

Report of the Defense Science Board

**Task Force on Federal Contract
Research Center Utilization**

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February 1976

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TASK FORCE
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OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

27 February 1976

TO: THE SECRETARY OF DEFENSE

THROUGH: THE DIRECTOR OF DEFENSE RESEARCH
AND ENGINEERING

The Defense Science Board Task Force on Federal Contract Research Center (FCRC) Utilization has completed its review of DoD-FCRC relationships. The Task Force found that the FCRCs continue to provide, in appropriate areas, high quality essential services for the proper and efficient conduct of the mission of the Department. The report on the study is hereby submitted. The recommendations are summarized in the Task Force Chairman's memorandum to the Director of Defense Research and Engineering.

A handwritten signature in cursive script, reading "Solomon J. Buchsbaum", is positioned above the typed name.

Solomon J. Buchsbaum
Chairman
Defense Science Board



ABSTRACT

Under the auspices of the Defense Science Board, acting on the request of the Director of Defense Research and Engineering, a comprehensive review of the relationships between the Department of Defense and the Federal Contract Research Centers (FCRCs) has been undertaken. The specially selected Task Force was asked to *'assess the DoD-FCRC relationships and recommend steps that could be taken to improve the short and long term posture of DoD with respect to FCRC utilization'*.

The Task Force carefully reviewed the several previous studies of the FCRCs, and supplemented these with its own hearings, interviews, and deliberations. The conclusions, which strongly endorse the current policy of Defense in the utilization of the FCRCs, are summarized in a Memorandum to the Director of Defense Research and Engineering.

The following report details the investigation and, in addition to the summary memorandum, includes a series of specific recommendations from the Task Force. Several addenda providing pertinent data on the current FCRCs are also included.

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I. CHARTER

CHARTER
DEFENSE SCIENCE BOARD TASK FORCE ON
FEDERAL CONTRACT RESEARCH CENTER (FCRC) UTILIZATION

- I. PURPOSE: To assess the DoD – FCRC relationship and recommend steps that could be taken to improve the short- and long-term posture of the DoD with respect to FCRC utilization.
- II. BACKGROUND: The Department of Defense has used FCRCs for a number of years. They provide high-quality research and development to all Services and most Defense Agencies. They are closely controlled and often reviewed by Congress, DoD, Services, GAO, etc., because of the unique position they occupy in a competitive society. The DDR&E now believes it is time to review the FCRC-DoD relationship and develop short- and long-term plans relative to their use, if the continued use is deemed advisable.
- III. SCOPE: The review is to encompass all nine DoD FCRCs.
- IV. STATEMENT OF WORK: The group will make an assessment of DoD-FCRC relationships in light of the following factors:

How are the FCRCs presently being used?

How is appropriateness of work for an FCRC determined?

What alternatives to FCRCs are there?

Should DoD alter its diversification policy?

How can the FCRC-DoD relationship, both from an FCRC and DoD point of view, be improved?

The Task Force will make conclusions and recommendations pertinent to their assessment. Both oral and written reports are to be prepared.

- V. GUIDANCE: Close coordination with Services, Defense Agencies, and FCRCs is desired. Travel by the Task force to secure first-hand information is encouraged. The report will be completed by 30 November 1975.

FCRC TASK FORCE MEMBERS

Mr. Robert A. Duffy (Chairman)
President
The C. S. Draper Lab., Inc.
68 Albany Street
M.S. 02, Room 11A-220
Cambridge, Mass. 02139

Cognizant ODDR&E Deputy
Dr. John L. Allen
DD(R&AT), ODDR&E
Room 3E114, The Pentagon
Washington, D. C. 20301

LGEN John W. O'Neill (Retired)
President, AFRBA
1156 – 15th Street NW, Suite 700
Washington, D. C. 20005

Executive Secretary
Mr. James H. Terrell, Jr.
ODD(R&AT), ODDR&E
Room 3E114, The Pentagon
Washington, D. C. 20301

Dr. Eugene D. Reed
Executive Director
Oceans Systems Division
Bell Laboratory – Whippany Rd.
Whippany, New Jersey 07981

DSB Monitor
Dr. Calvin F. Quate
Professor
Department of Applied Physics
Stanford University
Stanford, California 94303

Dr. Derald A. Stuart
Vice President and General Manager
Lockheed Missiles & Space Company
Missile Systems Division
Dept. 80-01, Bldg. 801
P. O. Box 504
Sunnyvale, California 94088

VADM William J. Moran (Retired)
2510 N 24th Street
Arlington, Virginia 22207

II. SUMMARY – Memorandum

15 February 1976

MEMORANDUM FOR THE DIRECTOR,
DEFENSE RESEARCH AND ENGINEERING

THRU: Chairman, Defense Science Board

SUBJECT: Summary Findings and Recommendations: Task Force on
Federal Contract Research Centers (FCRCs)

The FCRC Task Force, established by DSB to examine the relationship between the Defense Department and the FCRCs, has completed its investigations. We find that, with minor exceptions, FCRCs continue to provide high-quality essential services in appropriate areas for the proper and efficient conduct of the mission of the Department. We believe Defense should continue its present policy on their utilization and we make some suggestions for maintaining their current effectiveness. The nine centers designated as FCRCs, down by half from the number so designated at the time of the last DSB study on this subject, are each distinctly different and therefore broad generalizations are difficult to apply. Arguments for need must be considered individually and no common criteria can be established, owing to the diversity. Strength of the individual arguments will vary, depending on the criteria employed in making the individual assessments. A need for organizations of this type has not been unique to Defense. NASA, ERDA, and NSF all support similar facilities. Lawrence Livermore Laboratory, Los Alamos Scientific Laboratory, Jet Propulsion Laboratory, and the National Center for Atmospheric Research are among the well-known counterparts to the DoD FCRCs.

Federal Contract Research Centers considered in the Task Force Study were:

Aerospace Corporation, Los Angeles, California
Analytical Services, Inc. (ANSER), Falls Church, Virginia
The MITRE Corporation, Bedford, Massachusetts
MIT Lincoln Laboratory, Lexington, Massachusetts
RAND Corporation, Santa Monica, California
Center for Naval Analyses (CNA/University of Rochester), Arlington, Virginia
Applied Physics Laboratory, Pennsylvania State University,
ARL(PSU), State College, Pennsylvania
Institute for Defense Analyses (IDA), Arlington, Virginia.

APC - John Hopkin (Dai)

In an imperfect world, no given entity exactly matches in all respects every desirable attribute. However, as a group the FCRCs are pointed toward certain common desirable characteristics which are not generally matched by either government in-house agencies or industrial firms doing R&D. These organizations view Defense problems from a perspective completely different from that of either government or industry. We feel they provide a standard by which in-house and industry performers can be both compared and challenged. By all of the conventional standards we have been able to employ, and by testimony from senior levels of their sponsorship, the quality of performance of the FCRCs is high, their competence is broadly based and deep, and perhaps even more significant, a lasting historical reservoir of lessons learned is resident in them.

Our recommendations are formulated to assist Defense in maintaining the high quality of some of the FCRCs and to improve the effectiveness of all:

1. *We strongly endorse the current policy of Defense in the utilization of the FCRCs.*
2. The functions being performed are essential to the Defense mission; as a consequence, no abrupt change appears feasible so we do not recommend such action. We have, however, detailed various alternatives to the FCRCs in a rank ordering should Defense elect to phase out or replace the FCRCs.
3. We feel that the FCRCs situated in Universities are reasonably self-regulating and that their quality and size are a continuing concern of the University management. We think the involvement of Defense with the University community is important and should be nurtured. A management philosophy which continues to apply Defense focus to their work and which satisfies accountability standards for contract administration is about right. Overmanagement in detail is wrong.
4. The Study and Analysis FCRCs are most in need of a line item support concept of management which is permissive to a high degree as far as initiative is concerned. Placement of management control at too low an organizational level can defeat the purpose of the critical perspective needed to generate alternative command, and, in some cases, alternative service, policy advice.
5. MITRE and Aerospace, the two large, nonuniversity, systems engineering contractors should continue to be managed in their present single-contract mode at the level of the Commanders of ESD and SAMSO, so that setting of priorities is under the control of the agent responsible for the mission.

6. The current system of FCRC control by Congressional ceiling on internal operating costs appears to us to be outdated and inefficient, requiring far too much effort for the results obtained. While that control mechanism may have been necessary in the past, we believe a more useful concept would be an annual report of stewardship as recommended by the last DSB Task Force studying this subject. No further controls appear necessary.
7. Some margin for technical renewal and initiative must be provided in any management concept for these organizations. While the fee route, we agree, satisfies cash flow needs and plant and equipment renewal, at its current level as provided by the modified ASPR guidelines, it does not provide the government with an adequate independent planning and technological initiative. We believe some negotiated percentage of total volume should be devoted to FCRC-initiated research and planning tasks supporting the mission of the sponsoring agency. Costs for such relevant tasks should be considered as allowable and reimbursable costs in every contract arrangement.
8. All of the FCRCs exhibit some trends toward technical stagnation. We feel these trends, although not serious, should be ameliorated by planned technological renewal.
9. Diversification practice should be a subject of individual annual review by the sponsoring activity. Our judgment is that, on balance, Defense today has more to gain than it loses through diversification. The individual sponsor should satisfy himself that he is getting what he needs in undiluted management attention.
10. Staff salaries should continue to be allowed to move with the market for technical professionals as they do now. Average cost per member of technical staff and average salary per member of technical staff are not excessive by the standards we have been able to apply.
11. Our judgment is that the total current size of the FCRC family is reasonable and appropriate.
12. FCRCs are competitive, but in our judgment, rightly so. On the other hand, we believe that to avoid built-in conflicts of interest, no FCRC should be permitted to competitively respond to Requests for Proposal circulated to industrial sources.

