FINAL REPORT

(11)

THE DOD LABORATORY UTILIZATION STUDY

by

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ACKNOWLEDGEMENT

Early in the course of the Laboratory Utilization Study, the authors asked for "some typing help" from one of the ODDR&E secretaries. Our typist ultimately became our viewgraph maker and expediter, arrangement maker and note taker at briefings. She also volunteered to edit as well as type the final report. So while the thoughts are ours, much of the finished product - some of the words, most of the layout and the style - is a result of the impressive talents and hard work of Mrs. Judy Alexander.

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GLOSSARY OF ABBREVIATIONS

ADTC	Armament Development and Test Center (AF)
AFAL	Air Force Avionics Laboratory
AFAPL	Air Force Aeropropulsion Laboratory
AFATL	Air Force Armaments Technology Laboratory
AFCRL	Air Force Cambridge Research Laboratory
AFFDL	Air Force Flight Dynamics Laboratory
AFOSR	Air Force Office of Scientific Research
AFRPL	Air Force Rocket Propulsion Laboratory
AFSC	Air Force Systems Command
AMARC	Army Materiel Acquisition Review Committee
AMC	Army Materiel Command
AMD	Aerospace Medical Division (AF)
AMMRC	Army Materials and Mechanics Research Center
AMRL	Aerospace Medical Research Laboratory (AF)
APL	Applied Physics Laboratory, Johns Hopkins University
ARL	Aerospace Research Laboratories (AF)
ARO	Army Research Office
ASD	Aeronautical Systems Division (AF)
ASN(R&D)	Assistant Secretary of the Navy (Research & Development)
ATD	Advanced Technology Demonstration

BRL	Ballistic Research Laboratory (A)
BUMED	Bureau of Medicine and Surgery (N)
BUPERS	Bureau of Naval Personnel (N)
CND	Chief of Naval Development
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
CNR	Chief of Naval Research
CNR&T	Chief of Naval Research and Technology
CRP	Contract Research Program
DARPA	Defense Advanced Research Projects Agency
D&F	Determinations and Findings
DCP	Decision Coordinating Paper
DDE	Director of Development and Engineering (N)
DDR&E	Director of Defense Research & Engineering
DLP	Director of Laboratory Programs (N)
DNL	Director of Navy Laboratories
DNT	Director of Naval Technology
DOD	Department of Defense
DS&T	Director of Science and Technology (AF)
DSARC	Defense Systems Acquisition Review Council
ESD	Electronic Systems Division (AF)
FCRC	Federal Contract Research Center
FJSRL	Frank J. Seiler Research Laboratory (AF)

HDL	Harry Diamond Laboratories (A)
HEL	Human Engineering Laboratory (A)
IED	Independent Exploratory Development
ILIR	In-house Laboratory Independent Research
LUS	Laboratory Utilization Study
M&S	Materials and Structures
MERDC	Mobility Equipment R&D Center (A)
MRDEL	Missile Research and Development Engineering Laboratory
MILCON	Military Construction
NADC	Naval Air Development Center
NAVAIR	Naval Air Systems Command
NEVELEX	Naval Electronic Systems Command
NAVFAC	Naval Facilities Engineering Program
NAVMAT	Naval Material Command
NAVORD	Naval Ordnance Systems Command
NAVSEA	Naval Sea Systems Command
NAVSHIP	Naval Ship Systems Command
NAVSUP	Naval Supply Systems Command
NCSL	Naval Coastal Systems Laboratory
NELC	Naval Electronics La oratory Center
NMARC	Naval Material Acquisition Review Committee
NOL	Naval Ordnance Laboratory
NSWC	Naval Surface Weapons Center
NUC	Naval Undersea Center

NUSC	Naval Underwater Systems Center
NWC	Naval Weapons Center
NWL	Naval Weapons Laboratory
OASD(I&L)	Office of the Assistant Secretary of Defense (Installations and Logistics)
OASD(M&RA)	Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs)
ODDRE(R&AT)	Office of Director of Defense Research & Engineering (Research and Advanced Technology)
OMB	Office of Management and Budget
ONR	Office of Naval Research
OSD	Office of the Secretary of Defense
PBD	Program Budget Decision
PM	Program Memorandum
PS&E	Physical Sciences and Engineering
RADC	Rome Air Development Center (AF)
RD&E	Research, Development and Engineering
RDT&E	Research, Development, Test and Evaluation
6.1	Budget category for research
6.2	Budget category for exploratory development
6.3	Budget category for advanced development
6.4	Budget category for engineering development
6.5	Budget category for management and support
RML	Range Measurements Laboratory (AF)

SAMSO	Space & Missile Systems Organization (AF)
TAA	Technical Assessment Annex
Technology Base	RDT&E effort which has been funded by budget categories 6.1, 6.2 and "6.3A"

EXECUTIVE SUMMARY

This is the final report of the Laboratory Utilization Study, initiated in April 1974 by Dr. M. R. Currie, DDR&E, in response to management objectives stated by the Secretary of Defense. The Secretary had indicated concern about the quality and size of the DoD Laboratories. Since about 25 percent of the DoD Research, Development, Test and Evaluation (RDT&E) program is funded through the in-house laboratories of the military services, the efficient management and utilization of these laboratories is recognized to be of crucial importance to the DoD.

