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DEFENSE SYSTEMS ¹ MANAGEMENT COLLEGE



PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

INDEPENDENT RESEARCH AND DEVELOPMENT:
THE TECHNICAL EVALUATION PROCESS

STUDY PROJECT REPORT
PMC 77-2

Earl H. Talley, LtCol, USA
and
John T. Viola, LtCol, USAF

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE: INDEPENDENT RESEARCH AND DEVELOPMENT (IR&D): THE TECHNICAL EVALUATION PROCESS

STUDY PROJECT GOALS:

To become familiar with the mechanisms of the IR&D technical evaluation process as it is intended to work; to determine how the process actually works in practice; and to identify areas of improvement.

STUDY REPORT ABSTRACT:

The purpose of this report is to present the results of an analysis and evaluation of the IR&D technical evaluation process. DOD and military department documents and regulations were examined to determine implementation procedures. Interviews with government and industry IR&D managers are summarized and evaluated in the report. The value of IR&D is presented along with discussion of documentation from public law, ASPR and DOD policy guidance which stipulates requirements for conducting IR&D evaluations. Conclusions and recommendations are presented based upon an analysis of the information gained from documentation and interviews.

SUBJECT DESCRIPTORS:

Program/Project Management (10.02), Major Policies (10.02.01)
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Independent Research and Development

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Earl H. Talley, LtCol, USA John T. Viola, LtCol, USAF	PMC 77-2	November 1977

INDEPENDENT RESEARCH AND DEVELOPMENT:
THE TECHNICAL EVALUATION PROCESS

Individual Study Program
Study Project Report
Prepared as a Formal Report

Defense Systems Management College
Program Management Course
Class 77-2

by

Earl H. Talley
LtCol USA

and

John T. Viola
LtCol USAF

November 1977

Study Project Advisor
Mr. David D. Acker

This study project report represents the views, conclusions and recommendations of the authors and does not necessarily reflect the official opinion of the Defense Systems Management College or the Department of Defense.

EXECUTIVE SUMMARY

The purposes of this project were to examine the Independent Research and Development (IR&D) technical evaluation process as it is presently managed by the Office of the Secretary of Defense (OSD) and the three military departments; to evaluate the effectiveness of the process; and to make recommendations for improvement. The Department of Defense is compelled by public law to evaluate IR&D in order to establish potential military relevancy and to negotiate advance agreements with selected companies to establish a dollar ceiling on IR&D costs. Evaluations are conducted annually on a company's IR&D technical plan and by means of on-site reviews every three years.

Information on the IR&D technical evaluation process was obtained from DOD documentation and from interviews conducted with government and industry IR&D managers. The authors determined that the Air Force possesses the most highly organized evaluation process with dedicated personnel assigned the sole function of managing the IR&D program. The Army and Navy assign IR&D evaluators as focal points on an additional duty basis, resulting in less emphasis on the evaluation process.

Our findings indicate that the DOD is striving to improve the techniques and methodology of the evaluation process. Areas the authors identified for improvement are: identification of qualified government personnel to participate in the process and the creation of a separate fund citation to finance the cost of conducting the evaluations; assurance of continuity in the evaluation process by requiring the evaluation of the technical plan and the on-site review by the same individual and over an extended period of time; creation of a guide to assist evaluators in conducting a more effective evaluation; and the creation of a document

that explains IR&D and its benefits to the government in terms of its role in the systems acquisition process.

Industry places great emphasis on IR&D because of its role in improving a firm's competitive standing. Companies value direct communication and interaction between their own managers, scientists and engineers and their government counterparts. There is no industry consensus on required improvements; however, most companies believe that the on-site review is more beneficial to the government and industry than the evaluation of the IR&D technical plans.

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SECTION I

INTRODUCTION

Value of Independent Research and Development

The continuing close relationship between U. S. defense and industrial R&D communities has been a major contributor to the technological leadership on which our national security and economic vitality have depended since World War II. The Department of Defense (DOD) actively supports and draws on the wide base of advanced technology and efficient production processes of the private sector for the superior military hardware essential to meet national security requirements. DOD is continually seeking methods of improving the ties among the components of our national R&D community and to strengthen the competitive forces on which the U.S. depends for innovative, efficient, and high-quality military systems (1:267)¹. Independent Research and Development (IR&D) has been recognized as an important component of this process.

IR&D is company-initiated research and development undertaken to improve a firm's competitive standing by virtue of improvements in products, creation of new products or advancement of the company's technological capability in general. To take advantage of these developments DOD sponsors IR&D by permitting a closely controlled amount of the relevant R&D activities undertaken by defense contractors to be recovered as an allowable business expense on their government contracts. This allowance is small, typically one-to-three percent of the contract value, but the payoffs are viewed by the DOD as substantial.

¹This notation will be used throughout the report for sources of quotations and major references. The first number is the source listed in the bibliography. The second number is the page in the reference.

Support of IR&D enhances the essential element of competition in the development and procurement processes by encouraging contractors to develop their ideas and capabilities across the board. Improved contractor competence can mean more technology gained per dollar expended and can reduce technical risk. In addition, a contractor, anticipating defense requirements, may develop much of the pertinent technology prior to formal DOD commitment to a program, thus shortening development time.

The magnitude of the IR&D program is reflected in the following for contractor fiscal year 1976. Industry incurred \$1.232 billion in costs for IR&D; \$1.061 billion was accepted by the Government; and \$0.543 billion was recoverable by industry as overhead in DOD contracts (2). Thus, roughly 40 percent of IR&D costs were recoverable from DOD contract overhead.

Despite the advantages to the Government, there has been considerable controversy relative to support for IR&D. Criticism was expressed by some in the recent past; however, this criticism has somewhat abated. Perhaps, this is because of strong support for IR&D expressed by Dr. Malcolm Currie, former Director of Research and Engineering.