We have made an oral report to your staff and we leave with the staff a comprehensive discussion-oriented paper with a more detailed treatment of the subject.

A handwritten signature in black ink that reads "Robert A. Duffy". The signature is written in a cursive style with a horizontal line underneath the name.

Robert A. Duffy
Chairman
Defense Science Board Task Force
on FCRC Utilization

III. INTRODUCTION

III. INTRODUCTION

The Director of Defense Research and Engineering has asked that a review be made, under the auspices of the Defense Science Board, of the relationship between the Department of Defense and the Federal Contract Research Centers. The review group is to assess the current status of this relationship, and as a result of this assessment, to make both short- and long-term recommendations on the utilization of the FCRCs by DoD.

Current DoD policy is to use the FCRCs to augment, or in lieu of, in-house Research and Development agencies in those areas where the special characteristics of the FCRCs best fit Defense needs; this is under close management control in the form of Congressionally imposed ceilings on internal operating costs centrally administered as a bloc by the ODDR&E. A military service or a Defense Agency is specifically responsible for each FCRC. Congress regulates this control by an annual budget action specifying the amount of appropriated funds which may be expended for FCRC support.

The FCRCs are a special grouping of the National Science Foundation's classification of Federally Funded Research and Development Centers (FFRDC) which are devoted to Defense Department needs. The Report of the Commission on Government Procurement (COGP) dated in FY 1973 describes these organizations as operating under long-term commitments to Federal agencies to perform or administer R&D, systems management, or study and analysis. COGP states, *"the sponsoring agency has the responsibility for continuity of the center through funding its efforts and provides some degree of supervision of its activities"*. These organizations are operated by nonprofits such as universities and independent research institutes or by nonprofit corporations.

The oldest of the existing FCRCs is the Applied Physics Laboratory at Johns Hopkins University, organized in 1942 at the request of the Office of Scientific Research and Development (OSRD). It gave central direction and technological support to an association of universities and industrial contractors developing new concepts for weapons systems. The variable time (VT) or proximity fuze for artillery and aircraft munitions was a prime output of this effort. Harvard University's Underwater Sound Laboratory, the MIT Radiation Laboratory, and the Jet Propulsion Laboratory at Cal Tech were similarly supported and administered during the war years.

In the post-World War II years, comparatively low government pay scales for professionals, a conscious desire to prevent a large permanent technical staff from growing in the new Air Force, recognition of a need for independent technical judgments, increasing complexity of new weapons systems, and high degree of specialization required in their development, led government agencies to seek support from outside groups of recognized experts. FCRCs grew out of this need in the three areas now recognized as broadly characterizing them — study and analysis, systems engineering and technical direction, and specialized laboratory organizations.

At least in some cases, these special organizations were formed to circumvent the bureaucratic delay inherent in government where critical-time weapons developments were the concern of the nation. At least in the case of the Intercontinental Ballistic Missile (ICBM) and the SAGE (Semi-Automatic Ground Environment) Programs, there did not exist in government, at that time, a broadly based systems engineering capability adequate to the task of organizing and directing those two very comprehensive efforts. Space Technology Laboratories (STL), the predecessor to Aerospace Corporation, and for SAGE, the MITRE Corporation were created to satisfy this need.

The COGP states *"these private institutions continue to be in a position to provide unique and valuable services to their sponsoring agencies. Because they have been successful in attracting many talented professionals, possessing special skills and expertise in a diversity of fields, they can offer the services of multi-disciplinary. . . teams. Although largely dependent on the government agencies for their existence, they operate outside the government. . . and have an independent perspective. . . In principle, they are not tied to the particular sets of objectives and commitments that characterize the agencies, and their objectivity is not constrained by any profit or product bias that might arise in the profit motivated sector."*

The Congress has acted, in specific legislation, to curtail DoD's use of the FCRCs and to improve the conditions for government's acquisition of the professional skills and talents necessary to reduce the need for "outside" assistance in the work areas the FCRCs have covered. The Professional Services industry, a growing technical skill pool operating in the for-profit sector, has challenged the "special status" of the FCRCs, contending that government has an obligation to place ". . . maximum reliance upon the qualified for-profit performer". The National Council of Professional Service Firms, purporting to represent an industry of a \$16.1 billion annual volume, in the same statement from which the above is extracted, states further *". . . the fundamental policy which should guide support of captive organizations such as FCRCs is to limit their activities to those for which the private sector has no competence or no existing capability. Where there exists no capability in the private sector and the government needs a service performed, this service may be performed in-house or through an FCRC initially, but at the same time, steps should be taken to encourage the private sector to develop such capability and to commence providing the required services at the earliest possible time"*.

With this background, we address what we consider to be the key issues. Our findings and recommendations are formulated in that context.

IV. METHODOLOGY EMPLOYED IN THE STUDY

IV. METHODOLOGY EMPLOYED IN THE STUDY

The Task Force made no effort to define an FCRC but accepted as the scope of the review those organizations considered by the Congress and DoD to make up the present family of DoD FCRCs. This included the following institutions:

Aerospace Corporation, Los Angeles, California
Analytical Services, Inc., (ANSER), Falls Church, Virginia
The MITRE Corporation, Bedford, Massachusetts
MIT Lincoln Laboratory, Lexington, Massachusetts
RAND Corporation, Santa Monica, California
Center for Naval Analyses (CNA/University of Rochester), Arlington, Virginia
Applied Physics Laboratory/Johns Hopkins University, APL(JHU),
Silver Spring, Maryland
Applied Research Laboratory, Pennsylvania State University,
ARL(PSU), State College, Pennsylvania
Institute for Defense Analyses (IDA), Arlington, Virginia.

In undertaking this review, the Task Force believed that it was important that both the FCRCs and the principal sponsors had an opportunity to express their views concerning the current DoD FCRC policy and to make recommendations to the Task Force concerning actions that should, or could, be taken to improve the efficiency and effectiveness of this approach to military R&D. In addition, public sessions were convened so that other than DoD personnel and/or organizations would have an opportunity to either advocate or oppose FCRCs as a means to meeting these objectives:

Air Force, Pentagon, Washington, D.C. — 2 June 1975	(open session)
Navy, Pentagon, Washington, D.C. — 2 June 1975	(open session)
WSEG, Pentagon, Washington, D.C. — 2 June 1975	(open session)
IDA, Arlington, Virginia — 3 June 1975	
CNA, Arlington, Virginia — 3 June 1975	
APL(JHU), Howard County, Maryland. — 4 June 1975	
ANSER, Falls Church, Virginia — 4 June 1975	
MITRE, Bedford, Massachusetts — 5 June 1975	
Lincoln Laboratory, Lexington, Mass. — 6 June 1975	
RAND, Santa Monica, California — 21 July 1975	
Aerospace, Los Angeles, California — 22 July 1975	
ARL(PSU), State College, Pennsylvania — 24 July 1975	
Open Session, Pentagon, Washington, D.C. — 25 July 1975.	

The sessions with these organizations were structured to respond to a set of prepared questions (Appendix I) provided by the Task Force. This, however, was not a limiting factor

and all parties were encouraged to depart from the format if they so desired. In addition, at laboratory installations where "hands on" R&D is under way, the Task Force visited laboratory facilities and were briefed on work under way to understand the nature and scope of R&D at the various institutions.

In seeking the views of the parties involved in the DoD FCRC interface, responsible officials of the visited organizations and/or institutions were contacted. Briefings and discussions were undertaken with Assistant Secretaries (Research and Development) of the Services, Presidents of the Corporations, and Directors of the Laboratories acting as principals for their organizations and supported by top management assistants and advisors. The interest of high management personnel facilitated the acquisition of information by the Task Force and ensured responsible responses to specific questions.

Of concern to the Task Force was the need to determine specific changes taking place, intentionally or unintentionally, in the use of the FCRCs with respect to the functions they perform. As a convenience, the breakout used by previous studies was employed: (1) Studies and Analyses FCRCs; (2) System Engineering/Technical Direction FCRCs; and (3) Laboratory FCRCs.

The Task Force found that the Studies and Analyses FCRCs (RAND, IDA, ANSER and CNA) perform essentially the same type of work for the DoD (logistics, resource analysis and allocations, force structure, requirements evaluation, etc.) as they have provided to DoD over the past decade. However, there is a significant reduction in the number of professional staff members used by the DoD for this activity. The total decreased from approximately 975 professionals in 1967 to about 660 in 1975. The preponderance of the reduction was at RAND, but reductions also were significant at IDA and CNA. The Services and other sponsors continue to consider the Studies and Analyses FCRCs to be their best source of high-quality, independent professional judgments available for use in the decision process.

