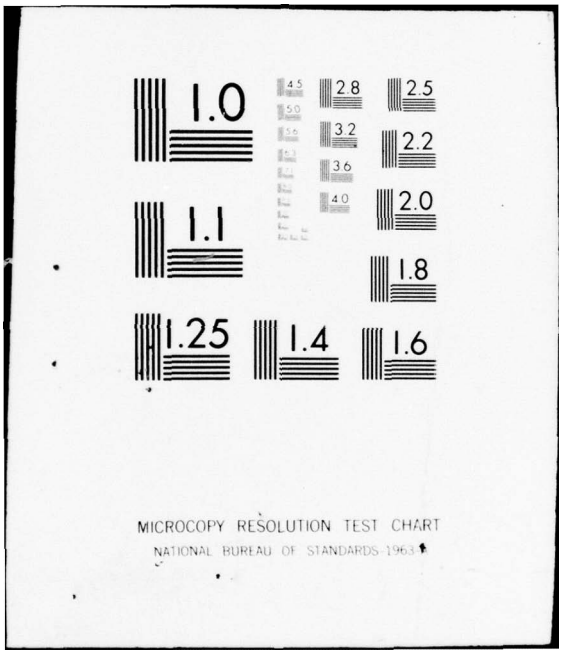
AD-A052 111 DEFENSE SYSTEMS MANAGEMENT COLL FORT BELVOIR VA F/G 5/1
IMPROVING THE INSPECTION OF USAF RESEARCH ORGANIZATIONS.(U)
NOV 77 M L SABIN

UNCLASSIFIED NL

| OF |
AD
A052111

END
DATE
FILMED
5-78
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963

1

DEFENSE SYSTEMS MANAGEMENT COLLEGE

PROGRAM MANAGEMENT COURSE

INDIVIDUAL STUDY PROGRAM

IMPROVING THE INSPECTION OF
USAF RESEARCH ORGANIZATIONS

STUDY PROJECT REPORT
PMC 77-2

Marc Leslie Sabin
Major USAF

FORT BELVOIR, VIRGINIA 22060

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* IMPROVING THE INSPECTION OF USAF RESEARCH ORGANIZATIONS		5. TYPE OF REPORT & PERIOD COVERED Study Project Report 77-2
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) MARC LESLIE SABIN		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS DEFENSE SYSTEMS MANAGEMENT COLLEGE FT. BELVOIR, VA 22060		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEFENSE SYSTEMS MANAGEMENT COLLEGE FT. BELVOIR, VA 22060		12. REPORT DATE 1977-2
		13. NUMBER OF PAGES 31
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT *(of this Report)*

UNLIMITED

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

SEE ATTACHED SHEET

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

SEE ATTACHED SHEET

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE:

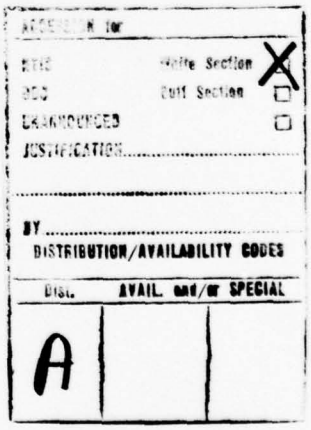
Improving the Inspection of USAF Research Organizations

STUDY PROJECT GOALS:

To examine various organizational approaches to research management. To examine the present IG perspective on the inspection of research organizations. To determine appropriate considerations for improving the inspection process vis a vis research organizations.

STUDY REPORT ABSTRACT:

The paper addresses the question of how the Inspector General of the Air Force Systems Command and his personnel can more effectively and usefully inspect and evaluate research organizations. Based upon an examination of pertinent regulations, directives and the open literature, and based upon interviews with knowledgeable personnel, the roles and missions of both the Air Force laboratories and the AFSC inspectors are analyzed. This analysis is then used to discuss where current practices should be modified in order to improve the meaningfulness of inspections of research organizations. Specific attention is given to the interface between the inspectors and the staff of the Director of Science and Technology. The final part of the paper deals with aspects of the laboratory-system mission which should weigh more heavily in the overall evaluation of a research organization than they do now.



SUBJECT DESCRIPTORS:

Program/Project Management (10.02): Research Management, Air Force Laboratory Management, Inspector General Activities, Inspection of Research Organizations.

NAME, RANK, SERVICE	CLASS	DATE
MAJ Marc L. Sabin, USAF	PMC 77-2	14 Nov 1977

IMPROVING THE INSPECTION OF USAF RESEARCH ORGANIZATIONS

Individual Study Program

Study Project Report

A Journal Article

Defense Systems Management College

Program Management Course

Class 77-2

by

Marc Leslie Sabin
Major USAF

November 1977

Study Project Advisor
Colonel Robert E. Lucas, USAF

ACKNOWLEDGEMENTS

I express my appreciation to Colonel Robert E. Lucas (DSMC), Colonel R. M. Monts III (AFSC/DLX), Colonel R. Sigethy (AFOSR), Major W. Campbell (AFSC/IG) and Capt H. J. Parrish (AFSC/DLXB) for their freely given time in discussing the subject matter of this paper and in reviewing the final product. I also express my appreciation to Mrs. Ruth Feltner for her excellent efforts in typing the manuscript.