"IR&D is absolutely central to the quality of defense RDT&E and weapons acquisition and I believe that its 'independence' must be maintained. It is the heart of a competitive and competent industrial base: it results in lowering the cost of acquisition and it is a uniquely efficient source for new technology...It is well managed, and excellent visibility is provided to the Congress. It pays for itself many times over. I feel that further controls such as separate line item budget approval in advance by Congress would destroy its independent and innovative character and be a serious loss." (3:1-13).

Congressional leaders have also expressed support. For example, Senator McIntyre in reviewing the "1976 DOD Annual Report to the Congress on IR&D Costs" stated:

"I am convinced that the investment we make in independent research and development is not only prudent but essential. It is one part of the total investment to preserve our technological leadership and is one that has paid rich dividends."

In July 1977, Senator McIntyre further stated:

"Mr. President, the costs for IR&D are high but I believe that the present system strikes a good balance between controlling these costs and giving our defense industry sufficient flexibility to maintain a strong technological base. The purpose of IR&D funds is to make sure there are qualified bidders to propose on DOD programs. It is the price we pay to make sure we have companies that are on the forefront of technology and prepared to bid on new projects.

There have been concerns expressed in the past that the Congress does not have adequate control of IR&D funds. I do not share this view.

It is clear that the process now used by DOD to control the amount spent for IR&D is not allowing wild increases, in fact, there is probably a decline in real value. If Congress were to become more involved in allocating these funds, it would mean that Congress would soon have to deal with choices as to which company should be proficient in which technology. Clearly, those decisions must be left to the individual companies. In my judgment the present system strikes a good balance between control and flexibility."

Purpose and Approach

The purpose of this study project is to develop an understanding of the IR&D technical evaluation process in order to evaluate the effectiveness of the process and to recommend improvement where necessary. Our approach was to examine pertinent literature on the subject, including appropriate DOD policy and procedural documents, and to collect information by means of structured interviews with IR&D managers from OSD, military departments, NASA and industry.

SECTION II

REQUIREMENTS, POLICIES AND IMPLEMENTATION

Requirements for IR&D Evaluations

The requirements for technical evaluations of company IR&D are specified by Section 203, Public Law 91-441, Appendix C which states that "funds authorized for appropriation to the Department of Defense...shall not be available after December 31, 1970, for payment of independent research and development or bid and proposal costs unless the work for which payment is made has, in the opinion of the Secretary of Defense, a potential relationship to a military function or operation..." (5)

The law further stipulates that the Secretary of Defense, prior to or during each fiscal year, must negotiate advance agreements establishing a dollar ceiling on such costs with all companies which during their last preceding fiscal year received more than \$2 million of IR&D or B&P payments from the DOD. The IR&D portions of the advance agreements thus negotiated must be based on company submitted plans on each of which a technical evaluation is performed by the DOD prior to or during the fiscal year covered by such advanced agreements.

The DOD has undertaken to comply with these requirements in an efficient and effective manner.

Department of Defense Policy

Department of Defense policies regarding IR&D and provisions for complying with Section 203 of PL 91-441 are set forth in DODI 5100.66, dated January 7, 1975 (6). It defines the IR&D Policy Council as an organization composed of Assistant Secretaries of Defense and Assistant Secretaries

of the military departments and chaired by the Director of Defense Research and Engineering (DDR&E). This Council is charged with developing and disseminating DOD policy and guidance essential to the administration of the DOD IR&D program. It stipulates that relevancy determination is part of the evaluation process and identifies one of the military departments as a Lead Department in each evaluation. The department is then responsible for arranging and conducting on-site reviews and for coordinating and summarizing technical evaluations of project descriptions in a contractor's IR&D technical plan.

This Instruction expresses the principle that DOD recognizes IR&D as a necessary cost of doing business and seeks to encourage the creation of an environment which enhances development of innovative concepts for defense systems and equipment. It strives to develop technical competence in two or more contractors who can respond competitively to requirements sought by DOD from industry. It states that the basic purpose of the IR&D technical evaluation is to assist in the determination of the potential military relationship and to assist in the evaluation of the reasonableness and technical quality of the contractor IR&D program.

This Instruction established the computer-based IR&D data bank at the Defense Documentation Center to aid in the coordination of the DOD contract R&D and in-house R&D programs with the IR&D programs. It was designed to be a centralized body of information which is useful in identifying IR&D projects.

Tri-Service participation in technical plan evaluation, on-site review and advance agreement prenegotiation is strongly encouraged to foster technical interchange and uniform treatment of contractors by DOD Components.

As stated in the Instruction, the important objectives of the on-site

review are to permit face-to-face technical dialogue between government and industry peers and to confirm the technical plan evaluation rating.

The DOD policy assigns the Secretaries of the military departments the responsibility of evaluating the project descriptions and conducting the on-site review of projects at each company at least once every three years.

The IR&D Technical Evaluation Group is composed of the three military department IR&D managers and a chairman appointed by the DDR&E. The Technical Evaluation Group is responsible for establishing methodology, criteria, and procedures for performing the technical evaluation of company IR&D projects.

Each Departmental IR&D Manager designates the organizations within his military department that are responsible for IR&D evaluation. He ensures effective evaluation of IR&D project descriptions; arranges for, and participates in, on-site reviews; and maintains an up-to-date distribution list for IR&D Technical Plans (also known as brochures).

Armed Services Procurement Regulation

Paragraph 15-205.35, Section XV of ASPR establishes cost principles and procedures regarding IR&D negotiations. It states that "a contractor's IR&D effort is that technical effort which is not sponsored by, or required in performance of, a contract or grant and which consists of projects falling within the following three areas: (i) basic and applied research, (ii) development, and (iii) systems and other concept formulation studies. IR&D effort shall not include technical effort expended in the development and preparation of technical data specifically to support the submission of a bid and proposal." (7)

The ASPR provides that any company that received payments as prime or sub-contractor, in excess of \$2 million from the DOD for IR&D and B&P in a fiscal year, is required to negotiate an advance agreement with the government which establishes a ceiling for allowability of IR&D costs for the following fiscal year.