The System Engineering/Technical Direction FCRCs, Aerospace and MITRE, are continuing to provide the major portion of system engineering support to the Air Force Space and Missile Systems organization and the Air Force Electronic Systems Division, in lieu of in-house support. MITRE's effort, in terms of professional staff, to DoD has remained essentially constant over a number of years. However, Aerospace has declined about 28 percent since 1967. The loss has resulted in Aerospace Corporation becoming essentially a space system engineering support organization to the Air Force. The missile engineering function has been assumed by other, nongovernment organizations. A second transition, not precisely definable, is the transition from System Engineering and Technical Direction organizations to, primarily Systems Engineering organizations. The Technical Direction function has declined substantially at both MITRE and Aerospace. A third change has been the decrease to a near zero level of the planning function provided by Aerospace and MITRE to their primary sponsors. The Air Force strongly endorses these FCRCs and the flexible manner in which they respond to Air Force needs. In addition, the lesser sponsors have high regard for the quality of these organizations. This creates a "demand" for additional use of Aerospace and MITRE that cannot be provided at this time because of overall ceiling limitations on FCRCs.

The Laboratory FCRCs [Lincoln, APL(JHU) and ARL(PSU)] have remained basically unchanged in size, with a collective professional staff that has neither grown nor dwindled significantly since 1967. All of the University laboratories have extremely close ties with their parent school and, although responsive to DoD needs, accomplish this goal within the broad policy guidance of their respective Universities. They continue to provide highly productive and innovative work for the DoD and have been most flexible in meeting changing operational and/or technological challenges. The facilities and equipment of these institutions have kept up with the times and provide excellent background for the acquisition of highly qualified professionals. The Services and other sponsors depend heavily on the Laboratory FCRCs for a relatively small but important portion of their laboratory R&D.

The Task Force had the opportunity to review and use previous studies conducted by various groups during the past 10 years. Principal references used by the Task Force were:

- DSB Task Force on Federal Contract Research Centers, 24 October 1966 (Alpert Report) *received*

An Assessment, The Need for, the Roles of, and the Alternatives to the Use of MITRE and Aerospace, 3 October 1968 (Terhune Report) *received*

Report of the Special Study Group on Federal Contract Research Centers, 30 August 1971 (Harwood Report) *received*
ADA007565

Statement by the Director, Defense Research and Engineering before the ad hoc Subcommittee on R&D of the Senate Armed Services Committee, 5 April 1972

Final Report on Air Force Federal Contract Research Center Sponsorship, October 1974 (Small Review Group). *received*

These reports, plus other material developed for the evaluation of FCRCs, provided the Task Force a baseline upon which to make considerations without the necessity of redoing much of the effort undertaken by the previous study groups. The Task Force acknowledges the values of this past work in arriving at its recommendations and conclusions.

Message left to her on 4/5/77
202-697-5737
Mrs. Earnes

V. DISCUSSION OF ISSUES

A. NEED FOR FEDERAL CONTRACT RESEARCH CENTERS

At the risk of some repetition of remarks made in the introduction to this study, some historical context is necessary to an understanding of the *need* issue with respect to the FCRCs. During World War II, desire for the involvement and active participation of the scientific community in decision making and in solution to real problems experienced by the government in the conduct of the war led to formation of FCRCs. The Radiation Laboratory at MIT, the Underwater Sound Laboratory at Harvard, and the Applied Physics Laboratory of Johns Hopkins were the progenitors. The need for the "honest technical broker" attitude continued after the war as a full realization of the complexity of the new technology and its impact on the military, and the civilian management of the military, became evident to the decision makers in government. They sought out, or created, the study and analysis talents of the not-for-profits such as RAND and IDA to satisfy this need. Finally, although professional engineering services and scientific assets were present in the government civil service and military ranks at the time, the Ballistic Missile programs and the Air Defense Electronics programs were too large and too complex tasks for the Air Force to accommodate within its internal resource structure at that time. TRW/Space Technology Laboratory, with hardware manufacturing exclusion, and MITRE Corporation, a not-for-profit, were created to systems engineer these two program families. Aerospace Corporation replaced STL under Congressional pressures questioning the propriety of a profit-seeking corporation in this role. Paralleling the DoD pattern, the AEC managed its weapon development activity through the auspices of the University of California by the establishment of the Los Alamos and Livermore Laboratories.

The characteristics of the FCRCs noted above were judged at the time to be vital to the roles played. In general, detachment from day-to-day operations, the absence of proprietary manufacturing prejudices and concomitant financial considerations, the technical excellence and dedication of the people in research at university centers, and the absence of military service biases, tended to influence the decisions in what were judged to be purely technically dictated terms. It was also felt that renewal of vitality and quality could better be assured in the management environment of the not-for-profit corporations. Finally, and very importantly, a priceless memory could be, and was, stored in these organizations' cataloging of lessons learned over a very broad and deep spectrum of events and circumstances.

Changes have occurred since the inception of the FCRCs. Federal salary structures have changed upward, military and civil service personnel have been schooled in the new technologies and in modern analytic methods, and a total industry in technical services has been born and is growing in the private sector. These factors and others have led to an average of one study per year on the subject of either the need for, or the management and control of, the FCRCs.

Perhaps the most telling criterion for judging need is the expression of demand. All FCRCs involved in this survey were, in effect, oversubscribed. In every case, we found positive statements of need and expression of intent for continuing sponsorship and support on the part of

DoD agencies concerned. Not all specific statements of need were free of criticism of the FCRCs emphasis on sponsor priority of effort nor in every case did we find precise agreement on detailed roles. In no case did we find any suggestion that, in the short term, the mission of the sponsor could be performed without the service the FCRCs are now providing. On the other hand, almost universally, statements were made to the effect that the mission could, in time, be performed by alternative methods. Since we have ample evidence that this latter case is, in fact, true, one then must make value judgments as to relative merits for the longer term solution in various forms. In the case of RAND and to some extent ANSER, CNA, and IDA, the issue becomes one of perspective. Can one describe a problem to another agent in a sufficiently detached manner so as to provide objective analysis free from the influence of sponsor viewpoint and prejudice? At what level organizationally would one introduce the product of this analysis? Does the need in itself create characteristics of the performer? Could one expect detached treatment from a performer with organizational loyalties, memory and aspiration related to his product? In the case of the product-related FCRCs — APL(JHU), ARL(PSU) and Lincoln Laboratory/MIT, the need issue is more broadly related to their total environment. The academic and research orientation of these institutions, their special facilities and people, and their divorce from proprietary-product interest in manufacturing is attractive to their Service sponsorship because of the creative totality the institution itself represents. The large Systems Engineering agencies, MITRE and Aerospace, are a more difficult case to substantiate in a need sense over the long term. No question is raised as to the basic need for the function both perform. Both were created at a time of acutely perceived need when industry was judged either to be incapable or politically unacceptable as satisfiers of a real need. The case for these two agents needs to be considered at least in terms of start-up costs. They exist, their function must be performed, and a cost is entailed in converting to any other form for satisfaction of the need. Civil service organizations do perform similar functions elsewhere and one answer in the long term would clearly be the establishment of such an agency. Military organizations, on a lesser scale, have accomplished complex tasks with some similarity to those performed by the FCRCs and that solution is an option. The establishment of suitable billets and the recruitment in depth of qualified personnel to fill the billets could prove troublesome in these two latter cases. Private industry, with suitable restrictions, can and does perform similar roles. On the other hand, no clamor has been noted for new additions to the FCRC list and these restrictions on management freedom have had, at least, that effect. Some transient effect will, in every case, be encountered in any conversion. A new "special relationship" will have to be established. A time of overlap and a proper, careful, transitional phasing will need to be arranged. Finally, some arrangement for the establishment of a new corporate memory and the transfer of the old memory will be essential if minimum impact on mission is to be expected. It is doubtful that this corporate memory can be provided on an across-the-board basis in a major field of endeavor by competitive industry — without having the Defense Department provide an unfair advantage to the company that would have access to all of the information required to perform this function effectively.

B. APPROPRIATENESS OF FCRC WORK ASSIGNMENTS

A continuing, frank, intimate, and privileged working relationship between sponsor and performer is probably the single common attribute one can make for the FCRC. The special relationship so created is not a unique FCRC/Sponsor characteristic; government agency/ industrial contractor intimate relationships do exist on some critical programs. This intimacy may also be the occasion for the largest body of criticism about the FCRCs. It gives the appearance of favoritism to the critic who feels outside the family when government procurement actions have eliminated him from an award. The critic construes the action as having been influenced by advice received by the procuring agent from an FCRC; perhaps, too, he sees work being performed by the FCRC for which he feels qualified. In both cases, he is frustrated and the FCRC is the common element. Since taxpayer resources are involved, his recourse is to the executive department appointed official or to the Congressional element responsible for oversight and appropriation. Is the government interest best served, then, when this challenge to its conduct of affairs in the public interest is constantly brought to its attention?

The consensus of prior studies to which we have had access was:

- (a) It is in the DoD's interest for each major DoD component to do its own decision making, but to have at least one intimately related study and analysis capability outside its command structure. This allows objective challenge to be offered the decision maker to sharpen his views of the advocacy position taken by his in-house agents.
- (b) A combination of in-house R&D activities, industrial muscle and technical capabilities, and the university-related laboratories, provides both a mix and a control, which strengthens the overall defense R&D community and provides the comparative performance necessary to give options for choice to the Government on how best to perform a given task.
- (c) Some jobs at some times are too complex for government to handle in-house and, at least in their early stages, are not appropriate to assign to industry unless suitable safeguards are applied to protect the competitive process, especially when very large procurements are involved. On the other hand, when government feels it must act, no job is too big. Apollo is an obvious example.