ABSTRACT

The paper addresses the question of how the Inspector General of the Air Force Systems Command and his personnel can more effectively and usefully inspect and evaluate research organizations. Based upon an examination of pertinent regulations, directives and the open literature, and based upon interviews with knowledgeable personnel, the roles and missions of both the Air Force laboratories and the AFSC inspectors are analyzed. This analysis is then used to discuss where current practices should be modified in order to improve the meaningfulness of inspections of research organizations. Specific attention is given to the interface between the inspectors and the staff of the Director of Science and Technology. The final part of the paper deals with aspects of the laboratory-system mission which should weigh more heavily in the overall evaluation of a research organization than they do now.

INTRODUCTION

The management and conduct of research should be a matter of concern to all Air Force personnel involved in systems acquisition. The reasons for such concern do not lie in the amount of money involved, though it is not insignificant, nor in the numbers of people involved. Military and civilian writers in the field of research management have cogently assessed the importance of research efforts. [10,12,13,18]† Martino and Stephenson perhaps express it best: " ... the future Air Force will be determined by today's research; it may be captive of a poorly chosen research program or beneficiary of a well chosen investigation." To well chosen, I would only add well managed and well conducted.

It is appropriate at this point to define what aspects of research I am talking about. Since the terms basic and applied research are subject to much interpretation, let me use Glennan's definition that research is that activity which includes "all effort directed toward increased knowledge of natural phenomena and environment and toward solutions to problems in physical, behavioral and social sciences having no clear, direct military application." [6] Into this definition we can fit nearly all of the basic research (6.1) and some of the exploratory development (6.2) activities of the various Air Force laboratories. (We could also include research performed by other organizations such as the USAF Academy.) Since these laboratories typically have broader charters than implied by this definition of research, I will in large measure restrict the considerations of this essay to their research and research-related activities.

---

† References will be designated by a superscript number designating the number of the reference in the List of References.

A separate activity, quite apart from research, that is of special concern to military commanders is inspection. This activity is an implicit and natural function of command. Keefe notes that there is a basic conflict in the Air Force between the freedom of science and the control of scientific efforts in the interest of the Air Force. [11] An extreme position on the side of scientific freedom would deny the efficacy of inspection (at least in the sense of a compliance inspection) in the research environment, an environment characterized in [14] as one of extreme uncertainty in the outcome of any task. The opposite position is reflected by Dean, who notes that "at both national and corporate levels the point has been reached where R&D is conceived as a production process subject to planning, control, and optimization." [5] Though truly not a production process, R&D must be managed and the inspection process is a part of the commander's management information system.[22] Thus it is necessary that there be inspection of research activities as well as operational activites.

The process by which inspection is carried out has been subject to criticism. Though not specifically addressed to the inspection of research activities, recent reports have professed that the time used to prepare could be more productively used in improving internal efficiency, [9] that the system is a detriment to effective operations, and that there has been a failure to innovate in the inspection process while the rest of Air Force management has experimented with new techniques such as participative management and management by objectives. [8] This last charge is not entirely correct, for the Air Force Systems Command Inspector General (AFSC/IG) has introduced a number of important innovations (some of which will be mentioned later). However, he has not fundamentally altered the manner in which an inspection is conducted - how the inspector interacts with the inspectee or

with the cognizant staff agency. That interaction has tended to be adversarial in nature.

Despite statements by staff personnel that the IG should be looked upon as an aid to effective management rather than an adversary, [24] and despite IG operating instructions that state that commanders should welcome inspections as direct contributions toward improving their operations rather than worry about surviving an inspection, [31] people are apprehensive and defensive about inspections. Despite the statement that "there should be no indication of 'finger pointing' during the interview, exit briefing, or report writing phases," [31] current inspectors recognize that fault finding (of either individuals or systems or both) is inherent in an inspection finding. [22]† A former deputy IG even states that there is some intimidation, perceived by the inspectee, in the nature of an IG report. [23] With the continued deemphasis of strict compliance inspections, the subjective judgements of inspectors heighten the friction in the process though they also increase the dialogue between inspector and inspectee. [22] There is staff concern over disclosing Staff Assistance Visit reports to the IG for fear of losing the confidence of the subordinate organizations they deal with if that disclosure might lead to an IG finding. [24] In fact, AFSC/DL has been excused from the requirement to provide such reports to the AFSC/IG. [23] Hartung-Schuster notes that "it could be said that the inspection system is a hindrance to solving problems because it could cause subordinate commanders to conceal problems rather than expose problem areas." [8]

---

† The need for fault-finding is based on the requirement that the cause of a finding be explicitly stated in the inspection report. Further, experience has made the IG feel that a statement of cause is necessary information for effecting corrective action. [22]

Given, then, the current criticisms of the inspection process and given the breadth of research, to which there is no "universally applicable method" of appraisal [17] yet which must be subject to better control by Air Force commanders than ever before, this paper addresses ways in which inspection might be more effectively applied to research organizations. I will begin by discussing the respective objectives of the laboratory system and of the IG. This discussion provides insight as to what is expected of each. That insight leads one to a better view of what it is that should be examined during the inspection of research activities and of appropriate ways to go about the process. Next I examine the interface between the research activities, especially at the staff level, and the IG. It is at this interface that the most significant benefits can be derived in terms of improved effectiveness of the inspection process. Finally, I will make some suggestions concerning areas of inspection emphasis that can improve the meaningfulness of inspections of research activities.