It states that in negotiating a ceiling particular attention must be paid to such factors as the technical evaluation, including the potential relationships of IR&D projects to a military function or operation, and comparison with the previous years' program including the level of the government's participation.

It is important to note that DOD does not make cash payments to the contractor for allowable IR&D costs. These costs must be recovered as overhead which is included as part of the price of products sold to DOD in the year following the negotiation of an agreement. If a contractor does no defense work during that year, the DOD incurs no cost. The costs related to products and services that are sold to the government are recoverable up to the dollar ceiling previously negotiated.

Common Areas of Implementation

DODI 5100.66 seeks to involve Tri-Service participation in the evaluation of a company's IR&D program. Therefore, common areas exist for the implementation of DOD policies on the technical evaluations. These common areas include criteria for the nature and types of tasks, requirements for the negotiations of funding limits, establishment of IR&D relevancy in areas in which DOD needs competition, review of the IR&D tasks as planned and then review when complete, and acceptance or rejection of IR&D costs based on adherence to its criteria.

ASPR requires companies to submit their IR&D Technical Plans for evaluation by service and NASA representatives. On-site reviews are commonly attended by these representatives and technical evaluations are scored on the DD Form 1855, "Independent Research and Development Project Technical Evaluation". Evaluation results on specific projects are tabulated on DD Form 1856, "IR&D Project Technical Evaluation Summary". These completed forms, together with written summaries, are used in the negotiation process.

Army Implementation

Responsibilities and procedures for the technical evaluation of IR&D programs of DOD contractors by the Army are contained in Army Materiel Command Regulation 70-40.

The Assistant Deputy for Science and Technology, Headquarters DARCOM, is responsible for carrying out the Army's mission in the DOD IR&D program. His agent in this activity is the Departmental IR&D Manager, the Army's representative on the IR&D Technical Evaluation Group. The commander of each subordinate command and the director of each laboratory are responsible for evaluating the Technical IR&D Plans, designating IR&D points of contact within their organizations and providing personnel to conduct on-site reviews (8).

Navy Implementation

Secretary of Navy Instruction 3900.40 assigns responsibilities and outlines procedures for the conduct of IR&D project description evaluations and on-site reviews of IR&D programs within the Navy (9). This SLCNAV Instruction is implemented by Office of Naval Research (ONR) Instruction 3900.32 and Naval Materiel Command Instruction 3900.11A (10 and 11).

The Chief of Naval Research is designated as the Navy IR&D Program Manager. He is responsible for the overall conduct of IR&D project description evaluations and on-site reviews of the IR&D programs.

As outlined in the above ONR implementing instruction, the Director of Research, ONR, is designated as the Navy member of the DOD IR&D Technical Evaluation Group. His special assistant serves as alternate member of the group and as the overall Navy focal point for coordination of all IR&D actions, to include technical plans and on-site reviews.

Each of the ONR Branch Offices serves as Lead Navy Activity for designated companies and conducts technical evaluations of their IR&D project descriptions and on-site reviews.

Air Force Implementation

As indicated in AF Regulation 80-53, the basic policy of the Air Force is that it supports and encourages the concept of contractor IR&D as a vital and necessary means of stimulating scientific, technological, and development efforts on the part of DOD contractors. Contractors' efforts should remain independent of Air Force control except for a technical evaluation of their quality and their potential relationship to a military function or operation. The results of technical evaluations are used in the determination of negotiation objectives for IR&D advance agreements (12).

In addition to basic guidance by DODI 5100.66, the Air Force has issued a number of regulations and operating instructions that are designed to aid in the IR&D technical evaluation process. AFR 80-17, "Air Force IR&D Policy Council", specifies the purpose and composition of the Policy Council. Members include ASAF/RD&L, Chairman, and representatives from AFSC and the Air Staff. The Executive Secretary is appointed by the chairman.

The Air Force IR&D Technical Program Manager and the Air Force Tri-Service Negotiation Chairman are advisors to the Council. The Council is the Air Force focal point for establishing overall IR&D policy, and serving as the interface with the DOD IR&D Policy Council (13).

AFR 80-53, "Technical Evaluation of IR&D", states policy, assigns responsibilities, and describes procedures for making technical evaluations and reviews of contractor IR&D programs. It designates DCS/ Research and Development, HQ USAF, as the office of primary responsibility for IR&D technical matters. The Commander, AFSC, is responsible for the administration and management of the IR&D program and for implementation of policy guidance and for the designation of the Air Force IR&D Technical Manager. The Technical Manager is responsible for evaluating written descriptions of IR&D projects, for conducting on-site technical reviews of projects and company IR&D programs and for preparing written evaluation reports of these reviews. When the Air Force is the lead department, the Technical Manager must verify that the overall evaluation has covered at least 90 percent of the dollar value of each company's IR&D program to ensure that the evaluation is valid.

The Technical Manager represents the Air Force on the DOD IR&D Technical Evaluation Group. Among other responsibilities, he designates the AFSC lead organization for each company division for which the Air Force is lead department and monitors, reviews, evaluates, and guides the Air Force technical evaluation of contractors IR&D programs.

AFSC Supplement 1 to AFR 80-53 provides further guidance and instruction on conducting the evaluations. It specifically states that each AFSC Commander is to actively support the IR&D technical evaluation process and ensure that technical evaluations that fall within his command are accomplished

by highly qualified personnel and with dispatch. It provides that the HQ AFSC Director of Science and Technology will designate a focal point for IR&D matters and ensure that projects are evaluated by well-qualified personnel. The focal points' organization will serve as lead for a particular company evaluation and discharge assigned duties. The AFSC supplement further specifies that at least 30 percent of the contractor's IR&D program should be reviewed at the on-site review and indicates certain standards regarding evaluator qualifications and coverage by different organizations and departments to ensure a broad based evaluation (14).

