companies and a NASA space research and development center. The emphasis was put on activities which precede formal procurement actions by the Government agency.

Examination of the information derived from these sources has resulted in the conclusion that important competitive factors operate prior to the formal initiation of the procurement process which not only affect the project planning and initiation, but also heavily influence the eventual selection of a specific contractor. This early activity, involving both potential contractors and sponsoring Government agencies, is felt to be sufficiently pervasive in the procurement process that it is given the status in this report of a distinct phase of the procurement cycle - the pre-solicitation phase.

II

SPONSORING AGENCY - CONTRACTOR ROLES IN THE PRE-SOLICITATION PHASE

In the pre-solicitation phase of major R&D procurements critical decisions are made by the sponsoring agency in regard to the portion of a project to be done within the sponsoring agency and that which a contractor will undertake, the degree of system integration effort that the contractor will be required to undertake, the utilization of designs which may be dependent on existing capabilities which some, but not all, contractors possess, the requirements for liaison effort which may dictate the close geographical presence of a contractor to the sponsoring agency, the choice of ground-based testing programs requiring large-scale facilities, and the type of management information, project control, or configuration control systems to be used. All of these choices and decisions may, in some degree, favor some contractors over others. The foresight of potential contractors in re-orienting their company research, capital expenditures, and marketing efforts to anticipate the results of these early decisions increases the probability of receiving a contract award. These anticipatory measures on the part of potential contractors emphasize the use of company-sponsored research and studies, the results of which are fed to sponsoring agencies in order to elicit reaction or comment. Company intelligence estimates attempt to predict the progress and timing of project decisions so as to bring together at the appropriate time results of company-initiated advanced studies and the sponsoring agency need for information for decision. The objectives of this activity are to shape early programmatic decisions and to be in a position to be totally responsive to the eventual Request for Proposal (RFP). Thus, in the pre-solicitation phase of a major procurement,

there is a dynamic interaction of sponsoring agency planning and programmatic decision-making and company initiated and sponsored advanced studies whose purposes are to influence project decisions, anticipate an eventual RFP, and to build up a relationship with individuals in agency project planning and management positions.

Some aspects of this interchange are beneficial for the sponsoring agency, as it helps to keep agency personnel aware of the state-of-the-art and provides a wider range of considerations in planning and decision functions. It is certainly beneficial to the companies involved, since it means ultimate competitive advantage insofar as their efforts are utilized in project planning and RFP preparation. The detrimental effect of this interchange is the introduction of a number of biased inputs into formulation of project plans and initiation of proposed procurements. This is particularly disadvantageous when it is recognized that the decision environment that exists in the pre-solicitation phase is characterized by high uncertainty regarding performance objectives and diffuse responsibility for decision making.

III

THE DECISION ENVIRONMENT IN THE PRE-SOLICITATION PHASE

In the space system acquisition process, which is primarily research and development oriented, there has been increasing recognition that a better understanding must exist on the levels of risk describing a project or system before its initiation. This risk factor may be better appreciated through development of a set of alternatives which reflect certain combinations of performance, reliability, time, and cost, which themselves carry an element of uncertainty. The choice of configuration of the project or system may be made by evaluating the sets or combinations of factors in the context of a low or minimum risk level. The problem of choice becomes complicated when certain factors are fixed in some degree, (e.g., funds limitations or budget ceilings, fixed astronomical dates for planetary exploration systems), while other factors, such as achievable performance, have varying degrees of uncertainty and, therefore, potentially frustrate the attainment of some acceptable risk level. The choice of a system, then, and the means of acquiring that system become primarily economic judgements requiring consideration and optimization of a number of constraints and variables, which contain the element of uncertainty. The choice takes on a further economic dimension in that it also becomes important to ascertain at what point in time decisions or choices should be made. A projection of information availability or the effect of "learning curves" vs. uncertainty must accompany the evaluation of sets of variables if optimum choices are to be approximated. This complex decision environment accompanies the project or system acquisition throughout its lifetime. On the one hand, the paradoxical situation exists where decisions that most seriously affect the course of the effort

are made in the pre-solicitation phase, when uncertainty is highest. On the other, as the element of uncertainty is reduced with time, other variables become more fixed and constraining, resulting in reduced flexibility in making major alterations.