The central issue throughout this essay is what do we require of an inspection of a research activity and how do we go about getting that from the inspection process? I do not even pretend to provide the answer, but I hope that I shall stimulate introspection in both the research and IG communities that will eventually provide the answers that the Air Force needs.

The Laboratories

As quoted in [7], AFR 80-3 defines the mission of the in-house laboratory as one of providing "the Air Force with scientific, engineering and analytic support in creating new weapons, vehicles, and equipment and in developing future concepts." AFSCR 80-23 states that "The primary mission of the AFSC laboratories is to maintain a technological base by conducting

effective research, exploratory, and advanced development programs .... laboratories are specifically tasked to provide support to ..." AFSC field commands that are responsible for acquisition of current systems.[27]

These are general statements of what the Air Force expects from its laboratories. Perhaps more important than these regulatory statements are the roles perceived to be appropriate for the laboratories. These perceptions exist within and without the research community, are flexible and varying, and provide a better basis upon which to judge whether or not the laboratories are fulfilling the role the Air Force wants them to at any given time.

Dr. Currie, former Director of Defense Research and Engineering, has stated that "a principal reason for the laboratories' existence is the perception that our system development and acquisition function needs a cadre of people with a combination of 'hands on' technical expertise and intimate familiarity with Service problems without industrial bias. [4] The DOD Laboratory Utilization Study (LUS) states that "... material acquisition support ... must be viewed as the principle raison d'etre of the PS&E laboratories and the ultimate performance measure of importance in assessing the contributions of the laboratories." [1]

Obviously, the advancement of the state of the art in technology is one of the primary roles for the laboratories. Kalisch states that the "mission of Air Force basic research is to create opportunities for the exploitation of science." [10] Martino and Stephenson say that it "is to provide a more relevant knowledge base to support future military technology." [13] The emphasis in each case is on pursuing that technology which is not of interest outside the military community.

Another role perceived by Currie and many others, is to make the services "super educated buyers". [7] In this vein, the Air Force's laboratory utilization study group noted that the laboratory complex must be able to "interpret the weapons system significance of changing technology to the service users ... [and] then interpret the service needs to the industrial base." [7]

Training is an important laboratory function and one which Col Sigethy, Director of Plans and Operations for the Air Force Office of Scientific Research (AFOSR), feels to be among the more important. [25] That the laboratories play a valuable part in the education and training of the young scientists and engineers who will develop into the senior managers of the acquisition process has also been noted by the Chief Scientist and Director of Plans and Programs for the Director of Science and Technology (AFSC/DL). [7]

Outside of DOD, the Office of management and Budget has stated what it believes to be a valid role for the laboratories: "Government laboratories should be considered for participation in agency mission analysis, evaluation of alternative system design concepts, and support of all development, test, and evaluation efforts." [30] This has led to the specification of a Technology Assessment Annex to be attached to Decision Coordinating Papers (DCP) that are reviewed by the Defense Systems Acquisition Review Council (DSARC).

Some other functions the laboratories should perform in the pursuit of their basic objectives include: provision of engineering support to fielded systems, provision of a technological corporate memory, provision of

scientific intelligence relative to potential enemies' systems, and provision of a rapid-response capability to solve immediate problems in technology. [1]

One final point, noted by Sigethy, is that the existence of a technological community within the Air Force sets a tone and tenor to the entire thought process of the service that enhances its ability to function effectively in the highly complex technological environment of the present. [25] The more competent that community is, the more pervasive its influence will be.

Briefly summarizing at this point, I ask that you appreciate the wide-ranging perspectives that exist relative to what the laboratories should be doing for the Air Force. These perspectives include technology advancement, personnel development, technical intelligence, and system acquisition support.

The Inspector General

It is appropriate to begin the discussion of the IG, as was done for the laboratories, by considering the governing regulations and directives and then looking at how the perceptions of those involved affect the actual inspection process. AFR 123-1 states that the objectives of the inspection system are to provide commanders with:

a. A capability to maintain continuing surveillance over the status of readiness within the commands.

b. A measure of effectiveness and efficiency of management systems.

c. A management technique to identify, assess, and resolve significant problems and to recognize exceptional managers and management practices.

d. An evaluation of the adequacy of safety and occupational health programs to include applicable provisions of ... OSHA ...

e. Factual information on which to base action if a management system is not achieving maximum effectiveness. [28]

IGOI 123-1 declares the purpose of AFSC/IG inspections to be the evaluation of the ability of AFSC activities to effectively, safely, and economically perform their missions and functions; to recognize the existence of problems which impede mission accompishment; and to provide assessments for the Commander, AFSC of how well command organizations are accomplishing their assigned missions. [31]

Within these words are the seeds of much of the controversy that surrounds the inspection process. The reasons for the controversy are the dichotomous positions that can be assumed based on the formal directives. Justification can be found to support inspection as a "fact-finding mission," [31] to support compliance inspections (as well as to reject them [28]) and to support subjective management inspections.[31] Additional controversy centers on the adversarial and fault-finding nature of inspections which was discussed earlier. The disparity of perceptions among those involved in the inspection process (both inspectors and inspectees) does little to dampen the controversy.