The Air Force Tri-Service Negotiation Group in DCS Procurement and Manufacturing of HQ AFSC is responsible for negotiating advance agreements in accordance with PL 91-441 and ASPR Section 15, Part 2 for companies under Air Force cognizance. It uses the technical ratings and determinations of Potential Military Relevance (PMR) prepared by the Air Force Technical Manager to establish the IR&D ceilings. Past experience has shown that over 90 percent of the IR&D and B&P projects have PMR. (15)

In 1977, the total proposed IR&D program for companies under Air Force cognizance is \$983 million. Air Force Tri-Service negotiated a total IR&D ceiling of \$747 million with 39 companies. This included 55 agreements and 120 separate ceilings. The DOD allocatable share is \$314 million. The remaining ceiling of \$433 million is allocated to commercial and other government contracts.

NASA IR&D Implementation and Participation

NASA and DOD share common objectives in investigations of many areas of technology, therefore, it has been and continues to be the practice of NASA to participate in the technical evaluation and negotiation of IR&D

programs of companies with whom NASA has a substantial business and technological interest. It is NASA policy to evaluate selected contractor IR&D Technical Plans and provide the results to the cognizant DOD organization and to provide adequate support to the DOD in conducting on-site reviews. NASA representatives are identified to serve on the IR&D Policy Council and on the DOD IR&D Technical Evaluation Group.

The directors of NASA field installations are tasked to designate a focal point for IR&D technical evaluations, to participate in on-site reviews, to interact directly with contractor IR&D managers, to conduct program assessments and to identify NASA technology needs to industry. Significant policy guidance is indicated in the NASA Management Instruction regarding IR&D (16).

NASA participation in IR&D has increased in recent years despite the fact that they are not required to do so by Public Law. For example, in 1975 NASA allowed \$40 million of IR&D in advance agreements signed by DOD negotiators.

SECTION III

DISCUSSION AND ANALYSIS OF INTERVIEWS WITH IR&D MANAGERS

General Comments

Research activities that were conducted for the collection of data and information involved, primarily, interviews with DOD, NASA and industry officials directly involved with the conduct and evaluation of IR&D. The authors attempted to interview each of the officials personally; however, in one case a telephonic discussion was necessary. Each of the interviews involved the questions identified below. Attempts were made to speak with individuals who have had a continuing involvement with IR&D over the years so as to gain an understanding of the evaluation of DOD-Industry interactions in this area. A list of persons interviewed is found in Appendix A.

Basic Questions for Interviews

In order to structure the interviews the following questions served to initiate discussion and to highlight areas of primary interest:

1. How is the IR&D technical evaluation process supposed to work?
2. How does it actually work?
3. Is this method satisfactory? If not, what are some considerations that might improve the process?
4. Can you suggest other references or sources of information?

In actual fact, many other questions were addressed; therefore, the report of the information gathered during the interviews is, in some cases, not structured according to the format of these questions. The authors have attempted to present in each case, the information in terms of how the interviewee perceives the IR&D technical evaluation process.

Specific Information Obtained From Interviews

Office of the Secretary of Defense

With the exception of policy statements provided to Congress by ODDR&E, there has been little recent direct involvement at the OSD level in IR&D policy matters. For example, the last meeting of the IR&D Policy Council occurred in August 1975 in order to address specific comments on IR&D published in a GAO report. During the interim OSD has continued to manage by exception.

It was felt that OSD leaders appointed by the new administration would continue the same policies on IR&D that were expressed by Dr. Currie and Dr. Foster. The IR&D Policy Council and/or Technical Evaluation Group should meet shortly after the current OSD reorganization is completed and reveal new faces and policies, if any.

It was indicated that although the Department of Energy (DOE) does not yet participate in the technical evaluations, they may soon begin to do so if relevancy issues are resolved. Several companies have described in their technical plans technology areas that appear to be quite relevant to DOE interests.

The OSD official pointed out that companies maintain and develop competence in DOD relevant areas with the aid of IR&D. This fosters the growth of competition which is a necessary part of cost-effective procurement. One could assume that IR&D quality and relevancy would be commensurate with DOD needs because companies will naturally seek to improve their competitive position vis-a-vis potential DOD contract awards. Nevertheless, technical evaluation and determination of potential military relevancy of IR&D is required by Public Law.

The Chairman of the Technical Evaluation Group believes that an important feature of the technical evaluation is the opportunity it provides to the industry IR&D team to review their activities and to prepare descriptive technical plans which are made available to DOD scientists. An important benefit of this is seen to be the fostering of technical interchange, a process which may not occur in the absence of the IR&D technical evaluations. The principal problem with the process is the uncertainty of whether or not the correct DOD member is participating in the evaluation and involved in the technical interchange. OSD has attempted to derive a scheme whereby the IR&D Data Bank at DDC can be used in conjunction with DD Form 1498's for DOD R&D activity to matchup common R&D tasks.

All IR&D task descriptive information is stored in the data bank by submission of the Form 271 which is contained on the front of each Task Plan when submitted by the company. Use of COSATI codes or key words has not successfully and unambiguously provided the matchup because the codes are too general and key words are too numerous.

The identification of the correct DOD scientist would facilitate more effective technical evaluation and interchange. OSD is continuing to work this problem.

IR&D requires additional explanation especially to the acquisition command member such as program managers because some in the past have been reluctant to pay for this as overhead in their programs.

Stimulus of laboratory personnel is also recommended in order to involve key personnel in technical interchange.

Army

How is the IR&D Technical Evaluation Process Supposed to Work?

All personnel interviewed in the Army were thoroughly familiar with the technical evaluation process as contained in appropriate DOD instructions and Army regulations.

Annually the Army as lead service evaluates approximately 21 technical plans and conducts approximately seven on-site reviews.

How Does the Process Actually Work?

The regulation mentioned in Section II above fully implements the policies contained in DOD Instruction 5100.66. Primary responsibility for IR&D has been delegated to the Commanding General, DARCOM. Representatives in the Secretary of the Army's office and on the Department of the Army staff serve as focal points at their respective levels, monitor IR&D actions, and keep the Secretary of the Army and Chief of Staff informed as necessary.