We believe the privileged status of the FCRCs is in fact privileged — both with respect to government *and* with respect to the industrial performers who must provide the final products, the systems to perform military missions. Some performers must be so privileged or the work done will repeat steps long resolved and unnecessary and wasteful expenditures will be made, perhaps even on an ultimately faulty premise.

Why can't this privileged access work be accomplished within the permanent resources of the Defense Department? In most cases, where resources exist, it *is*. The report of the Commission on Government Procurement (COGP) covering all aspects of government's "Acquisition of Research and Development" makes comparisons showing that of the \$15.5 billion of the analyzed year's Federal R&D budget, over 25 percent was expended at in-house facilities. In the case of Defense expenditures during that year, 25 percent was expended at in-house laboratories. The share of the same budget expended at FCRCs was about 3 percent, leaving the bulk of the remaining R&D expenditures, most of which were not in the privileged class, for all other performers. Industry was by far the largest recipient of all Defense R&D funding in that typical year.

If the difficulty of providing in-house resources in adequate depth and span of talents and quality is as typically reported in the AFSC Terhune report of 1968, the report of the Air Force Small Review Group of 1974 and the Congressional testimony of the Director, Defense Research and Engineering, then the possibilities of privileged source on a continuing basis narrows down to two reasonable choices, both select groups: a safeguarded segment of industry or the FCRCs. Select industrial activities have performed in this role before, where systems engineering is the primary product and safeguards satisfactory to the Congress have, in general, been negotiated. It is likely that with mature development, this practice can (and should) continue.

On the other hand, for policy guidance, and as a check on and critique of advocacy positions, the case for the industrial agent becomes less clearly desirable. Since memory in the system is an important quality and cost factor in continuing analysis and study activity, the tendency is strong that single preferred performers would emerge as captors of a given procurement agency's awards for a given area. In this way, a new "corporate memory" in a mission area would grow, and the tendency, for sound economic reasons, would be to reprocur from the same performer/supplier. Either the profit-seeking industry, not so privileged, or the Congress would surely react to this "favoritism" if past experience is a guide.

A different consideration with respect to the appropriateness of awards to certain of the FCRC performers is the nature of the interrelationship which grows between performer and sponsor with respect to policy advice. Can a contracting agent at a level deep in a command influence the product of a performer whose advice is targetted at the top of an organization? How do cross-command problems get resolved objectively if one command controls the purse strings with respect to the generation of policy advice? An advertised procurement with open bidding for study activity of this nature might be extremely unwieldy to handle also. Therefore, the total relationship between the performing member, his total working environment, and the nature of the task to be performed are factors to be accounted for in the appropriateness judgment. Any given task taken as a singularity could well give the appearance of an inappropriate award;

yet when judged in total, with the factors noted, this may not only be appropriate but singularly so. It is not clear to the review group how one can make this point in a convincing manner to the critics of the FCRCs.

There are obvious cases where effort in R&D outside the privileged field or within the resource capacity of the government itself should not be awarded the FCRCs. Since the amount of such activity appears to be approximately 97 percent of the R&D budget (as reported by the Commission on Government Procurement) — and all of the non-R&D budget — it would appear that the government procuring activities are able to make this distinction. It would be important to make a further investigation to determine whether work that would most appropriately be assigned a privileged performer were — in fact — because of controls applied by the government through FCRC ceilings or Civil Service limitations — assigned to a performer who was not best suited for the task because of inherent conflict of interest. Are we, in fact, penalizing ourselves with unrealistic gates through which a procuring agent must pass? It is as true today as it was when the FCRCs were first established that government, Defense certainly, is faced with many complex issues needing objective and qualified analysis, and technical supervision. The perspective from which an issue is addressed can have an important effect on the insight provided by analysis. Finally, the conflicts of interest created by performers having a stake in the outcome, even if not real, but only apparent, would encourage the involvement of disinterested, qualified and properly motivated performers in some aspects of government activities. We wonder, in fact, whether the current 2.5 percent budget commitment for the FCRCs is adequate?

C. CONTROLS

The Congress of the United States, the Department of Defense, the individual Services, Corporate Boards of Trustees, and in some cases (usually university parents), government bodies above the individual Federal Contract Research Center (FCRC) all exercise some form of control over the special form of nonprofit organization termed FCRC. Ten years ago these institutions numbered 18; at the time of Dr. Foster's report to the Congress in 1972, the number was 12; and at the time of study by the currently constituted review group, 9 institutions made up the list. The total professional manpower devoted to Defense issues by these performers has been reduced. The salaries of executive managers and key technical leaders have been legislatively limited. Personnel paid above a given salary level are reviewed and approved at a central government level above the contracting agency. Individual tasks are negotiated to the level of the nearest tenth of a man-year and government audit agencies have resident government personnel in contractor activities.

Particularly in the case of the SE/TD performers, what have not been matched in a control sense appear to be requirements and resources. From all sources — military, civil service, industry and the not-for-profits — a best fit between fluctuating work demand and resources available and directed on prioritized tasks has not occurred. The major fields we examined were in military space and command, control and communication. We saw clear evidence of Air Force switching resources within Aerospace Corporation from ballistic missile to space activities to accommodate to new requirement priorities in Navy and Air Force interest. On the other hand, we also noted that, notwithstanding these changes, the application of the FCRC resources was inadequate to meet demand. No additional civil service or military technical resources were available to fill the gap. While industrial resources have been used in selected procurements, the controls applied to the overall FCRCs resource are such that very large commitments of funding are being made with what might be shallow engineering oversight. The situation at MITRE appeared to be similar, except that the Air Force does have resources, and is, recently, augmenting the military and perhaps the Civil Service technical staffs at the companion Electronic Systems Division of the Air Force Systems Command.

A possible control scheme, which might be useful in such a set of circumstance, might be one keyed to the systems program resources. As new major systems acquisitions are initiated, one could provide a given percentage of the systems program budget to the systems engineering function, dependent on program complexity, and permit the associated FCRC level to fluctuate with program progress. Further modification of the FCRC level, where military or civil service support is available, could be (and has been) effected through the Defense Department management resources as delegated. In all cases the control for this negotiated level of support should rest with the mission-responsible agent in government.

On a reduced scale we saw evidence of similar constraints at Pennsylvania State University with respect to the Navy lightweight torpedo program, and at Lincoln Laboratory with respect to Navy laser and other activities. In both cases a further restraint not tested on these specifics is the stated policy of the parent against expansion.

The current control scheme by ceiling appears too rigid to accommodate to the exigencies of the situation. Placing the authority to exercise these controls at the level where the mission is to be performed appears to be appropriate. A report of stewardship on a regular basis would provide overview management an opportunity to test the adequacy of the control at the responsible level.

D. SIZE & GROWTH

What is an optimum size for a FCRC or what growth rate should be permitted to maintain momentum within the organization so classified? Is the characteristic of growth a proper criterion of goodness and success for all organizations? One view holds that stably managed entities will never exhibit the verve, elan, and enthusiasm of the growing, changing unit. Creative, original, innovative people thrive on change. Is there some characteristic of the FCRCs work area that would permit attracting these people in a nongrowth environment? The current control concept does dictate level or, in most cases, declining resource management in behalf of the Defense Department mission.

The congressionally established ceilings for the Department of Defense for the FCRCs has not inhibited total growth. Some of the FCRCs have grown since the constraints have been applied. Others have chosen to diversify to stabilize overall size rather than to shrink. Some have done neither. What other constraints are there on size and growth?

First of all, there is a minimum size for any mission. Each skill area must have adequate representation. The depth to which program areas can be worked will depend on manning. The impression one has is that the increased and forecast increasing utilization of the space medium to extend capabilities in the tactical field of operations will tax the current resources of Defense to accomplish its missions. Similarly, not enough capability exists to perform the architectural tasks and the scoping and unification tasks needed in systems engineering command, control, and communications systems currently planned for acquisition if the 5-year forecast on funding to be applied to this mission area is a true reflection of the activity expected. Either an in-house systems engineering capability will have to be grown, the Lincoln Laboratory, and MITRE and Aerospace Corporations will have to expand, or some methodology for placing that function in the hands of industry will have to be devised in the face of the Congressionally imposed restrictions on hardware-supplying agencies regarding their SE/TD activities.

In the case of the university-controlled FCRCs, our observation is that the stability evidenced over the past 5, or 10 years in these organizations indicates that the trusteeship and the operating management of the universities involved felt that those activities — Lincoln Laboratory, Pennsylvania State University Applied Research Laboratory, Johns Hopkins Applied Physics Laboratory — were about the right size in the university community. These laboratories have been reasonably self-regulated.

The study and analysis FCRCs have followed a pattern more closely akin to the university laboratories than to the systems engineering organizations. We believe this to be a manifestation of government controls, except for the RAND Corporation which had begun a trend towards some growth through diversification long ago. Again, however, in RAND's case, there is clear evidence of manpower-level modulation downward with respect to Air Force activities as a consequence of the Government's active control. The modulation in growth applied by

the Service agencies, for whatever reason, is clearly evident and all FCRCs show some effect of this.