A further element which complicates the decision process in the pre-solicitation phase is the multiplicity of organizational elements and persons who are in a position to influence various aspects of the project design which, indirectly, affects the choice of ultimate contractors. As an example, for NASA projects there are the Field Centers which initiate project proposals and are delegated responsibility to manage system and subsystem contracts.[1/] Within NASA Headquarters there are many individuals who participate in project planning decisions, and there is a high degree of influence from the scientific community as to project objectives.[2/]

Thus, decision-making in the pre-solicitation phase involves choices between project alternates which are characterized by some level of risk and a high degree of uncertainty; these choices are affected by certain constraints and influenced by many organizational entities. It must be recognized that here is a climate in which companies have the best chance for competitive advantage, that is, before the issue of Requests for Proposal, when they must compete on an equal basis through the formal proposal and contract award process. The next sections of the report will discuss in some detail the impact of the pre-solicitation phase on project initiation and contractor selection

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1/ NASA Management Instruction 4-1-1.

2/ NASA Management Instruction 37-1-1.

IV

THE PRE-SOLICITATION PHASE AND PROJECT INITIATION

Project initiation consists of successive approximations, each in greater depth and detail, of a mission and/or project configuration which will satisfy a specific objective within the broad objectives of, for example, the national space program. Utilizing data derived from interviews conducted at two aerospace companies and a NASA Center, a model sequence has been developed which includes essential events in the advanced study and project initiation process.

The sequence starts with planning studies whose purposes are to examine possible future projects and missions and their inter-relationship, to identify the degree of reliance on technology derived from present and past projects, and to forecast the state of technology as a function of time. The second step is to investigate the various general concepts for, and characteristics of, systems which could accomplish the projects and missions identified in the planning study phase. From these general system concepts and characteristics various alternate system designs capable of meeting mission objectives may be studied, or a single system design may be developed to gain understanding of its capabilities. At this point specific technology and state-of-the-art advances necessary in the accomplishment of stated objectives should be isolated. This analysis should be developed in economic as well as technical terms and should be extended to include schedules, costs, and reliability requirements. The next step in the sequential planning process is the investigation of specific designs required to meet fairly definite sets of mission objectives. The goal of these studies is to establish feasibility and to examine the trade-off's between probability of

mission success and extent of mission capability. At this point, an approximation of the level of risk should be available to determine if the specific designs considered should be pursued further. If so, the preliminary design phase begins to establish the precise system configuration, subsystem requirements, specifications, and interfaces. This sequential procedure should be punctuated by deliberations on study results and design reviews, followed by decisions on the direction in which further design activity should proceed. At the end of this process a firm basis presumably exists upon which to proceed with formal solicitations for system and subsystem contracted efforts.

In practice, this idealized planning activity is affected by pressures to compress the sequential aspects and bypass some of the considerations of alternate systems and concepts. For example, long hardware lead times dictate that design choices be made earlier. Potential contractors attempt to second-guess specific mission objectives and required capabilities by engaging in company sponsored design and planning studies of their own. The results of these studies are made known to the sponsoring agency or Field Center through presentations or unsolicitated proposals and thus indirectly may provide an input into the planning process, creating the possibility of some advantage for particular contractors. However, the chance for competitive advantage is considerably diminished by the number of firms who engage in this kind of activity and utilize similar "marketing" techniques, thus partially neutralizing the efforts of any one company.

In order to understand better the particulars of company marketing strategy during the pre-solicitation phase a structured interview was designed, consisting of a number of interrelated questions bearing on company-initiated actions in anticipation of a procurement solicitation. This list

of questions appears as Appendix A.