The key figure in the IR&D process is the Army Departmental IR&D Manager. In addition to assisting the Assistant Deputy for Science and Technology in carrying out the Army's mission in the DOD IR&D program, he is responsible for:

- Representing the Army on the IR&D Technical Evaluation Group.
- Designating appropriate subordinate commands to conduct technical evaluations of the IR&D Technical Plans that are submitted to the Army.
- Coordinating and participating in on-site reviews.
- Assuring the maintenance of an up-to-date distribution list for IR&D Technical Plans.
- Coordinating Army evaluation of appropriate IR&D that is sponsored by other services.
- Furnishing the procurement office with copies of the evaluations for companies conducting Army-sponsored IR&D.

In addition to providing necessary support to the IR&D Departmental Manager, each DARCOM subordinate commander designates an individual as point-of-contact for his organization.

Interviews with industry officials reveal that the Army's system of conducting on-site reviews and particularly providing respective companies with "feedback" after technical evaluations is more than adequate.

Is This Method Satisfactory? If Not, What Are Some Considerations That Might Improve the Process?

The personnel interviewed feel that the IR&D technical evaluation process is an important and necessary function. It provides a useful interface between technical personnel in industry and in the Services. However, the effective implementation of the program is hampered by budget and personnel constraints. Sufficient funds are not always available for the proper number of qualified personnel to participate in on-site reviews. Current personnel manning levels determine the amount of effort that a given office can devote to this subject. The Army does not have personnel at any level who are solely dedicated to IR&D. As an example, the IR&D Departmental Manager is the Chief of the Industry Liaison Office in Headquarters, DARCOM. IR&D is just one of his many responsibilities.

Similar to any other process, command backing is a necessary ingredient. With proper backing and adequate personnel and administrative funds to support the process, the IR&D technical evaluation process would become a cost-effective means of managing the availability of future technology.

Navy

How is the IR&D Technical Evaluation Process Supposed to Work?

Responsible individuals at each level of command are familiar with the

process as described in appropriate DOD and Navy instructions.

Annually the Navy, as lead service, evaluates approximately 80 technical plans and conducts approximately 30 on-site reviews.

How Does the Process Actually Work?

The policies described in DOD Instruction 5100.66 are implemented by the following Naval instructions:

- SECNAV Instruction 3900.40
- Office of Naval Research Instruction 3900.32
- Naval Materiel Command Instruction 3900.11A

SECNAV Instruction 3900.40 designates the Assistant Secretary of the Navy (R&D) and the Assistant Secretary of the Navy (I&L) as Navy representatives on the IR&D Policy Council. In addition, the Chief of Naval Research is designated as the Navy IR&D Program Manager with responsibility for the overall conduct of IR&D project description evaluations and on-site reviews of the IR&D programs.

Office of Naval Research (ONR) Instruction 3900.32 designates the Director of Research as the Departmental IR&D Manager, and therefore the Navy's member on the DOD IR&D Technical Evaluation Group. His special assistant for IR&D serves as alternate member of the Evaluation Group and as the overall Navy focal point for coordination of all IR&D actions. The instruction also assigns the following responsibilities to ONR Branch Offices located in the United States:

- Serve as lead Navy activity for designated companies and conduct the technical evaluation of their IR&D project descriptions and on-site reviews.
- Request necessary technical assistance from other Navy activities for each IR&D evaluation and/or on-site review.

The Navy Materiel Command's (NMC) participation in IR&D, as outlined in Instruction 3900.11A, is to:

- Require active participation by NMC activities in the technical evaluations and on-site reviews of IR&D programs.
- Establish the NMC IR&D Technical Manager.
- Describe the responsibilities of NMC activities relative to the IR&D program.

Is This Method Satisfactory? If Not, What Are Some Considerations That Might Improve the Process?

The procedures contained in the above Naval instructions are highly satisfactory; and, from all indications those procedures are being complied with at all levels of command. There is unanimous agreement that IR&D, and hence, the technical evaluation process is highly worthwhile; however, there is difficulty in monitoring the process. Like the Army, the Navy is hampered by budget and personnel constraints. On-site reviews are costly in terms of per diem and travel funds. One attempt at overcoming the shortage of funds available is the policy of assigning ONR Branch Offices responsibility for respective companies on a geographical basis. This method does not always provide for the proper break-out of qualified personnel for each on-site review.

Additionally, the Navy suffers from the lack of personnel dedicated to IR&D at the various levels of command. Specific personnel are identified as focal points and address IR&D as an additional duty, or on an as-necessary basis.

Air Force

How is the IR&D Technical Evaluation Process Supposed to Work?

All individuals interviewed in the Air Force had an adequate understanding of the technical evaluation process as it is described in detail by Air Force Regulations and documents. Under the direction of the Director of Science and Technology at Headquarters AFSC effective IR&D evaluation procedures have been identified and implemented. The DOD Instruction and Air Force Regulations are followed quite closely by Air Force Managers in conducting the evaluation of the Technical Plan and in on-site reviews.

In 1976, 91 technical plan evaluations and 37 on-site reviews were conducted by the Air Force as lead service. In addition, the Air Force Technical Manager was also responsible for the validation of 24 technical plan evaluations and 10 on-site reviews done by the Army and Navy as lead service for Air Force negotiated companies (17).

How Does the Process Actually Work?

The Air Force follows stated guidelines very closely in conducting the evaluations. Specifically, the Technical Manager chairs a meeting in November with focal points from Air Force Systems Command organizations that are participating in the evaluation. The focal points represent all ten Air Force Laboratories plus the four Product Divisions and two Centers. The purpose of this meeting is to select the lead organization who is responsible for organizing the evaluation of a particular company. By mid-January the on-site review schedule is established. The on-site review for a particular company now takes place once every three years; thus, a large portion of the efforts of the lead laboratory focal point is involved with the annual review of each company's technical plan.