There is one aspect of inspection about which there appears to be a concensus. While the how of inspection is disputed, the why of inspection is generally agreed to be to assist the commander in fulfilling his management responsibility for control of his organization by functioning as part of the commander's management information system. [9,22,24,25] In this capacity, the IG must reflect the commander's concerns,[25] and the thrust of an inspection must be focused in the direction that the commander desires. [23] The information that the IG provides the commander must be factual in basis

if command decisions are to be reliably made.

Once past the factual, objective aspects of inspection, one enters the subjective arena in which much of the controversy exists. At the heart of the issue is the question of how much compliance should be emphasized versus how much management effectiveness should be emphasized. Robertson defines a compliance inspection as one which "determines conformity with formal, published, official requirements," and a management inspection as one which "determines the effectiveness with which managers are effecting their responsibilities." [16] The argument as to which approach is proper predates the Air Force itself, and Trace appropriately notes that "the USAF Inspection System was born amid controversy." [20]

Arguing against excessive compliance requirements, Sigethy expresses the interesting concept that such an inspection is a suboptimization process. [25] Strict adherence to individual regulations and directives insures the individual effectiveness of each, but only at the expense of the overall effectiveness of an organization. It is the overall effectiveness of an organization however, that is ultimately important.

The trend today is away from compliance inspections. [22] AFR 123-1 states that "purely compliance oriented inspections are to be avoided" avoided" and notes that compliance problems are to be avoided unless they are indicative of an underlying management problem. [28] The AFSC/IG operating instruction flatly states that "there is nothing wrong with including judgement findings in a report." [31]

Management inspections are more difficult to accomplish than compliance inspections because of the subjectivity involved. They also increase the friction between inspectors and inspectees as was mentioned earlier.

Some of the AFSC/DL staff are concerned lest this trend go too far and feel that there may already be too much subjectivity entering the inspection process. [24] Monts notes that "the IG must keep parochialism under control to prevent inspectors from using their position to arbitrarily make management recommendations in their findings based on personal preconceived ideas that directly conflict with the policy and background of the responsible staff." [23] If carried to an extreme, one can visualize the management judgement of the IG, derived from the short period of examination available to him, overriding the judgement of field commanders and staff personnel, who bear the responsibility for the organizations involved. This does not deny the necessity for the IG to examine the validity of policies that are in effect. The AFSC/IG is aware of this adverse potential, and he instructs his inspectors to exercise discretion in the application of management principles based upon the situation at hand. Emphasis is to be placed on the "results and economy of obtaining those results." [31]

I have now separately discussed the roles and objectives of the laboratory and inspection systems. From these discussions, it is clear that in his search to provide the factual information upon which the Commander, AFSC can base action to assure effective and efficient mission accomplishment, the AFSC/IG needs to fully understand the entire range of the laboratories' roles and he must subjectively examine many of the activities in which the laboratories engage. The next two sections of this paper address, respectively, how this understanding can be better assured and a few important activities that should play larger parts in the overall evaluation of a laboratory.

The Interface - A Lack of Communication

If the inspection process is to function in a worthwhile manner, there must be a two-way flow of information and understanding across the interface between the research activity and the inspector.† This communication flow must take place before, during and after the actual inspection. Both parties must seek to close the communication loop around the interface and attempt to make the other smarter about his own objectives and requirements. Today that loop is not adequately closed; in Sigethy's words, communication between the research activities and the IG is incomplete. [25] Blame for this problem can be ascribed to both sides. Research activities have failed to make clear to the IG those matters that are truly important to the successful fulfillment of their prescribed and perceived roles. Nor have they provided the rationale concerning the formal documentation that will provide the IG the insight to make the proper subjective judgements during an inspection. The inspector, in turn, has not asked the penetrating questions that must be asked before such insight can be gained.

The relatively unstructured nature of the research environment as compared to an operational environment only serves to exacerbate the problem of communicating these concepts. The inherent uniqueness of each research facility further compounds the difficulty. Though the inspector does not evaluate technical competence per se, he does evaluate the effectiveness of management in obtaining technical ends. He must, therefore, be knowledgeable to some moderate degree about those technical ends, for management must

---

† I include both the laboratories and the AFSC/DL staff in the term research activity and use "inspector" to mean the inspection team rather than a single individual.

tailor its activities to them. For example, an item in the AFSC/IG Checklist asks whether the laboratory Technical Planning Objectives contain adequate descriptions of projects. [32] Technical comprehension is required to make such an evaluation. The current IG approach to providing knowledgeable inspectors is to form IG teams comprised "of personnel whose working experience has been in the field they are inspecting." [8] Within R&D however, the disciplines are exceptionally diverse, thereby limiting the carryover value of technical experience and accentuating the need for full understanding of organizational objectives to be conveyed at the interface between the research activity and the IG.