Using this interview format, extended conferences were held with management, marketing, and engineering personnel of two aerospace firms which have conducted space system developments of sizeable magnitude. In responding to the interview questions both firms generally displayed similar attitudes and approaches to the activities conducted during the pre-solicitation phase. One significant feature that emerged from the interview question concerning the choice of company funded projects was the treatment of this decision in a capital investment context. Company funded research projects were considered in the same manner as additional facilities and equipment. Indeed, the need for special purpose facilities was evaluated as a supporting item to research efforts. The diminishing number of major weapons and space systems initiated, the concomitant intensity of competition, and the fewer number of funded "hunting license" research contracts contributed to an awareness that anticipatory research and development activities must be viewed in the capital investment sense. It was stated that company funds have to be spent much in advance of expected pay-off and must be justified on the basis of efficient utilization of, and maximum return on, capital expenditures. This awareness was manifested in the criteria for selection of the company funded (or Independent Research and Development) efforts. Generally, these criteria were as follows (no priority implied by the order):

1. Contributions to long range sales and income objectives.
2. Company capability to undertake research efforts in terms of existing skills and experience.
3. Perceived competitor activity in the same technical area.
4. The opportunity for "fall-out" to other projects or commercial products.

5. The probability that the project(s) to which company-sponsored work is applicable will be approved.

6. Technical feasibility and relationship to the state of technology.

The above criteria were weighted and formed a value system used by company management to decide which projects were to be undertaken and the level of effort to be applied to each. Two salient points to be noted in the above list are the perception of the activities of the competition and the role of risk, both in terms of technical feasibility and project initiation. As regards the competition, forecasts were made of the progress of competing firms in solving technical problems through company-funded efforts. Competitor breakthroughs were quickly factored into the evaluation scheme, and research tasks dropped if they had been pre-empted by competitors' activities. The value of new data to potential customers was constantly measured against cost, and the "stock" of a research project was determined, not by its intrinsic value, but by its relative value to a customer who is also being exposed to the research and study results of the competition.

The second point to be made in conjunction with the above enumerated list of criteria is the role of risk. The last two criteria on the list are expressions of economic risk. The first of these is the risk that the project will not be approved, thereby reducing the possibility of near-term payoff for the sponsored activity. The second is an expression of technical risk, or feasibility, given the present and forecasted state of technology. The interesting feature of these criteria is their interaction. A high technical risk also increases the probability that the project will not be approved, whereas a low technical risk may mean that the particular technical problem proposed for company sponsorship is already on the brink of being

solved. Thus, to the proposer a dilemma exists; he cannot propose a research project which has either too high or too low a technical risk, for either way it may not be approved. Likewise, the company would not be motivated to apprise a potential customer of the high risk estimated for successful solution of a particular problem, since this would increase the risk of project cancellation. This suggests that a customer should be in a position to study independently risk factors in future projects.

The aspect of uncertainty also entered into the risk calculations of companies. Sometimes a research project was approved, just to narrow the uncertainty and to determine what the risk really was.

A prime technique that was mentioned by the two companies interviewed as effective in apprising the potential customer of these company efforts was to utilize unsolicited proposals early in the planning process in order to offer specific company experience and results of company-sponsored studies and development. In terms of economic payoff the interviews indicated that unsolicited proposals result in a higher percentage of awards than that achieved through the formal RFP system. A further objective of unsolicited proposals, more subtle, was to give to the sponsoring agency or Center the image of a responsive and aggressive contractor who is able to undertake a complex project by virtue of the quality of the planning and analysis effort that the particular company has achieved under its own funds.

Summaries of the specific responses to questions asked in the aforementioned interviews are given in Appendix B.

V

THE PRE-SOLICITATION PHASE AND THE CONTRACTOR SELECTION PROCESS

The discussion so far has attempted to emphasize the importance of the pre-solicitation phase as to its impact on early project decisions and project planning. It is the purpose of this section to explore the question of the effects of the pre-solicitation phase on the specific choice of contractors.

Some recent research at Massachusetts Institute of Technology has yielded results which show a certain connection between contract awards and the preferences of the technical initiator for certain companies.[3] In studies carried out over a two-year period on Department of Defense R&D contract awards, contractors preferred by technical initiators, as indicated by the company order on Purchase Requisitions, won eventual contracts in 60 percent of the cases studied. Ten percent of the contract awards went to contractors not listed by technical initiators but added from small business lists or procurement source lists. The balance of the awards went to sources on alphabetized lists or sources so indicated by the technical initiator that it was not possible to determine his preferences. The surveys encompassed eighty-eight contract awards with amounts ranging from $100,000 to $8,000,000.