A concluding observation might be that growth appears to us to be a noncritical element in the equation of utility as far as Defense is, or should be, concerned. The university laboratories are self-regulated to a very large degree and only minor control attention appears to be needed from outside forces. The study and analysis FCRCs are growth controlled adequately by their Service sponsorship now, and their avowed independence will tend to restrict growth in their traditional roles. Who needs too much criticism from paid critics? On the other hand, where advocacy of a sponsor's course of action is the product, as in the case of the SE/TD contractors, the planning and study activity should probably be regulated as a percentage of total effort. One growth-modulating scheme could be a phased elimination of FCRC support on mature systems by prearrangement so that Industry performers move into activities behind the FCRC and the scarce resources in intimate contact with the Service sponsor move on to new systems activities. Major fluctuations in size of these SE/TD FCRCs could be one consequence of this scheme. The turnover in personnel, in depth, would be beneficial in a renewal sense. The "corporate memory" would have to be guarded by some combination of some line item like support covering laboratory-like and planning activities.

E. QUALITY

A characterization of the FCRCs frequently quoted is that they bring to the Government's service a quality impossible to attain within government. Since all FCRCs have differences in mission, we find differences in personnel characteristics and professional qualification. This same statement is true with respect to industrial and government research and development activities. The generalization can be supported to a degree by comparing academic qualification of professional personnel. The FCRCs as a whole tend to have a significantly higher proportion of their professionals holding advanced academic qualification, and of those holding advanced degrees, roughly twice as many doctorates appear on the FCRC roles as appear on the roles of the Defense Department in-house laboratories. Another generalization which probably has truth in only some cases concerns "hands on" experience. Lincoln Laboratory, Johns Hopkins Applied Physics Laboratory and Pennsylvania State's Applied Research Laboratory clearly can make this distinction. Aerospace and, to much lesser extent, MITRE have research operating activities, but to a very much lesser degree than the university laboratories — certainly some government laboratories have comparable levels of "doing" activity. The study and analysis FCRCs have essentially no such distinction.

A method for acquiring familiarity with developing technology could be a turnover which brought into the system new faces from an active industry or from the university research activities. All performers exhibit some of this mobility; it is higher for the FCRCs than what we would expect the government organizations could experience. As one might expect, the rate varies dependent on the characteristics of the organizations. On the average, the annual turnover at the FCRCs has been about 10 percent over the past 5 years. For some activities, the "hands on" laboratories, this rate appears reasonable. It may not be so for the system engineering FCRCs. In the same vein, it is important to note that in-service laboratories are experiencing an increasing change rate, largely occasioned by the rate at which civil servants are retiring. An encouraging trend in qualification for the in-house activities is also to be expected as a consequence of the much more favorable pay rates professional civil servants can expect now over those of former years. This turnover is occurring more frequently now at all levels in government laboratories.

Finally, the tone, forcefulness and competence of the leadership may be a vital factor in establishing the quality of product in any organization. The total environment of the FCRCs comes through in general as a net plus for Defense on this score. On the other hand, where this element is weak, the impact is immediately evident. Should a continuing involvement with FCRCs be desirable to Defense management, it may be important to consider some method for rotation at the top levels of management. Since the very independence of these corporations is a sought-for attribute, it is not clear how this might be accomplished. It is worth a study.

F. COSTS

In examining the costs of the functions performed by the FCRCs, three fundamental cost items were examined. These cost elements were the salaries of the members of the technical staff, the largest single element of the costs involved; the overhead or support costs to enable the members of the technical staff to function properly; and facility and associated costs. There are also a large number of myths, some differences in standards of accounting, and a number of hard-to-quantify costs which complicate any cost comparison in depth. Finally, there is a judgmental factor which may be even more significant in costs judgments than all of these mentioned above. How much technical direction and systems engineering is necessary to adequately perform with proper assurances the complex task of producing new, better and more efficient national security systems?

On the subject of salaries for technical staff members, we noted that in general the costs associated with salary for staff members were normally those necessary to meet the market for the talents represented by the various technical staffs within any given market area. Staff (MTS) salaries, in general, were in line with industrial salaries in associated industries, but were equal to or lower than comparable government salaries paid for the same functions. In examining support costs, salary level and overhead percentage on the basis of direct salaries and wages we found roughly comparable in all elements of the industry. It was not possible for us to make similar comparisons with government agencies. On the question of facilities costs, we note that there are some investments in unique and highly specialized facilities at a number of the FCRCs we visited. Two examples are cited: the 48-inch water tunnel at Pennsylvania State University used in torpedo research is a "one of a kind" facility that would either have to be moved or manned by a contingent of personnel from another performer, such as the government itself or a for-profit agent, on the current site if the same functions are to be performed for the sponsors. The circumstances of an interested and competent faculty and an involved university administration might be difficult to duplicate. Similarly, the Lincoln Laboratory has built and operates unusual facilities associated with radar and laser propagation properties. Again, the proximity of the facilities to MIT and its involvement with faculty and research staff would be a difficult circumstance to duplicate. Both examples imply added costs with any changes.

Some of the myths that have grown up about the FCRCs center on these cost factors. As an example, critics in citing the cost of an MTS frequently quote the salary of an MTS, forgetting that a task has been negotiated in a contract which may have very large support requirements. The critic does not see the difference between contracting for a performed task in total and job-shopping a body. All performers, including at times FCRCs, buy bodies to relieve program pressures on a short-term basis and they do, in fact, buy them at nearly the MTS salary cost. On the other hand, in buying a task, the procurement agent has to describe the nature of the work required and he pays about what the market demands for that performance. Only incidentally is the number of technical people involved used as an accounting measure for sizing tasks. Since FCRC overhead as a percentage of direct cost

was comparable to, or lower than, that we see in the for-profit industry for similar functions, we can see no appreciable or significant differential in cost related to this factor for any reasonably competent performer.

Another myth is that associated with individual staff and executive salaries. We found no evidence to indicate that the average salaries paid by the FCRCs were any different for comparable quality people from those paid by any other performer. As a matter of fact, in some instances, we found government salaries for comparable levels slightly in excess of the salaries paid at the FCRCs. There is an obvious exception to this comparison where executive levels of compensation reach the Congressional limitations.

We did examine fees paid FCRCs and find that the weighted guidelines employed in fee negotiations with not-for-profit organizations as modified from ASPR do result in fee structures which appear to us to be reasonable, and about half those traditionally paid the "for-profit" industry. Some management freedom is essential to cover the acquisition of needed facility and equipment items to conduct contracted research and for attacks on future problems. Transitions between major program onsets and demises require some management flexibility too. There appears to be no practicable substitute for fee. It should be noted that the ASPR-modified weighted guidelines do take into account the income tax factor in establishing fee for not-for-profits.

A final point on costs has to do with cost competition on contracts that can be reasonably completed. The for-profit industry performer can exercise judgment as to quality of people and, in some special cases, overhead rates to be applied when he bids on well-understood procurements. On the other hand, the memory in the government's procurement system must be well established and adequately manned or the savings on one task may well be lost many times over on subsequent tasks. The final judgment on the suitability of competitive jobs probably can be made only on an individual task basis. The complete environment of the FCRC performer is a factor to be taken into account in this respect. The availability of a seasoned and informed team with memory in the system should have a beneficial effect on cost to the Government. The presence of other forms for accomplishing the function provides a measure of relative efficacy.

G. DIVERSIFICATION

Diversification has occurred in a majority of the FCRCs in one form or another. A few of the FCRCs have not altered their basic sponsorship since their inception. The ranges can be represented by approximately a 50 percent diversification in the case of the MITRE Corporation and RAND in other than traditional sponsorship, and the Pennsylvania State University Applied Science Laboratory and the other study and analysis FCRCs would be the other extreme where essentially no diversification has occurred.

Like every other issue discussed, there are two sides to this argument. On the one hand, constraints applied as ceiling dollar volumes have not been maintained at an annual rate comparable with the rise in the cost of doing business. The result has been an economic bind within the Federal Contract Research Centers to the degree that, after reasonable economy measures were applied, the only remaining freedom for management action has been the lay-off of members of the technical staff. This is occurring in some FCRCs. Others are converting their staff to new areas closely associated with the problem-solving capabilities the FCRCs have built. Their argument is that, although they are special agents of the Defense Department, they are not completely captive by Defense. A bright group of people encouraged earlier by Defense to seek support or apply talents, depending upon one's viewpoint, at agencies other than Defense — where very complex problems are facing government outside the field of Defense — have found a market for their services. The consequence of these forces has been a varying mix of sponsorship for the FCRCs.

Two supporting arguments are offered as representing gains accruing to Defense resulting from diversified activity (other than the direct services of a competent team to solve problems for other government agencies). These supporting arguments are: (1) the spread of the overhead costs over a base that includes a large number of sponsors reduces the expense to any given sponsor, and (2) although Defense has a limitation of funding available to be expended in the FCRCs, other agencies do not, and Defense is a net gainer by having their experienced team exercised to keep their skills sharp on problems requiring the skills assembled by Defense. Some mobility is provided management between Defense and non-Defense areas of support. There are obvious truths in these arguments.

The counter arguments to the issue are: (1) the divided attention of management degrades the effort applied to Defense, particularly since a growing activity will require more management attention than a stable activity, and (2) an unfair advantage accrues to the FCRCs over the competitive profit-seeking industry. That argument is developed through statements that a floor or core of support is provided at known levels for predictable time periods by Defense, permitting management of the FCRCs to concentrate their efforts on the acquisition of new capabilities, and generally these new capabilities awards are made on a negotiated, non-competitive basis.

On balance and in the context of the overcontrol observations made under C above, we have no compelling argument to make against diversification, if the sponsor can satisfy himself that diversification in the FCRC does not constrain him in the conduct of his mission. Further, he should satisfy himself that diversification does not dilute the ability of the FCRC to support that mission in the future. We believe, therefore, that today diversification is not a critical issue, and if any effect is felt, it is more a gain than a loss. Since these conditions can change with time, it would probably be best that the current Defense practice be reviewed annually to be assured that the balance does not tip unfavorably.