The lead laboratory focal point is responsible for the evaluation of the assigned company. He must interact with other support laboratory focal points to identify Air Force and other government personnel who are

qualified and have an interest in participating in the evaluation. The lead focal point collects the results of the evaluation, which are indicated on the DD Form 1855, and prepares the DD Form 1856 on the results of the evaluation. These documents are forwarded to the Air Force Technical Manager within 30 days after the on-site review, and within 120 days after receipt of the Technical Plan. The technical evaluations are an important factor in the negotiations of the IR&D ceilings between the government and the company. Changes, up or down, in the rating of the company from one year to the next impact the negotiated ceiling according to a formula used by the Directorate of Contract Management at HQS AFSC (18). Thus, the current company effort in IR&D is compared to the company's effort during the previous year, and not with the effort of other companies, in determining the ceiling.

An important benefit of the evaluation summary report is the feedback to the company of its strong and weak points in a timely fashion. Detailed results of the evaluation are given to the company by the Air Force Technical Manager with names of organizations and individuals deleted. Necessary adjustments in the IR&D project can be accomplished after receipt of this information.

In addition to this feedback by the Technical Manager, there is also a de-brief of the company's on-site IR&D presentation that takes place before the technical evaluation team departs. The lead service focal point appoints from among the evaluation team members an individual to serve as team leader for the specific scientific area being presented at the on-site. The team leader focuses in on specific highlights and problem areas and presents these to the company representatives near the end of the review. This is looked upon by the company as valuable information to improve their program.

Many of the Air Force managers indicated some concern regarding the use of government personnel in conducting the evaluation. Their concern was in the qualifications of the evaluator and whether or not the correct individuals are involved. Evaluators with sufficient knowledge of the IR&D project are able to provide higher quality evaluations. Qualified evaluators understand the details of the project and are able to provide more critical evaluations and can provide valuable feedback to the IR&D project leader.

Another factor here is the idea that the individual evaluator judges his own qualifications and indicates this in block 7 of the DD Form 1855. Numbers are assigned to each qualification level. The Air Force regulations require a certain minimum number for the sum of the numerical qualification factors for each project under evaluation. It has been suggested that the evaluator's supervisor verify the qualification level indicated to provide more objectivity in this area.

The degree of participation in the technical evaluation process varies among Air Force organizations and depends strongly upon the attitudes of the organization commander. His active encouragement and support enhances the probability of a successful technical evaluation.

It was indicated that some companies identify for the Technical Manager or focal point individuals in government laboratories who the company feels can provide an effective evaluation. One Air Force Manager indicated that this process should be done routinely. It would seem to be a good idea to establish continuity in the evaluation if the same qualified individuals evaluated the annual tech plan each year and also participated in the on-site review.

The on-site review covers only a portion of the total IR&D effort of

the company. As stated previously, only 30 percent of the total must be reviewed. Only pre-selected projects are presented formally at the on-site review. Therefore, in order to obtain an idea of the scope of the IR&D effort, the on-site evaluator should read and evaluate beforehand all of the projects in the technical plan that deal with the scientific area under consideration.

The on-site review is considered by most managers to be more valuable than the readings of the tech plan in obtaining information and providing judgments concerning the quality of the IR&D project.

In addition to the problems of identifying the qualified evaluators and gaining their interest and support, there is also the factor of travel funds required to attend the on-site review. As far as is known, no separate fund citation is available for use in IR&D travel. Travel for IR&D on-site reviews competes with other travel requirements for funds. This is perceived by many as a definite problem in terms of obtaining sufficient numbers of qualified individuals to attend the on-site review.

The time factor also plays a role in the quality of the technical evaluation. Many highly qualified scientists and engineers feel a lack of sufficient time, in light of other pressing duties, to participate in the technical evaluation. Again, the attitude of the organization commander is key here. If he places strong emphasis on the need for effective IR&D evaluations, then members of his organizations will assign a high priority to IR&D technical evaluation participation. However, as one manager indicated, the involvement by scientists must be strictly voluntary; they must want to participate in order to be effective.

Is This Method Satisfactory? If Not, What are Some Considerations That Might Improve the Process?

The methods and procedures that the Air Force uses to establish quality level and potential military relevancy of IR&D projects is by no means perfect. However, the technical evaluation process is considered by all Air Force managers interviewed to be effective in discharging the requirements of Section 203, Public Law 91-441. As stated previously, the Air Force has established effective guidelines through the issuance of general policy statements on the conduct and support of technical evaluations and in assigning responsibilities and describing procedures for making a technical evaluation and review of a contractor IR&D program. Presently, the evaluation process functions effectively, yet, it is a dynamic process. Air Force managers are continually striving to improve the process.

The Air Force Audit Agency has conducted a recent audit of the technical evaluations. This audit was conducted in order to compare actual procedures with standards of conduct specified in Air Force Regulations. This evaluation has uncovered certain discrepancies in complying with these standards. Most of the discrepancies are administrative in nature and can probably be corrected by establishing tighter control of these factors.

There is the need for ensuring maximum project evaluation continuity where emphasis should be placed on consistency in the year-to-year evaluations by providing the same evaluators for the technical plan and for the on-site review. The organization commander would play a strong role in providing for this continuity by ensuring that qualified laboratory scientific personnel are made available, as required, to participate in the evaluation process. In addition, the proper balance and relationship between related contractual R&D, DOD in-house R&D, and IR&D would be established in the mind of the laboratory scientist. This should improve utilization of the IR&D scientific information by the government and provide additional benefits to the

Government beyond the primary benefits of IR&D.

Another suggestion to improve the utilization of company IR&D was to ensure that the on-site review Lead Organization Summary Report is provided to the AFPRO. Since the AFPRO carries out the interfacing function between the company and the Air Force Product Division where systems acquisition program management is conducted, IR&D results can flow to the Program Management Office in a timely manner. AFSC, DCS/Procurement and Manufacturing has issued a letter to HQ/AFCMD providing guidance on AFPRO responsibilities in surveillance of IR&D and B&P efforts (19).