The most appropriate time for this educational process to take place is during the preparations prior to an inspection. Detailed preparations essentially begin when the inspection subteam chiefs assign functional area responsibilities to the individual team members. [22] The inspectors then formulate their personal checklists for the inspection based upon all the information that they can gather. Their basic charge is to "familiarize themselves in detail with the organization and key personnel of units to be visited, the breakout of responsibilities within their particular areas of interest, pertinent findings from previous efforts which may be applicable to their areas of interest, and current problems as reported in the TIG Brief and any other available documents." [31] They are also tasked to contact major headquarters staff offices on items selected or proposed for inspection and for inputs from the staff as to additional areas which should receive inspection emphasis. [29] Within this guidance, each inspector defines his own approach to meet the specific responsibilities and objectives worked out by the team as a whole. [22]

The key to the entire inspection is the checklist that the individual inspector makes up. The AFSC Inspection Checklists are formulated on an organizational basis; i.e., there are parts for program offices, for ranges and test centers, for laboratories, etc. The part for laboratories is broken into seven sections dealing with organization and management, planning, work unit management, engineering services/interfaces, R&D procurement, ADPE/Software, and documentation. These basic lists "must be tailored and supplemented ... as required. Each inspector must include items resulting from special inspection requirements, directions from the inspection charter, current command interest items, and functions unique to the unit to be inspected." [32]

Information for the tailoring comes from a number of sources. Documentary sources may include regulations, directives, Staff Assistance Visit Reports, Special Subject Regulations (SSR), Special Interest Items (SII), Special Checklist Items (SCI), other inspection reports and the TIG brief. The SIIs and SCIs are usually based on items submitted by a staff member who desires a close examination of a certain functional area. The original request to the staff for inputs relative to a specific inspection is made simultaneously with the notice of inspection that is given to the unit involved. [22] Conferences in which the DL staff briefs the IG team on laboratory technology and missions are often held as much as 60 days before an inspection. [22,23]

AFSC/DL has designated an office (DLXB) for the responsibility to coordinate the interface between the IG and the staff and laboratories. Parrish says that there are essentially two distinct types of information requested by the IG. The first concerns identification of those organizations and

functional areas (such as the Job Order Cost Accounting System) that are appropriate for inspection. The second pertains to specification of important items to be checked at the organization selected for inspection. The provision of the information involves written responses and personal contact. The degree of personal contact depends upon the individual inspector, for it is typically left up to him to decide what information he wants from the staff. Some inspectors spend a lot of time talking with AFSC/DL personnel and some do not spend much. [24]

The basis for an effective interchange between the IG and the research activity clearly exists, but it is not used to the advantage it should be. The conversations take place, the letters go forth, but the communication is inadequate. The letters that AFSC/DL sends to the IG identifying specific items for consideration in the inspection of a unit are simply listings of things to check. They typically say, for example, to check on the implementation of a regulation, directive, or procedure. There is no insight provided as to the genesis of the requirement, nor as to the relative importance of various aspects of the requirement or the relative importance among requirements. If the inspector does not come and ask for clarification, no staff attempt is made to provide it. [23,24] This is an unfortunate omission, for without such understanding, the perceived roles and functions are unlikely to be understood and a meaningful evaluation of whether an organization is effectively performing its mission cannot be made.

Clear communication of the technological role of a given laboratory has not been accomplished if the inspector cannot reliably ascertain who the principal users, or customers, of its output are. Yet the inspector indicates that he cannot always determine beforehand where the interfaces

are, who the customers are. [22] (I will discuss the use of this knowledge in the next section.) It is of course true that the research we are concerned with here will typically not have direct military application, but if management cannot determine where the technology outputs of a laboratory have been used, with whom a laboratory has coupling efforts, for whom a laboratory performs consulting or other support efforts, then management is not doing its job. If it does know these things, then it can and should communicate them and their importance relative to the overall laboratory mission to the IG.

The inspector is at fault in this communication failure because he does not ask sufficiently penetrating questions of the staff. [25] When he receives back a list of things to be checked he does not sufficiently probe for the rationale behind the requirement, the understanding of what is important and what is not. He is also at fault for restricting his requests for information to the AFSC/DL staff. Contact with groups such as the Research Objectives Panel, the Research Utilization Council, or the research directors at AFOSR could provide additional insight and understanding into the science and technology being pursued and what might be required to manage it, but they are not routinely querried. [22] Admittedly, finding the time to make these contacts would be difficult.

There has been an innovation (begun in the summer of 1976) by the AFSC/IG that takes a long step in the right direction. A staff liaison officer, designated by AFSC/DL, accompanies the inspection team as an advisor. The staff representative provides advance information to the inspection team and provides real-time constructive inputs to the inspection by commenting on findings, potential causes and recommendations. Not only

is the inspection enhanced by this approach, but the friction between the staff and the inspectors is reduced by the improved communication between them. Both AFSC/DL and the IG have been very satisfied by the results of this effort to date. [22,24] Presently, AFSC/DL leans toward selecting an individual from the directorate having primary responsibility for the organization to be inspected rather than an individual with a more general perspective from plans and programs. [24] This is appropriate, but care should be taken to maximize the amount of input the staff liaison individual receives from the other AFSC/DL staff offices having responsibility for broad functional areas. This need is analogous to the need to provide similar understanding to the IG.

A different, but related, approach taken by the IG is the use of augmentees for the inspection team. The augmentee is a full-fledged member of the inspection team provided by "HQ AFSC major staff offices or AFSC field commands and laboratories." [29] The augmentee provides technical expertise that can be used to look for duplication of technical effort, problems in technical management, and failures or oversights in the technical direction that is being provided by management. [22] More than being a generator of findings (he is typically less productive of findings than trained inspectors [22]), the augmentee is a source of knowledge, understanding and perspective that enables the inspection team to do a better job. If the inspection team recognizes this fact, the value of the augmentee will be high.