Another study, also carried out at MIT, involving smaller contracts[4] indicates that the contractors ranked technically highest in twenty-two

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[3] "How the U.S. Buys Research", article in International Science and Engineering magazine, E. B. Roberts.

[4] "Factors Influencing Technical Quality of R&D Proposals", Working Paper No. 68-65, MIT, T. S. Allen and D. G. Marquis.

proposal solicitations expended only an average amount of proposal effort, whereas the next highest ranked companies expended considerably higher effort during the proposal preparation period.

A third study relating to pre-proposal activity shows the increasing use by companies of unsolicitated proposals[5]. This has already been mentioned as a technique for presenting results of company sponsored efforts to prospective sponsoring agencies. The MIT results from this study were reinforced in one of the interviews conducted as a part of this investigation, wherein the company indicated that its acceptance rate of unsolicitated proposals was 30 percent, a figure higher than the percentage of contract awards vs. the number of formal company bids.

One conclusion that could be derived from these research study results is that some sort of preferential treatment is accorded some companies by elements within sponsoring agencies. Indeed, regulations in DOD and NASA aimed at reducing improper involvement prior to contract award have been initiated over the past two years. NASA has issued a Source Evaluation Board Manual designed to outline procedures and policies which ensure impartiality and objectivity in contractor selection of large contract awards[6]. DOD has been further evolving arrangements to increase impartiality in source selection procedures[7]. Another measure whose objective is to reduce the possibility of improper involvement is the anti-gratuity regulations employed by DOD and perhaps to be followed by NASA. All of these

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5/ "Comparative Analysis of R&D Marketing Strategy", L. B. Berger, Masters Thesis, MIT.

6/ NPC 402, NASA Source Evaluation Board Manual.

7/ "Source Selection in DOD", Aviation Week, October 5, 1964.

measures are aimed at increasing the competitive aspects of contract awards by minimizing the chance of competitive advantages being obtained by any one contractor over another. However, the emphasis is on actions of contractors and sponsoring agencies during the formal proposal solicitation period.

It is the contention of this report that implications of improper involvement are not supported by the research studies mentioned and, further, that the preferences of technical initiators and decision makers for certain companies are due, not only to satisfactory past experience, but also because of activities of these companies in the pre-solicitation phase of the procurement. As previously discussed, these early activities consist of presentation of company research and study results, unsolicited proposals, contracts for supporting services, and other measures aimed at conveying the image of a responsive, energetic company that understands the technical problems and complexities of the proposed procurement, and one who has done its homework in anticipating the requirements of the project. To the extent that a particular company has been successful in creating this impression there is a natural predisposition toward this potential contractor. This is particularly true in very advanced research and development projects, where project success depends on close cooperation between the contractor and sponsoring agency or Center. In these cases anticipated contractor responsiveness is weighted heavily during the evaluation process.

While the restrictions on gratuities and improper individual involvement, along with the new procedures on source selection and evaluation by both DOD and NASA, are necessary for a well-ordered procurement system, it

should be recognized that possibilities for real competitive advantage exist completely outside the scope of many of these regulations. The results of the studies mentioned, which are among the few that bear on this subject, seem to underscore the importance to contractor selection of activities in the pre-solicitation phase. The study result pertaining to effort expended during the proposal preparation is particularly illuminating, since it indicates that proposal effort is correlated with higher or lower technical rankings, except for the first-ranked company. The sample was a significant one, the correlations clean, and the explanation of the highest ranked firm only expending average proposal effort would seem to substantiate the contention that the selection was influenced by the pre-proposal effort of the first-ranked company. This conclusion is further reinforced by another result of the same study, namely, that the strongest element influencing technical ranking is the size of the technical staff of the company. The first ranked company, possessing a depth of manpower resources, apparently employed this staff strength, prior to formal proposal efforts, in a manner which anticipated the requirements of the formal solicitation. Companies not employing a large technical staff would experience difficulty in mounting a broad-based technical activity prior to the Request for Proposal.