The key role of the organization IR&D focal point is self-evident. As the commander's representative his ability to organize an effective, qualified technical evaluation and review team is, perhaps, the most important factor in the quality of the resulting evaluation. With effective backing by his commander and, perhaps, with a separate funding line item for IR&D review travel, efficient evaluations can be obtained. It is interesting to note that during Company Fiscal Year (CFY) 1976 Air Force evaluation organizations expended 23 man-years at a cost of \$1 million to conduct IR&D evaluations. Of the dollar total, \$100,000 was for per diem and travel (17).

In addition, the leadership and guidance of the AFSC Director of Science and Technology is evident in the Air Force technical evaluation process. An example of this guidance is found in a recent policy letter sent to Air Force organizations that participate in IR&D evaluations and also sent to contractors. This letter expressed the need to increase emphasis in R&D focussed toward improvements in manufacturing technology in order to find techniques that lead to reduction in acquisition and support costs of defense systems. IR&D projects directed toward manufacturing areas would be accorded equal credit to projects in other technical areas during Air

Force technical evaluations (20).

NASA

Because of the existence of common areas of technological interest, NASA participates extensively with the Air Force in IR&D technical evaluations. It is strongly attuned to the Air Force evaluation procedures and considers them to be effective and efficient. It was indicated that NASA provided a total of 6 manyears at a cost of \$200K during CFY 1976 for technical evaluation support to DOD. This is roughly 20% of the resources expended by the Air Force in conducting its technical evaluations. Several examples were cited of the extensive participation and support provided to Air Force lead evaluations by NASA, one in which eight NASA scientists attended an on-site review to support a SAMSO lead organization review in 1975. One of the authors (JTV) was directly involved in an on-site review in which four NASA scientists attended and provided important input.

NASA views participation in the IR&D technical evaluation process as being important to its own interests because it provides them visibility into the entire IR&D program. NASA personnel are able to multiply the scientific knowledge available to them, thus providing them with the leverage necessary to advance the state-of-the-art in their respective areas.

Their policy is to expose their top scientists to the evaluation and therefore establish a communication link between the company and NASA scientists. Dialogue is continued after the evaluation process is complete. Thus, NASA views IR&D technical evaluation as an effective means of making industry aware of its needs. DOD would also benefit by viewing IR&D with this attitude.

The NASA manager urges the government scientists to pay greater attention

to the technical content of the IR&D program. He encouraged increased interaction with the IR&D project leader by means of telephone calls, visits, and briefings after the on-site reviews. In order to focus on discrete problem areas, round-table discussions were advocated. The objective would be to convey to industry the technical needs of the Government. Again, it was considered very important to identify the right people and to provide encouragement to industry scientists but to avoid providing them direction to keep the R&D independent.

In conclusion the technical evaluation process works and it should be used to advantage.

Industry

It is evident that high ranking industry officials are cognizant of their companies' IR&D program. It is considered an important part of their operations because it provides an opportunity to develop expertise and experience in new areas of technology that are viewed by the company as potential new areas of business.

According to one company IR&D manager, it was not uncommon for members of the company Board of Directors to participate in the on-site review.

Typically, an on-site review begins with an overview briefing by a Division Manager that describes the overall company policy regarding its planning and identification of responsibility for its IR&D program. Then an assigned Technical Program Manager presents a technical description of the entire program followed by more detailed descriptions by project leaders. There is generally a good question and answer session and technical interchange in a give-and-take session.

Most companies have a positive attitude concerning the on-site reviews.

One company representative, in commenting on the evaluation teams from the respective services, offered the following information: size of the on-site review teams varied from as few as ten members (Army team) to as high as fifty-four members (Air Force team); in terms of which projects were to be reviewed during the on-site review, the Navy indicates to the company which projects they wish to review; the Army requests the company provide a list of projects that they would like reviewed; and the Air Force uses a combination of these techniques.

In addition, this company representative expressed the view that the Air Force's policy of reviewing at least 30 percent of the IR&D projects at the on-site review should be modified. He felt it is more beneficial to examine fewer projects in-depth rather than examining many projects superficially. There appears to be no consensus as to the relative effectiveness of the three Services' methods. Industry believes there is a serious effort to improve the quality of the evaluators by calling upon top scientists within government laboratories to participate in the evaluations. NASA and the Army Missile Research and Development Command were cited as having made considerable progress in this area. The Air Force Product Divisions, being more management oriented, tended to experience difficulty in finding qualified technical people to conduct the evaluations when they assumed lead organization responsibilities. The situation is seen to be improving.

The feedback from the government evaluation team is considered an important input for considering the following years' IR&D program. Thus, it was emphasized that this needed to be sufficiently detailed and provided in a timely fashion. This area also varied considerably from service to service. The Air Force gives a detailed debriefing after an on-site review; the Army gives an adequate debriefing, but not as extensive as the Air Force;

and, on occasion, the Navy has not provided the company being evaluated any feedback whatsoever.

It would seem that the massive exposure received by evaluators of a company's IR&D program would lead one to make a strong case for positive economic benefits that offset the costs required. In the view of industry, knowledge of new areas of technology is considered very valuable and should result in continuation of on-site reviews.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

Benefits

The benefits of IR&D programs to the government can be summarized as follows:

1. They provide major contributions to Nation's technological base and avoidance of technical surprises.
2. They stimulate competition and create technical alternatives for government requirements.
3. They provide cost-effective technology.
4. They provide quick reaction and flexibility because IR&D work can be quickly initiated, terminated or redirected.
5. They create a climate which encourages creativity.
6. They reduce risk and provide responsiveness to weapons acquisition process.
7. They generate studies and system concepts supplementing government planning.
8. They enable company management to anticipate and respond to changing requirements.

These are but a few examples of the importance and value of IR&D to the government.

All IR&D managers interviewed unanimously agreed that the evaluation process provides an opportunity for open communication between the government and industry. In a different context, an example of effective communication follows.