H. COMPETITION

One issue specifically raised by critics of the Defense Department's relationship with the FCRCs is that termed "unfair" competition with private for-profit performers. The point is made that FCRCs operate from a privileged "special" relationship, and that Defense procuring activities take advantage of this special relationship to circumvent the Armed Services Procurement Regulations for their convenience, thereby losing the advantages to be gained for the Government in cost competition.

To put this issue into perspective, one must first note that approximately 2.5 percent of the Defense RDT&E budget is expended internal to the FCRC performers. The largest fraction of the Defense R&D budget is expended through the private for-profit industry, and all of the larger procurement budget is so expended. On the other hand, in detail, it would be difficult to conclude that at some time, under some circumstances, a government procuring activity would not take advantage of the possibility of short-cutting procedures to place perhaps a time-critical study at an FCRC activity for convenience. Much more likely, however, is the fact that the total environment of the FCRC body of intimate knowledge and its corporate memory of the Government's experience in a given field or area of activity make it the proper choice for some sensitive, time-urgent, or background-peculiar study before industrial or other performers can be included.

FCRCs should, in our view, compete with all performers on new ideas which are self-generated. We find clear evidence of such competition between FCRCs, for example, on communication satellite concepts and technology (MITRE/Aerospace/Lincoln). Basic navigation-satellite-based systems concepts have benefitted in a marked way by competitive study, technology development, and concept formulation between the Aerospace Corporation/Johns Hopkins Applied Physics Laboratory and the Naval Research Laboratory. Lincoln Laboratory is conceptually and technologically in competition with Aerospace and other performers in reentry technology, particularly with respect to penetration aids. Pennsylvania State University's Applied Research Laboratory competes on a healthy basis with Navy in-house activities on torpedo concepts and technology. Many times a challenge to industrial sources can, and should, be made by both the FCRCs and in-house activities, where solid differences of technical judgment can be based on fact generated competitive to the industrially posed solution to a given problem. Without this challenge to the industry, the possibility of oversight in critical areas and consequent bad procurement, is, in our estimation, appreciably higher than prudent regard for the taxpayer's interest and, more importantly, the nation's security should permit.

There is a family of procurement activities where Defense should not permit the FCRCs to compete in our opinion. These procurements are those resultant from circulated requests for proposal (RFP). It seems to us that once Defense has decided that it can completely describe the intended procurement action and judges that all performers can be polled, the FCRCs should be excluded. Obviously, any procurement with a repetitive or production motivation should, in like manner, exclude the FCRC performer as an inappropriate source.

VI. OVERALL IMPRESSIONS

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As a consequence of the review group's activities at the request of the Director of Defense Research and Engineering, we have formed the following major impressions about the issues we have perceived in our own deliberations or have been directed to address in the charge to the committee:

1. FCRCs currently provide a valuable and different perspective to the solution of complex problems, from the study through the systems application level, in the conduct of Defense R&D. The present need for their services is clearly stated and, in the short term, we see no alternative.
2. The quality of the FCRC staff has remained high, and perhaps improved, with respect to time and in comparison with the industrial and in-house performer in like roles. The total environment of the FCRC/sponsor relationship enhances quality.
3. The costs of the services rendered by the FCRCs remain competitive with the costs of all other performers in like roles. A judgmental factor, difficult to quantify in the case of the SE/TD performers, complicates this observation somewhat and leads to the question: How much technical supervision is needed for what tasks?
4. Controls applied by the Government to the FCRCs may be more harmful than helpful to Defense. On the other hand, the need for some control has been demonstrated in the past and is, to some degree, still evident.
5. Diversification in the work of the FCRCs into fields not related to the DoD programmatic effort is a troublesome trend. It clearly has benefit to Defense in some reduction in required support and in stimulation to the staff. However, it has the attribute of dividing management's attention and it sometimes creates pressures from the professional services' industry. It benefits other Government agencies. In sum, we believe that for now, the net gain is in favor of Defense and we agree that the locally responsible Government contracting agent should be in control. An annual review of the practice at the DoD level should maintain perspective.

6. The requirement for a nonaligned, qualified, but solidly grounded, informed, and continuing performer in analysis and the generation of policy advice without involvement in command line appears to be well established.
7. The review group examined mission responsibilities, and in some cases, their definition appeared to be lacking to a degree which could be important in output quality or appropriateness evaluations. MITRE gave a diffuse and less responsible impression in that context to the group than did others. Lincoln, while superb in quality and in some management attributes, left questions in our minds concerning where the talents were really directed by its sponsors. IDA, CNA and ANSER were difficult to distinguish from their sponsorship, although it is clear that some independence from sponsor comes through. These factors, if real rather than impressionistic, may be more sponsor-related than performer-related in all of the cases cited. Pennsylvania State's ARL and the Aerospace Corporation seemed clearly in focus. To somewhat lesser degree, Johns Hopkins and RAND concentrated along known mission lines with respect to their principal sponsorship, but diffused with respect to secondary sponsorship.
8. FCRC leadership differences were evident in the responsiveness and responsibility exhibited by the organization.
9. In all cases, sponsor enthusiasm and expressed need for the FCRCs were clearly evident.
10. Privileged relationships are necessary, although not unique to FCRC.
11. With difficulty over a period of time, and at some increased cost in the interval, all FCRCs could be either converted to some other form or eliminated. Defense could perform its mission in the area associated with FCRC support through different agents. The function these agencies perform, however, is crucial to an effective Defense.
12. Mobility and renewal, although better than that which the civil service exhibits, is still not good enough overall in the committee's view, particularly in the senior management of the FCRCs. Stagnation in ideas is the more serious consequence of such a trend.

VII. RECOMMENDATIONS

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1. The Federal Contract Research Centers, supporting Defense Department agencies, are so valuable a resource, because of their perspective, the quality of their work, and the responsiveness they can exhibit because of their special relationship to their sponsorship, that they should be retained and protected in essentially their present roles.
This recommendation is meant to be read as a strong endorsement of current Defense policy in utilization of the FCRCs.
2. Alternatives to FCRC utilization all require transitional preparations which will be sufficiently extensive that, in the event Defense decides on one or more such alternatives, a phased changeover must be programmed over a period of from 3 to 5 years. Our rank ordering of the preferred alternatives follows.
 - a. Removal of line-item support for the current FCRC family should be with the two large SE/TD performers: Aerospace Corporation and MITRE. This would put them on a basis comparable with Johns Hopkins University's Applied Physics Laboratory. To compensate these performers, all competition and growth restrictions should be removed, and ASPR guidelines with respect to fee and marketing should be modified accordingly. Whatever special relationships these three operators can negotiate with their respective present Program Manager-sponsors should be allowed on a contract-by-contract basis. Let them compete with the industry and in-house performers for their future after suitable phase-out or novation of current contracts. Level-of-effort contracts should be negotiated with Lincoln and Penn State on whatever terms they can obtain from each of their current sponsors. This will work a particular hardship on these two organizations, since they traditionally have had single-contract coverage and they do not have staff for the administrative functions attendant to multiple-contract operation. Lincoln at least will have trouble surviving this transient because of its multiple-sponsor characteristic. The study and analysis performers, RAND, IDA, ANSER and CNA, will be best replaced by organic performers combining civil service and military personnel, and government lead time in establishing billets and staffing them should govern the time phasing. Continuing the current contract form would be the most appropriate interim methodology for assuring support to their current sponsorship. Negotiation between Defense and the Services on exact schedules is required.
 - b. A phase-out of all FCRC performers by fiat through direction to the individual service secretaries with a set time scale to be complied with and complete discretion as to the form of successor performers would be a second choice. Our advice would be to put this date 5 years from your decision time.

- c. Individual programs or, better, program areas which Defense deems mature could be designated as inappropriate for an FCRC involvement and a piecemeal reduction in required FCRC support would be a consequence. Industrial performers are competent and eager to acquire the involvement now enjoyed by the FCRCs. A reassessment, perhaps 3 years after this method is employed to reduce FCRC activity, could give Defense management a check on effectiveness.
- d. Government corporations could be created to match each FCRC.
- e. Civil service agencies could be established in all areas.
- f. Technical military personnel could be organized to perform the missions.

The major elements of the alternative solutions proposed above are discussed in detail in the Terhune Report to which we subscribe in general.

- 3. Since we do not recommend any of the alternatives listed above, we make the following recommendations with respect to the governance and operation of the FCRCs.
 - a. Since Lincoln, PSU/Applied Research Laboratory, and JHU/Applied Physics Laboratory have a history of stability, a parent organization with quality and an expressed intent to regulate size, and a reasonably unique orientation, we feel the best management posture Defense can adopt would be as close to "hands off" operation as is consistent with maintaining focus and meeting the accountability requirements of contract administration.
 - b. The study and analysis FCRCs are more needful of level-of-effort line-item support.
 - i. RAND needs to apply itself to its non-Air Force DoD tasks in a mode more consistent with its Project RAND activity. This will require closer involvement with Defense collectively and we feel a steering committee with Defense Department chairmanship is at least an initial step one might contemplate.
 - ii. IDA needs a tougher problem orientation with a closer involvement on major and controversial Defense/JCS issues. WSEG gives indication that it understands the recent lessened impact of IDA on decision making and the correct words are used about reorientation. Keep an eye on that issue.