VI

SUMMARY AND IMPLICATIONS

The discussion to this point has focused attention on the decision environment that exists during the pre-solicitation phase of R&D contracting, an atmosphere which creates possibilities of competitive advantage through company funded efforts aimed at influencing programmatic decisions, creating an image of responsiveness, and anticipating the requirements of the eventual Request for Proposal. This report has also attempted to relate the effects of this contractor activity during the pre-solicitation phase to contractor selection. Results of other research indicate a connection between technical initiator preferences and contract awards. These preferences are shaped by experience with the potential contractors, no doubt, but interviews with two electronics-based firms who are heavily engaged in R&D contracting revealed a methodical, aggressive policy toward shaping the preferences of sponsoring agencies. Furthermore, contract awards went to those companies who expended an average amount of effort during the formal proposal phase, and it is suggested that this result reveals considerable pre-solicitation activity in the part of the successful proposers.

If the contention is accepted that the most significant possibilities for competitive advantage exist during the pre-solicitation phase, then the appropriateness of measures designed to reduce the extent of potential advantages should be evaluated. The consequences of these measures may not be in the best interests of the Government. For example, there are efforts to regulate the contacts between agency and company personnel prior to the formal solicitation phase. Policies are presently in existence whose

objectives are to enjoin sponsoring agency personnel from discussing any aspect of pending solicitation effort unless such information is coincidentally made available to all potential contractors. Strict application of this policy to fairly immediate procurement actions is necessary. However, overzealous attempts to regulate and restrict communications with potential contractors can have detrimental effects, since planning for highly complex projects demands the widest possible range of considerations and investigation of factors which may contribute to project success. Also, contractors afford an important method of cross-fertilization of experience between sponsoring agencies and between projects. It would seem more prudent not to unduly restrict information exchange between potential contractors and sponsoring agency personnel; indeed, the wide-spread sharing of technical information is necessary to a climate of competition and is advantageous in the long run to technological advancement.

Also, one cannot restrict the right of companies to invest their own money in anticipatory studies regardless of the competitive advantage that this seems to present, since this is simply exercising traditional company prerogatives of indulging in present investment to create future production. In this regard, company investment in research is a capital decision much the same as the buying of machine tools or other capital equipment.

Another measure which has been considered is the structuring of the pre-solicitation phase to insure maximum competition during the solicitation phase of a procurement. The Department of Defense has codified the early phases of project initiation in very large weapon systems acquisitions through the use of the Program Definition Phase, and NASA has adopted a phased procurement approach for large contracts. During early phases of a

weapon or space system acquisitions parallel design study contracts are let, themselves a costly item. The emphasis is on consideration of various program alternatives to assess feasibility, risk levels, and cost effectiveness. Insofar as this forces measured deliberation on program objectives and design options, this development is necessary to construct a sound foundation for major weapons and space system acquisitions. The question may still be raised as to the effectiveness of the phased procurement approach in maximizing competition. There is evidence that this approach simply pushes the informal competition back prior to the definition phases and, therefore, does not materially change the competitive situation. An example of this circumstance is seen in the published practice of one large aerospace company of scheduling specific company funded advanced studies and unsolicited proposals as distinct milestones prior to the anticipated RFP date for the Program Definition Phase studies. Since the perception of what the competition is doing is so important to the initiation of advanced studies, it is not unreasonable to assume that the practice of this particular aerospace company is widespread.