When a member of a Defense Agency asked a Navy R&D manager how the Navy transfers in-house R&D results to the User Commands and Development Commands, the R&D Manager indicated that the Navy Laboratories first communicated with the private sector by taking briefings on R&D results to various companies. In learning what R&D the Services were interested in, industry would then respond more effectively by planning IR&D that could be targeted to DOD needs.

This example appears to be a circuitous route, but it is known to be effective. There appears to be no doubt that open, effective communication between government technical personnel and industry technical personnel can be catalyzed by the IR&D technical evaluation process. This provides a ready opportunity for the DOD to provide feedback and encouragement to industry regarding their IR&D efforts. However, industry response to DOD comments and how they tailor their IR&D program must be carefully judged in order to avoid excessive direction on the part of the government which would cause the R&D effort to become dependent, thus unallowable. The object is to keep the word "independent" in independent research and development.

Thus, the DOD must strike a balance between comprehensive technical evaluations and determinations of PMR as required by law, and the need to permit flexibility and innovation in IR&D. Each of the three Services falls at a different location in the spectrum of the technical evaluation process which can be considered to range from a laissez faire attitude (hands-off or lenient) at one extreme to a pragmatic, task-oriented attitude at the other. Without specifying how close to either extreme any one Service falls, we can state that the Navy leans toward the laissez-faire end of the spectrum, the Air Force toward the pragmatic end with

the Army somewhere between the other two.

Recommendations

Recommended areas for improvement in the technical evaluation process follow.

It is essential that qualified government individuals participate on a continuing basis in the technical evaluation process. The identification of qualified individuals for the evaluation team is an area that requires some consideration. The attempts by OSD to utilize the IR&D data bank and the DD Form 1498 to identify common technology projects and the scientists and engineers managing these projects and to bring these people together should be continued. Once qualified individuals have been identified, it is recommended that they continue their association with the evaluation process in order to provide continuity. In addition, the same evaluators must review the technical plan on an annual basis and participate in the on-site review. One method of accomplishing this would be to ensure that IR&D Technical Evaluation would be part of an individual's responsibilities which could be incorporated into his job description. It is also recommended that a fund cite, strictly for use in conducting IR&D evaluation, should be created. This should include funds for per diem and travel as well as administrative charges.

For the benefit of the evaluator, it is recommended that an IR&D Evaluator's Handbook be generated which explains the IR&D process, the requirement for evaluations, current DOD policy, and implementing procedures for conducting a meaningful evaluation. This would be prepared under the aegis of ODDR&E with guidance from the IR&D Policy Guidance Council and the Technical Evaluation Group and be applicable to all three Services.

There is a feeling that too few individuals in the weapons acquisition process have a proper understanding of IR&D and its value to the Government. It is recommended that an IR&D position paper be prepared, again under the aegis of ODDR&E, which explains in some detail the functions and benefits of IR&D and to encourage the involvement of development and acquisition personnel in the technical evaluation process. This involvement need not be for the purpose of technically evaluating the IR&D program but to define, educate and, in general, explain why IR&D is important.

In general, industry appears to be content with this troika of evaluation procedures which they encounter, and the OSD is satisfied that IR&D is accomplishing what it is intended to do - foster competition.

As stated to Congress by Dr. Currie in 1977:

"We believe that IR&D is a well-managed cost element which contributes to the competence of the Defense Industrial Base. We have recently taken steps to provide Congress with an overall estimate of future IR&D expenditures. This complements our previous controls and provides full visibility to permit overall policy guidance without imposing external direction on what qualifications a company can have. Our success in Defense research and development depends on industrial competition, and that competition depends on the independence of IR&D." (4:IX-22)

Natural forces of evolution will continue to act on the technical evaluation process. It may become more streamlined or more efficient; however, we foresee no major changes in the present method.

APPENDIX A

Persons Interviewed

Office of the Secretary of Defense

Mr. James W. Roach
Assistant Director (Engineering Policy)
Office of the Director of Defense Research and Engineering
Chairman of the IR&D Technical Evaluation Group

Department of the Army

Mr. Charles R. Woodside
Deputy for Management and Budget
Office of the Assistant Secretary of the Army (R&D)

Mr. John W. Crellin
Chief of Industry Liaison Office
HQ, Development and Readiness Command
IR&D Departmental Manager

Department of the Navy

Ms. Evelyn Richards
Staff Assistant (IR&D)
Office Chief of Naval Research
Alternate IR&D Departmental Manager

Department of the Air Force

Major Loren Jacobsen
DCS/Research and Development (AFRDPS)
HQS USAF
Executive Secretary of the Air Force IR&D Policy Council

Captain William Lewandowski
Director of Science and Technology (DLXB)
HQS Air Force Systems Command
Air Force IR&D Technical Manager/Departmental Manager

Mr. Donn V. Aaby
DCS/Procurement and Manufacturing (PPMO)
HQS Air Force Systems Command
Chief, Overhead Management Division
Air Force Tri-Service Negotiator, Chief

Captain Hudson Ratliff
DCS/Procurement and Manufacturing (PPMO)
HQS AFSC

Mr. Matt Kerper
Air Force Office of Scientific Research
Air Force Systems Command
AFOSR IR&D Focal Point

NASA

Dr. Ralph Nash
NASA Hqs, Washington, D. C.
Technical Manager, IR&D, NASA Headquarters

Industry

Elliot B. Harwood
The Boeing Company
Manager, Corporate IR&D Activities

D. Max Heller
Martin-Marietta Company
Director of Research, Martin-Marietta Aerospace

Walter L. Weitner
Aerospace Industries Association of America
Secretary, CODSIA IR&D/B&P Task Group

James F. Lovett
Westinghouse Electric Corporation
Director, Federal Government Relations

William Pearson
General Electric Company
Corporate IR&D Representative

Additional comments and information were provided by the following:

Lt Col Richard Hartke
Office of the Scientific Advisor to the President

Lt Col Howard Bethel
DCS/Research and Development
HQS USAF

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