- iii. ANSER and CNA appear to be fast-reaction, technically oriented agents of the Air Force and Navy staffs. CNA exhibits much more independence than does ANSER and that pattern may be useful to keep in mind. The deeper involvement between CNA and the fleet through the OR program afloat may be worthy of emulation. Both need more rigorous quality-assessment processes for their output.
- c. MITRE and Aerospace ought to be regulated to program funding with fixed percentages of program budgets, locally negotiated, applied to independent research and planning activity. A single contracting agent in the parent sponsor organization as now employed appears to us to give control where it belongs. The Aerospace and MITRE managements must be made to realize no guaranteed level of support can exist under this scheme and manpower fluctuations in phase with program life spans are an inevitable consequence.
- d. All of the FCRCs are exhibiting stagnation trends which vary in degree. These trends should be modified. This attribute is particularly pronounced in the management tiers just below the principal executive officer. We strongly recommend that, by what ever means practical, some mobility be encouraged. Suggestions are noted here, but it must be pointed out that delicate negotiation with Boards of Directors or Trusteeship will be an inevitable consequence of these suggestions.
 - i. Employment contracts for fixed time spans for any officer or employee above a given annual salary level — e.g. \$45,000.
 - ii. Transfer of FCRC senior management staff between centers for fixed terms (Lincoln/MITRE; RAND/Aerospace and between any of the Washington-area FCRCs on a trial basis could be attempted with little personal inconvenience for the individuals so chosen).
 - iii. Fixed-term assignments for some percentage of all new hires may be another strategem for turning over a higher volume of the technical staffs.
 - iv. Some arrangement with industry to permit internships for FCRC personnel in development- and production-oriented organizations may produce some part of the desired cross fertilization.
- e. The currently used modified ASPR guidelines for fee negotiation should be retained as long as a mutually benefitting special relationship is retained.
- f. After much discussion and some internal disagreement on scale, the committee consensus is that current DoD practice on diversification should remain as it is presently understood.

- g. Staff salaries at FCRCs should be allowed to stay as they are now – market determined. Senior level salary restrictions should be removed at the rate at which the Federal Government has relaxed its senior-level compensation restrictions.

- h. While our observation is that compensation rates paid technical staff personnel in the FCRCs are reasonable, we are unsure about determinations made with respect to how many people belong in a given category. A standard for negotiation should be developed to guide the responsible government agents in this respect. In all other cost-related areas, we find no significant differences between the FCRCs and the industry.

VIII. ADDENDA

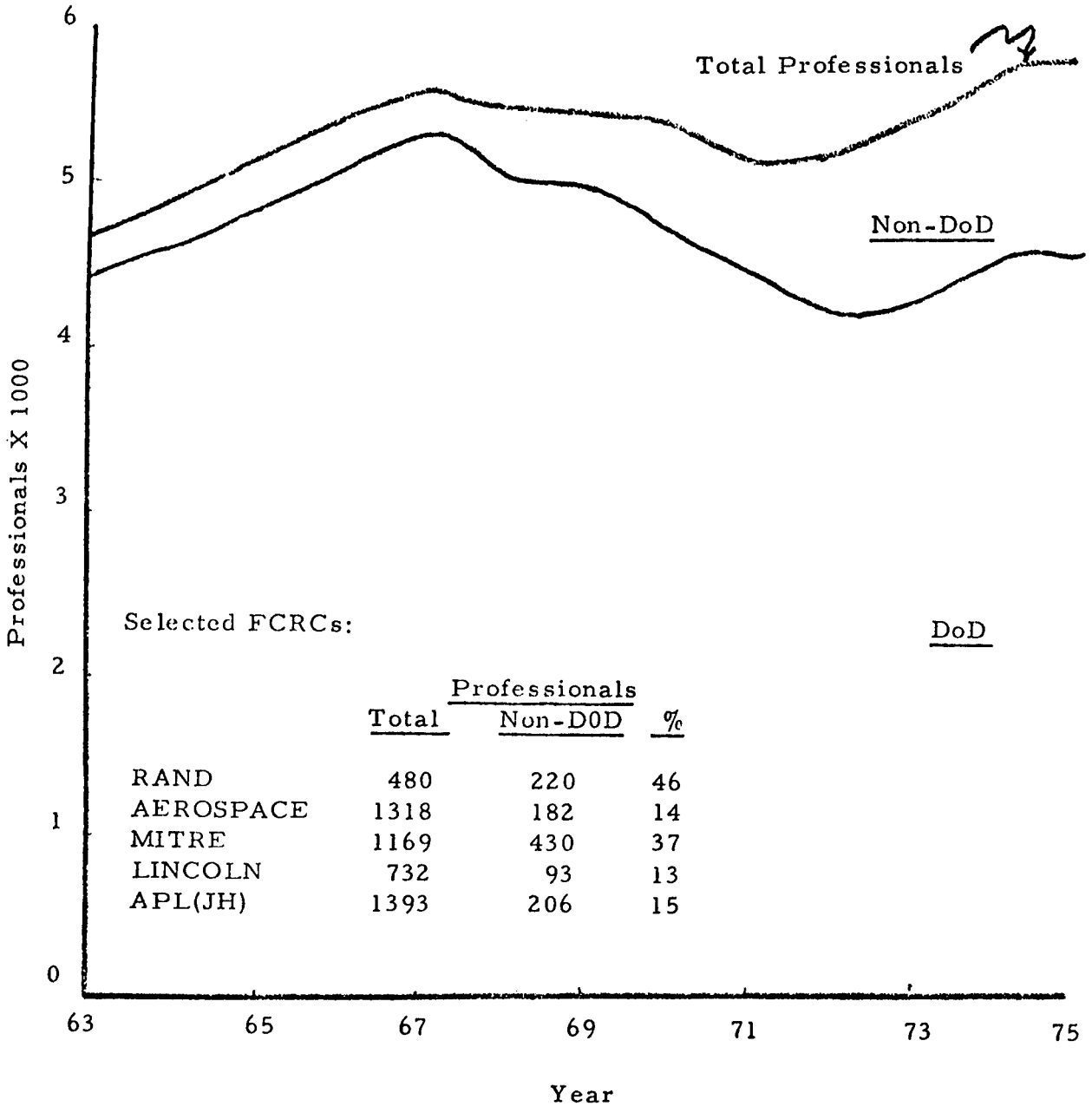
(To be answered by each individual FCRC)

1. Does your FCRC still possess a type of level of capability outside or beyond that available in the in-house laboratories or in private industry?
2. Do its assigned tasks demand such capability, or could they be done in-house or in industry?
3. Are there extra costs involved in using the FCRC over that of doing the task elsewhere; if so, are they justified by the nature of, or quality of, the work?
4. What are the trends for the FCRC with respect to:
 - a. level of staff competence?
 - b. areas of staff competence?
 - c. attention of management to DoD needs?
 - d. levels of DoD/non-DoD activities?
5. What would be the likely consequences of ending "line item" support in an orderly way?
6. What would be the likely consequences to DoD and the FCRC of a 5- to 10-year phased ending of the FCRCs "special status"?
7. Does the FCRC possess unfair advantages with respect to (a) not-for-profits or (b) for-profits as a result of:
 - a. its privileged position with respect to its DoD sponsor?
 - b. the size of its fee?
 - c. its tax-free status?

when these are balanced against the restrictions peculiar to FCRCs, including:

- a. ceiling control?
 - b. exclusions on work undertaken?
 - c. restriction on competition?
8. Are controls on the size of the FCRC and the tasks it accepts, both DoD and non-DoD, appropriate? Is there a better way?

FCRC DIVERSIFICATION
By Professional Staff



TURNOVER RATES

<u>FCRC</u>	<u>Rate %</u>	<u>Source</u>	<u>Remarks</u>
IDA	50	Notes/Chart	
CNA	13-17	Notes	
APL (JHU)	4-6	Telephone	Over 5-year period
ANSER	16	Charts	
MITRE	10	Notes	
LINCOLN	8	Notes	
RAND	15	Charts	Over 5-year period
AEROSPACE	9	Notes	
PENN STATE	10	Charts	Over 5-year period; very low last year