The actions of the two companies examined in this study provide an important insight, namely, that competition does exist in an intense, but unregulated, form during the pre-solicitation phase. On the other hand, the possibilities for competitive advantage also are greater prior to formal initiation of the procurement by a Request for Proposal. To repeat an earlier proposition, overly restrictive measures to regulate this phase of the procurement process could be disadvantageous; for example, restriction of contractor-agency contacts and communications could reduce the wide range of considerations important in planning complex projects. It is

suggested that a better mode of operation during the pre-solicitation phase is for sponsoring agencies to concentrate on developing appropriate methods for planning, mission analysis, risk assessment, and cost-effectiveness. This implies that sponsoring agencies must organize an in-house capability for mission analysis and techno-economic studies and not rely on industry for inputs in these areas. However, the competitive energy of industry in the pre-solicitation phase can be put to use in advanced work on challenging technological problems, the solution of which would advance the state of technology and reduce uncertainty regarding technical feasibility. In effect, this suggestion seeks to clarify an appropriate and useful role for both potential contractors and sponsoring agencies during the pre-solicitation phase, rather than to regulate the actions of either or to restrict contacts between the two groups.

The scope of this investigation to date does not permit further specific recommendations. This report has, however, attempted to emphasize the importance of analyzing and further understanding the complicated interaction of companies and the government during the pre-solicitation phase. This understanding is necessary in pursuing the over-all objective stated in the Introduction, namely, to ascertain the effects of these early activities on the eventual outcome of R&D projects. A delineation of such effects could produce more effective and efficient approaches to initiation of R&D projects.

APPENDIX A

Interview Questions

1. How does your company decide what corporate projects will be undertaken (incl. Independent Research Programs)?
2. Explain the process of selection.
3. At what point do results of corporate activity become unsolicited proposals? How is the approach of the unsolicited proposal determined?
4. Given an objective or a mission (via a funded study contract or feasibility study), how does your company proceed to organize its efforts; what consideration is given to time, cost, performance tradeoffs?
5. How does your company decide the level of effort to apply to efforts (funded or not) which show the promise of future contracts?
6. Does your company attempt to quantify values that accrue to the company from alternate approaches? Does it attempt to generate a value system for a particular effort?
7. How does your company assess its own capabilities and capacity for undertaking a job?

APPENDIX B

Company A - A Division of a large, well-diversified electrical/electronic company which has been involved in major space and weapons systems developments for both DOD and NASA.

1. & 2. How does your company decide what corporate projects will be undertaken, including Independent Research Programs? Explain the process of selection.

Market forecasts are formulated in terms of "products" (manned space vehicles, lunar & planetary vehicles, etc.). Ten-year estimates are made of funds available from Government agencies for such efforts, and each "product" is assigned to an organizational element. For example, emerging products (such as nuclear propulsion) are assigned to an advanced systems engineering department, while satellite applications are assigned to a spacecraft development department. Specific proposals for projects to be undertaken as a part of the IR&D program are made by the various departments according to the relationship to product line, impact on future business, technical risk, and availability of resources. These proposals, in turn, are reviewed for allowability of costs and "business balance" by business management and for technological balance and requirements for specialized research skills by the technical director. The final review and approval is made by the general management of the company. The measure of technological balance is made by relating critical problems and/or technologies to potential "products" or projects. Those IR&D projects are selected and approved which treat the solution of critical technological problems ranging across the largest number of products. The definition of

a critical problem area is principally an unsolved technology problem, the solution of which would increase the chance of "getting the business".

Technical risk tends to be measured in two ways: in terms of anticipated performance margins vs. the state of technology and the applicability to ultimate business (the risk that the product or project will not be approved). Uncertainty sometimes prompts the decision to fund a high risk effort, just to determine what the risk really is. A low risk technological effort is one on which previous work has been done.

3. At what point do results of corporate activity become unsolicited proposals? How is the approach of the unsolicited proposal determined?

There is no set time for generation of unsolicited proposals; timing is determined by being sensitive to customer needs for information. Generally, unsolicited proposals are distilled from on-going company-funded research projects, are tied to long range requirements, lead formal RFP's by 8 to 12 months, and have a higher pay-off than response to RFP's (unsolicited proposals result in contracts 30% of the time).

4. How does your company organize its funded study efforts; what consideration is given to time, cost, performance tradeoffs?