I urge greater use of both the staff liaison officer and the technical augmentee. A possible variation of the use of a technical augmentee is to

have an evaluation of the laboratory program completed in a manner similar to that by which independent Research and Development Reviews are accomplished based upon written brochures. The input would be provided to the inspection team during their preparation period. Unfortunately the rewards to the augmentee that exist because he now is able to personally participate in technical exchanges at the inspected unit are denied him if he is only requested to provide a pre-inspection evaluation. [22] Lack of motivation could interfere with obtaining useful results. An alterntive approach in this vein would be to have an augmentee accompany any pre-inspection visit by AFSC/IG personnel to the organization in question. [23]

Finally, consider the post inspection period. Here too there is room for improved communication. The IG operating instruction says that "it is essential that DCSs and Chiefs of Special Staff Offices be familiar with inspection results pertaining to their functional areas of responsibility." [31] The same attempts made to improve pre-inspection communication need to be made after the inspection.

The USAF/IG has an analysis system that can provide data concerning common Air Force-wide problems arising in inspections. There have been retrieval problems with this system, so the AFSC/IG is developing a deficiency analysis system that will be particularly applicable to AFSC. The research activities must make full use of this feedback mechanism. Not only will it help provide them with a clearer picture of the deficiencies in the field, but it will also give them a fuller understanding of current IG perspectives and objectives. This, in turn, will allow the staff to provide better information and understanding to the IG for future inspections.

The subject of this section has been the need to improve the communication link between the research activities and the inspectors. The objective is valid throughout the Air Force, but is especially valid in the research environment where even similar type units (e.g., laboratories) are significantly different. The interface between the research acitivities, especially the AFSC/DL staff, and the IG must be used to transmit understanding and perspective to both parties to a greater extent than now occurs. Inspectors must seek broader input to and fuller understanding of those items that they do include in their checklists. The research activities must take the initiative in providing the information they think the IG needs to have in order to perform a valid inspection. The current initiative in the area of staff liaison officers should be exploited as fully as possible and increased use of augmentees should be considered.

Areas for Inspection Emphasis

Having examined the matter of improved communication at the interface between the research activity and the inspector, I turn, in this final section, to an examination of some of the specific areas of importance that are relevant to the evaluation of how effectively a research activity is fulfilling its role in the Air Force.

The perspective brought to bear in selecting the areas for emphasis should be fully cognizant of the unique nature of research and the requirements this nature places on management. An Army policy statement reflects an excellent philosophy from which to begin: "Management will emphasize the emergence and application of new, useful and bold ideas, rather than administrative smoothness of operations." [12] Reflecting this philosophy, one must

address the fulfillment of the raison d'etre rather than the details of the administrative process supporting that fulfillment. In fact, a valid inspection item, recognized by the IG, is that the administrative process should not be an overbearing burden. It is worthwhile noting that virtually the same philosophy is cited by Dean for application by industry: "The final measure of system effectiveness is maximum profit to the corporation rather than blind conformance to any system." [5]

Much discussion can be found in the literature concerning important considerations in the evaluation of research activities. Frequently cited is the resultant impact of the research effort on company operations [18] or, in slightly different terms, it's "utility or value ... to the mission of the agency or society." [14] The time period over which that utility is considered is important; an extended period of time should be examined. The Committee on Federal Laboratories (COFL) report notes that "the nature of the R&D process ... mitigates against any meaningful measures of performance for periods as short as a year." [14]

In terms of measuring the contribution of basic research, Kalisch cites four important considerations: (1) the creation of new fields of endeavor; (2) the innovations in applied science that result from an effort† (3) the USAF relevancy of the body of knowledge within a discipline, and (4) the ability of science to relate to Air Force problems and the Air Force's understanding of science. [10] Dean talks about the contribution of a research project in only slightly different terms. He states that "project evaluation is usually based on (1) an overall measure of corporate performance such as profits ...; (2) a tabulation of relevant project

† Project Hindsight was an unsuccessful effort to formalize the tracking of those innovations.

factors affecting corporate performance, and (3) the analysis of the ways in which these factors contribute to performance; ..." [5]

In accomplishing the research ends reflected by the above considerations, management needs to be flexible enough to deal with short-term problems, steadily and patiently pursue long term objectives, have the courage to fight for the programs it believes are necessary, and be alert to happenings in the scientific world at large. [21] Though an ability to pursue long term objectives is important, rigid adherance to plans may be counterproductive as well as impractical. The COFL notes that an important consideration for evaluating management efficiency is not differences between accomplishments and plans, but the ability to explain such variances. [14]

A last point in this general discussion concerns the relations between the laboratories and the users of their output. The LUS says that in system development by program managers this relationship should be one of customer and supplier. [1] Dean states that an R&D program in industry may be considered a success when its projects are being handled competently and the corporate operating divisions are satisfied with the output. [5]

In light of the preceding, a list of important considerations for evaluating a research activity might enumerate them as follows: (1) Is the overall mission being accomplished by effective and efficient management? Are the outputs or products of a research activity useful to its customers, in sufficient quantity to meet their needs, and is technical performance satisfactory? (3) Are the outputs appropriate to the organizations's mission and do they contribute to its accomplishment?