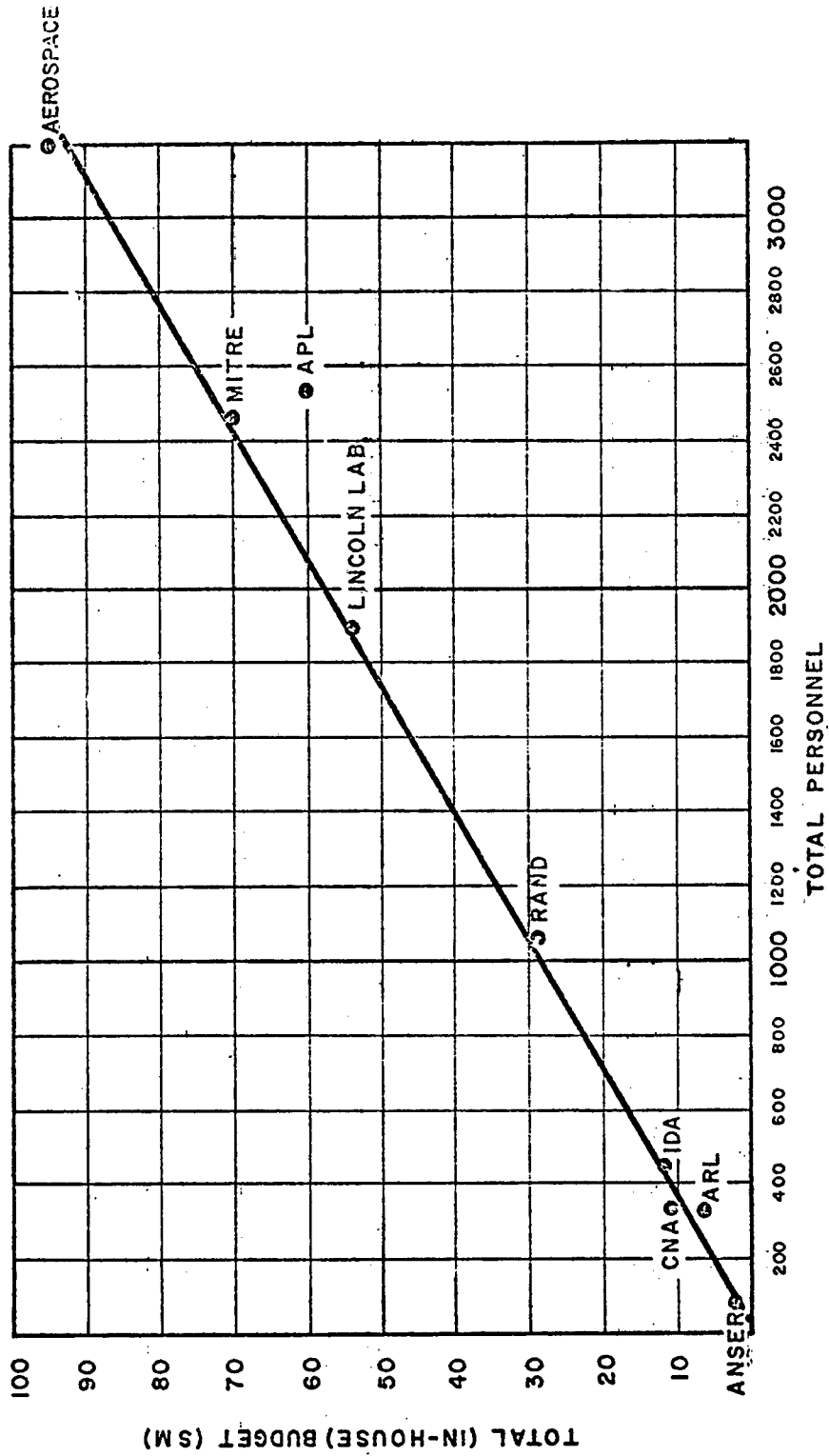
COMPARISON OF FCRC'S

EOR JUNE 75

NAME OF FCRC & YEAR OF FORMATION	LINCOLN LAB (1951)	APPL. PHYS. LAB (1942)	APPL. RES. LAB (1945)	MITRE (1958)	AEROSPACE (1960)	ISA (1956)	RAND (1948)	CNA (1962)	ANSER (1958)
UNIVERSITY AFFILIATION	MIT	JOHNS HOPKINS	PENN STATE					UNIVERSITY OF ROCHESTER	
TYPE OF ORGANIZATION	LABORATORY								
PRINCIPAL SPONSOR	SYSTEMS ENGINEERING & TECHNICAL DIRECTION (SESTD)								
OFFICE OF SECRETARY OF DEFENSE						✓			
AIR FORCE	✓			✓			✓		✓
NAVY		✓						✓	
BARPOWER	TOTAL	1900	2550	2470	3200	470	1070	360	90
	PROFESSIONAL	750	1280	1270	1650	190	500	190	50
TOTAL (IN-HOUSE) BUDGET (1) / DOD CEILING	\$M	53/48	60/50	70/45	95/80	12/11	29/16	11/10	2.5/2.4
PART OF DOD BUDGET LINE FUNDED	\$M	16	—	8	12	—	9	8	1.5
FEE	%	—	3.4	1.9	3.5	4.2	4.7	— (2)	3.7
% OF TOTAL BUDGET TO PRINCIPAL SPONSOR	%	AF 51	NAVY 72	NAVY 100	AF 52	WSEG DARPA 90	AF 31 ARPA 20	NAVY 94	AF 95
% OF TOTAL BUDGET TO OTHER DOD (EXCLUSIVE OF PRINCIPAL SPONSOR)	%	ARMY 17 ARPA 19 NAVY 4	ARMY 5 OTHER 5 10	0	DCA 7 ARMY 14 ARPA 7 OTHER 2	0	6	0	0
DIVERSIFICATION (L.L. NON DOD)	%	FAR NEW RVC 9	NASA DCT 18	0	NASA 16	FEDERAL AGENCIES 10	NEW NSF FEPT HOUSING 43	6	5
PROFESSIONAL STAFF									
ADVANCED DEGREES	%	47	13	24	15	60	39	53	33
AVERAGE AGE	YRS	25	31	35	51	28	38	39	35
MAJOR TECHNICAL FIELDS		SPACE COMM REENTRY RADAR ATC ELECTRONIC SCI	SPACE NAVIG APPL. EVAL AIR DEF NSL COMMAND & CONTROL	TOPOGRAPHY RELIEF SCIENCES	C.I.C. SYSTEMS COMM. SYSTEMS MOT	BALLISTIC MSL SYSTEMS SPACE SYSTEMS SPACE LAUNCHER SPACE JETTER SYSTEM	STUDIES & ANALYSIS	STUDIES & ANALYSIS (NAVY)	STUDIES & ANALYSIS (AF HQ)

(1) TOTAL BUDGET DOES NOT INCLUDE "FLOW-THRU" PROCUREMENT (81.5% TO UNIVERSITY OF ROCHESTER FOR NAVY RELATED RESEARCH

COMPARISON OF FCRC'S



Addendum E

A Comparison of Educational Levels
in FCRCs and DoD Laboratories

Education-level data for personnel working for FCRCs and DoD Laboratories is as follows:

	(1) Total Pers.	(2) Total Prof.	(3) % Prof.	(4) Adv Degree	(5) % Adv Degree	(6) No. Dr.	(7) % Dr.
FCRCs	12,275	6,116	50	3,794	62	1,517	25
Army	24,519	10,908	44	4,170	38	1,674	15
Navy	32,916	12,599	38	4,639	36	1,577	12
AF	7,907	4,389	55	2,297	52	735	16
Total Labs.	65,342	27,896	43	11,106	40	3,986	14

Notes:

(1) Total Personnel means total employed. For FCRCs, this means for both DoD and non-DoD work.

(2) Percent Advanced Degrees and Percent Doctor Degrees is with respect to the total professionals.

In a gross sense the professionals to total employees ratio comparison between DoD Laboratories and FCRCs is not dramatic (43% versus 50%). The Army and Navy have lower percentages (44% and 38%) however; this is not surprising because these organizations have full spectrum laboratories and more need for nonprofessionals (NWC – 69%; NUC – 64%, etc.). The Air Force, on the other hand, leans toward 6.1, 6.2 and 6.3 types of R&D and, therefore, the ratio is more similar to that of FCRCs.

If you look at the level of education within the professional force only (Columns 5 and 7), the FCRCs tend to have more people with advanced degrees. The advanced degrees to professionals level ratio in a total sense is 22% (62% to 40%) higher in the FCRCs than in the DoD Laboratories. The Air Force has a comparable ratio (55%), but their much smaller base does not greatly alter the overall DoD Laboratory percentage.

In terms of "Doctor" percentages, the FCRCs almost double (25% versus 14%) the Services. Even with respect to the Air Force, a significant difference exists between the number of doctors making up the professional force of the FCRCs (25%) as compared with the Air Force (16%).

In the comparison of FCRCs with DoD Laboratories, a question arises concerning the subject – are we comparing "apples and oranges"? Two significant areas exist that could alter the data:

Addendum F

The Services have a number of medical facilities. The FCRCs have none.

The FCRCs have purely studies and analyses organizations. The Services have none.

In order to examine the data without these "differences", the medical data have been taken out of the DoD Laboratory figures and the studies and analyses data have been taken out of the FCRC figures.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	<u>Total Pers.</u>	<u>Total Prof.</u>	<u>% Prof.</u>	<u>Adv. Degree</u>	<u>% Adv. Degree</u>	<u>No. Drs.</u>	<u>% Drs.</u>
FCRCs	10,342	5,130	50	3,009	57	1,007	21
Army	21,509	9,676	45	3,474	36	1,136	11
Navy	31,607	12,192	39	4,361	36	1,411	12
AF	7,611	4,226	56	2,186	52	677	16
Total Labs	60,727	26,094	42	10,021	38	3,224	12

The data show that there is no major change in the relative positions of FCRCs versus DoD Laboratories:

The percentage of professionals is essentially the same

The percentage of advance degrees is slightly lower both in FCRCs and DoD Laboratories but the relative positions are not altered

The Doctors ratio is still essentially two to one, with the FCRCs having the larger percentage of doctors in their professional force.

CONCLUSIONS

FCRCs and DoD Laboratories have a similar mix with regard to professionals as a proportion of total employment.

The FCRCs have a 22% greater population of advanced degrees than that of the DoD Laboratories.

The FCRCs "Doctor" population within their professional staffs is about twice that of the DoD Laboratories' professional staff.

Addendum F