Prior to receipt of funded study contracts, a small study team is assembled (perhaps as much as six months prior), placed in one physical area and answering to a project, or study, manager. Work is begun to schedule the anticipated study requirements, to define the expected problem areas, to initiate parallel technology tasks in critical areas, to establish the "market picture" and potential budget and funding availability. Also, customer contacts are extensively carried out; heavy emphasis

is given in this period to informal presentations.

When a study contract is awarded, the study team is already organized and experienced, there is an established relationship between company sponsored efforts and the agency-funded contract.

5. & 6. How does your company decide the level of effort to apply to efforts (government funded or not) which show promise of future contracts? Do you attempt to generate a value system for a particular effort?

Primarily a risk calculation. An assessment is made of the various opportunities that exist at regular points in time for future contracts. This assessment consists of a weighted evaluation of the factors of credibility (will the project be approved for execution through the acquisition phase), competitive chance (what is the competition doing), hardware timing (long-range or short-range prospect), estimated first hardware contract value, and degree of obligation to the customer. The application of this weighted evaluation represents a value system that the management can use to approve company funded projects or to make a bid-no bid decision on government funded study efforts. The application of this value system is conducted within the context of the company objectives concerning product line balance and specific goals as to sales and income, cost reduction targets, and control of overhead rates.

7. How does your company assess its own capabilities and capacity for undertaking a job?

The assessment of capability is conducted in four areas: technical competence, facilities and equipment, manpower availability, and corporate funding available. Panels are established in various technologies to

present management with reports on the state of technology in that area, the existing company capability, present activities, key events, critical problems, manpower availability. An important item in this assessment is the adequacy of capability vs. the competition both for the present and future.

Company B - A Division of a large, well-diversified electrical/ electronic company, which has been involved in major space and ground communications developments for both DOD and NASA.

1. & 2. How does your company decide what corporate projects will be undertaken, including Independent Research Programs? Explain the process of selection.

Formal independent research planning documents are generated by engineering groups in the fall of each year, reviewed by division and corporate management during the last quarter of the year, and initiated in January. The projects usually sponsored have as their objective the solution of system and subsystem problems. No "product" is expected to accrue, but rather the company technological base is increased. The criteria which affects the selection of company funded or IR&D programs are current and anticipated governmental need, feasibility, state-of-the-art, competence in the field, facilities, cost, manpower availability, and value of data to be obtained. Continuing reviews of existing efforts are based on data value vs. cost. Programs may be re-oriented due to the advent of new techniques or breakthroughs (both company and competitor). Review of research proposals allows management to gauge engineering group perception and understanding of company goals.

3. At what point do results of corporate activity become unsolicited proposals? How is the approach of the unsolicited proposal determined?

Unsolicited proposals arise from effort conducted under company sponsored and government sponsored programs. They are considered particularly

appropriate when hardware development is foreseen. The approach to unsolicited proposals is determined by understanding the customers' future plans and submitting possible solutions to problem areas.

Unsolicited proposals take on more importance because of decreasing "hunting license" study contracts.

4. How does your company organize its funded study efforts; what consideration is given to time, cost, performance tradeoffs?

A study program manager is assigned and staff support is provided from the various technology groups. The normal arrangement is a line-type organization within the engineering department. Technical (including reliability) considerations are paramount to time and cost in the study phases.

5. & 6. How does your company decide the level of effort to apply to efforts (government funded or not) which show promise of future contracts? Do you attempt to generate a value system for a particular effort?

The factors considered in determining the level of effort are: potential contract award value, company past experience in the particular area under study, probable competition, relationship to current and long-range plans, inherent risk to company and customer, potential for commercial spin-offs. No specific value system is constructed; rather the collective judgements of marketing, engineering, and manufacturing personnel are applied.

7. How does your company assess its own capabilities and capacity for undertaking a job?

The assessment of capability is made principally by review of the

requirements by marketing, engineering, and manufacturing departments. The criteria of capability is primarily past experience in the particular technical area; a review is made on each requirement as to the amount of study, research, design or production that has been previously carried out at the company. In addition, the following are considered: manpower availability, personnel training and knowledge exchange possibilities, facilities availability, special assembly techniques required (which may improve the company's competitive pc ition on other prcjects), and any unusual risks foreseen.