There are many quantifiable measures of research accomplishment that reflect upon management effectiveness and that may be applicable to a greater

or lesser extent in any given circumstance. Among these are the obvious things such as numbers of technical papers and reports written; numbers of patents received; frequency of citation of published works; the numbers of creative and technically competent researchers employed and the ability of the organization not to fragment their efforts; ratings received through a peer review process; numbers of Technology Needs supported; membership by the research staff in professional associations and their participation in advanced education; numbers of on-time project completions; the accuracy of technical, time and cost estimates; and the timeliness and adequacy of research dissemination. [1,2,5,12,13,14,17,18,19,21,23] The list can easily be extended but one must recognize that quantitative determinations cannot be used as final measures. They are only useful guides and their trends are likely to be more significant than their absolute magnitudes. [2] The COFL further cautions that many of these items such as numbers of patents, or publications and frequency of citation may be completely inappropriate in the federal laboratory environment. [14]

There are also measures that are not precisely quantifiable, yet which do provide a strong indication of the degree to which the general considerations discussed earlier in this section are satisfied. I believe that these measures do not receive sufficient emphasis in present inspections. I will discuss a few of the ones I feel to be more important in the remaining paragraphs. Specifically, I will touch on customer relations, personnel management and development, personnel awareness, and project evaluation.

I have mentioned the supplier-customer relationship previously as a general criteria for laboratory performance and as a consideration in improved communication between the research activity and the IG. The AFSC/IG

Checklist Guide mentions the interactions of a laboratory with the users of its technology only briefly. It asks what the magnitude of involvement with product divisions is and what coupling has been implemented. [32] As Sigethy indicates, care is required in the determination of who the customers are [25], but once they are identified, it is important to determine whether the customers are satisfied. The LUS states that laboratory input should be provided to the decision-making process up through DSARC. This input should reflect upon the "technical merits of courses of action proposed by [the laboratory's] customers..." [1] It is equally valid, and especially appropriate during inspection, to determine the degree of user satisfaction with the laboratory. One indicator of such satisfaction is the amount of consulting that laboratory personnel are requested to do to solve problems for various customers.

A very important aspect of the role perceived for research activities is their function as a training ground for future high-level managers. The LUS specifically mentions the use of laboratories for that purpose. Though SIIs at times emphasize personnel management, there is an absence of reference to this activity in the inspection checklist. Kellog notes that "early identification of creative scientific personnel ... [is among] the most desireable skills to be sought in research managers." [12] Management should also foster development of people by providing and encouraging the use of opportunities to upgrade their technical and management skills. A potentially valuable consideration is where people go when they leave the laboratory and how well they do when they get there. A study along the first of these lines has been done by Capt Sells of the Director of Science and Technology staff (AFSC/DLX). Data of this nature would be very good indicators of how

well the laboratories develop their people for future assignments. (I do not intend to imply that the IG should undertake studies such as this. He should, however, evaluate management effectiveness in achieving this goal.)

Closely related to the preceding issue is the development of awareness in laboratory personnel. In talking about the maintenance of technical expertise as a responsibility of the laboratories, the LUS goes on to say that "Operational expertise is neither expected nor appropriately placed in a laboratory; the uniqueness of in-house labs can be satisfactorily fulfilled by operational awareness." Equally important is awareness of the technological goals and objectives of the laboratory involved. The basic checklist talks of how direction and policy guidance from higher echelons is disseminated and implemented. It questions the application of TNs to programs and it addresses the effective distribution of technical information and intelligence. [32] The missing element here, though one could possibly argue that it is implied, is the examination of how well the needs, policies, and organizational goals are understood by all personnel. Robertson notes that not only must management begin with clearcut goals and objectives, it must insure that they are clearly understood by all levels in the organization. [16] The inspector must assess how well the research personnel actually do understand these needs and policy objectives. To do this requires the inspector to have the understanding and insight I talked of earlier in this paper.

My final point is in the area of project evaluation. The checklist asks how work units are established, how the research program is evaluated and what criteria are used for establishing priorities. My concern here is again one of insufficient emphasis, for it may be said that "selection, evaluation, and termination of basic research projects constitute the most

important work of the service management organizations...." [12] If this is true, then some of the important aspects of the evaluation of research projects should be specifically identified. The type of considerations that characterize a proper evaluation should be provided to guide inspectors. Dean and Burgess provide useful lists that, while oriented toward industry, can be adapted to give a valid picture of the appropriate factors to be considered. [2,5]

SUMMARY

In this paper, I have discussed a perspective on how the application of the inspection process to the research and development process should be conducted. I have discussed the need for improved communication between the inspected research activities and the inspection teams, and I have recommended specific areas of investigation that could enhance the meaningfulness of an inspection. The paper has provided food for thought, but only the people in the research activities and the people in inspection can make the system work better. It is up to them.

LIST OF REFERENCES

Books and Reports

1. Allen, J. L. et al, Final Report, The DOD Laboratory Utilization Study. Office of the Director of Defense Research & Engineering, Washington, 28 April 1975.

2. Burgess, R. E., "Criteria for the Evaluation of Industrial Scientific Research." The Management of Scientific Talent, J. W. Blood, ed., New York: American Management Association, 1963, pp 222-235.

3. Burtis, T. A. "Defining the Role and Responsibilities of the Research Manager." ibid. pp 30-36.

4. Currie, M. R., Program of Research, Development, Test and Evaluation FY 78. Statement to the 95th Congress First Session 1977, Washington: 18 January 1977.

5. Dean, B. V., Evaluating, Selecting and Controlling R&D Projects. AMA Research Study 89. New York: American Management Association, 1968.

6. Glennan, T. K., Jr., "Research and Development." Defense Management, S. Enke, ed. Englewood Cliffs: Prentice-Hall Inc, 1967, Chap 15.

7. Hansult, C. C. Lt Col, USAF. An Analysis of the Organizational Alignment of the Air Force Laboratory System. Study Project Report PMC 76-2, Fort Belvoir: Defense Systems Management College, November 1976.

8. Hartung-Schuster, E. M., Major, USAF. The Air Force Inspection System: Management Overkill? Maxwell AFB: Air Command and Staff College, Air University, May 1975.

9. Hearon, A. P. Lt Col, USAF, Combining Standardization Evaluation with Inspector General Functions: A Feasibility Study. Report 5938, Maxwell AFB: Air War College, Air University, April 1976.

10. Kalisch, R. B. Col, USAF, "Productivity of Basic Research." Air University Review. Vol XXI, No. 1. November-December 1969, pp. 10-18.

11. Keefe, J. A., Capt, USAF, Air Force Technology Base Management. (Draft Copy) Term paper for Course 54641 Public Management of Science. Washington: The American University. Spring 1976.

12. Kellog, D. A., Lt Col, USA, Management of Basic Research in Defense. Report M65-90, Washington: Industrial College of the Armed Forces. March 1965.

13. Martino, J. P. Lt Col, USAF and Stephenson, C.D., Jr., Lt Col, USAF. "Orienting Today's Research to Tomorrow's Air Force." Air University Review. Vol XXI, No 1. November-December 1969. pp. 28-35.

14. Muehlhause, C. O., Chairman, Task Force on Performance Measures for Research and Development. Performance Measures for Research and Development Vol I Executive Summary and Report. Committee on Federal Laboratories, Federal Council for Science & Technology, May 1973.

15. Pontius, E. A., Lt Col, USAF. The Role of Headquarters Air Force Systems Command in Development and Acquisition Management. Study Project Report PMC 77-1, Fort Belvoir: Defense Systems Management College, May 1977.

16. Robertson, J. E., Col, USAF. Self-Inspection; A Key to Good Management. Maxwell AFB: Air War College, Air University, April 1977.

17. Seyfried, W. D., "The Evaluation of Research" The Management of Scientific Talent. J.W. Blood, ed. New York: American Management Association, 1963. pp. 215-221.

18. Suits, C. G., "The Measureability of Scientific Research." ibid. pp. 22-29.

19. Thompson, D. M., More Effective Methods for Selection and Control of Research and Development Programs. Report M61-69, Washington: Industrial College of the Armed Forces, March 1961.

20. Trace, T. L., Lt Col, USAF, Evolution of the Air Force Inspection System and Policies. Report 5784, Maxwell AFB: Air War College, Air University, April 1975.

21. Werner, J. "Effective Planning for Research." The Management of Scientific Talent. J. W. Blood, ed. New York: American Management Association, 1963. pp. 53-59.

Interviews

22. Campbell, W. S., Maj, USAF. Major Command Inspector, Air Force Systems Command. Discussions at HQ AFSC, Andrews AFB, 20 and 27 September, 12 October and 3 November 1977. Discussion on 20 September initially included Col W. F. Wootton, Chief, Acquisition System Management Inspection Division, AFSC/IG.

23. Monts, R. M. III, Col, USAF, Special Assistant to the Director, Laboratory Plans and Programs, Director of Science and Technology, Air Force Systems Command Former Deputy IG, AFSC. Discussion at HQ AFSC, Andrews AFB, 12 October 1977 and telephone discussion 8 Nov 1977. Capt Parrish (AFSC/DLXB) also participated in the discussions.

24. Parrish, H. J., Capt, USAF. R&D Laboratory Management Analyst, Director of Science and Technology, Air Force Systems Command. IG Focal Point for AFSC/DL. Discussion at HQ AFSC, Andrews AFB, 7 October 1977. Discussion at times included Capt Sells (AFSC/DLXB).

25. Sigethy, R., Col, USAF, Director, Plans and Operations, Air Force Office of Scientific Research. Discussion at HQ AFOSR, Bolling AFB, 20 September 1977.

Official Documents

26. AFR 80-3. "Management of Air Force In-House Research and Development Labs." 18 February 1971.

27. AFSCR 80-23. "Laboratory Research and Technology Support to AFSC Organizations." 30 December 1975.

28. AFR 123-1. "The Inspection System." 1 August 1975.

29. AFSC Supplement 1, AFR 123-1. "The Inspection System." 28 June 1977.

30. OMB Circular A109. "Major System Acquisitions." 5 April 1976.

31. IGOI 123-20. "AFSC Inspector General Operating Instructions." 1 Dec 1976.

32. AFSC Inspection Checklists. *Section I. Chapter II - Laboratories.* No date.