A coordinating board, headed by the Deputy Director (Research and Advanced Technology), ODDR&E and consisting of members from the military departments, initiated this study on 20 June 1974. The study focused on four principal issues as follows:

(1) Does the DoD really need in-house laboratories?

(2) If the answer to (1) is in the affirmative, how should the Services' RDT&E structures be organized and managed to get the most out of the laboratories?

(3) What is the most appropriate division of effort between the in-house laboratories, industry, the universities, and other performers in the various areas of the RDT&E program?

(4) What is the proper size of the laboratory complex in view of the foregoing considerations?

Each service carried out its own study which was later integrated into the ODDR&E study. The findings of each Service's study are briefly summarized below.

Army Input - The Army input to this study was the report of the Army Materiel Acquisition Review Committee (AMARC): The AMARC report confirmed the need for Army laboratories but recommended a major reorganization of the current system of 33 laboratories. The new laboratory system would be made up of six mission-oriented development centers (Ground Mobility, Air Mobility, Armament, Communications, Electronics, and Missiles) and four corporate laboratories which do not specifically fit these mission areas. Implementation of this reorganization will result in substantial personnel savings. Other recommendations

included a continuation of the Army's move to "single program element funding" for a strong research and exploratory development program, and several personnel and procurement improvements.

Navy Input - The Navy input to this study expressed the convictions that the Navy laboratories are needed and that the Navy laboratories and test facilities appear to be reasonably matched to the Navy's requirements without unreasonable duplication of facilities and services available elsewhere. Several improvements were stated as being needed in the Navy RDT&E process, notably in the Technology Base (research, exploratory development and early advanced development) effort. This area has a subtask orientation rather than broad program objectives, so that the programs are unduly fragmented. Further, the study concluded that there is poor coupling between the research programs with the remainder of the RDT&E programs. To improve coupling, the study suggested that the planning and management of the research and the exploratory/advanced development programs be under a single command to be entitled the Chief of Naval Research and Technology.

Air Force Input - The Air Force laboratory utilization report, also affirmed their belief in the need for laboratories. The study recommended that the research program be shifted to a predominantly contract operation under a single manager, that Aerospace Research Laboratories be phased out, and that Cambridge Research Laboratories should be funded from the exploratory development category. A command, control, and communication laboratory was recommended to provide an increased level of support in that area. "Single program element funding" is utilized in exploratory development and was recommended to be continued. Many other improvements were suggested in the personnel management and procurement fields.

ODDR&E Study

The ODDR&E follow-on study was conducted by members of the professional staff of ODDR&E(R&AT) whose normal responsibility is the management of the Technology Base programs. This study found, as did the Service studies, that there is a vital role for the laboratories not satisfactorily available from other sources such as industry, universities, FCRC's, Headquarters staffs, Systems Commands, etc. The combination of attributes possessed by the laboratories qualifies them to play a unique and needed role in the military planning function, especially to the planning of systems development acquisition and usage and the planning of the Technology Base program to support future systems development. Laboratories also help the services to be "smart buyers" by providing technical advice and supervision to the

Services interaction with industry, by providing an alternative source of technology so that their existence serves as a source of stimuli to industry to perform well, and by providing centers of excellence in areas of little or no industrial interest.

Before the managements of the Service laboratory systems were examined, a set of management principles was derived, based upon the following tenants: (1) Each laboratory should be assigned the responsibility for an important job, (2) Good RDT&E leadership must be attracted and retained, and (3) There must be sufficient flexibility in the system to allow the leadership to most effectively utilize its talents. These management principles address the question of how to best organize and operate the Services' RDT&E structure and optimize laboratory contributions and reflect the best features of the laboratory systems of the three Services. The Services' proposed management systems were evaluated against these principles.

The ODDR&E study found that the Army laboratories are now, as a result of aggressive improvement programs in recent years, operating in close agreement with the ODDR&E management principles. The AMARC recommendations are in general, endorsed by the study. Additional recommendations are that the Army should: (1) develop and document a system for financial control of the in-house expenditures of R&D laboratories or centers, (2) develop and document a formal planning process (similar to that of the Air Force) for the Technology Base and spell out the program approval authority and (3) develop an R&D career pattern for some officers which includes advanced technical training and laboratory experiences early in their careers to prepare them for senior technical assignments.

The ODDR&E view of the Navy laboratories was that: (1) they are well integrated into many of the Navy programs, including fleet support, (2) they possess a large reservoir of internationally recognized scientists and engineers but (3) their involvement and success in systems development has varied widely from program to program, (4) the Navy Technology Base is fragmented largely as a result of micromanagement by the Systems Commands, (5) there is excess laboratory capacity leading to excess competition and (6) the laboratories technical expertise is not adequately utilized by the System Commands in making critical technical decisions. The ODDR&E study essentially concurs with the description of the problems of the Navy RDT&E structure contained in the report of the Navy's own study. The ODDR&E study concluded that the following problems exist and recommends that the Navy undertake their solutions: (1) redundancy in function/platform assignments and concomitant excessive interlaboratory competition for funds,

(2) Technology Base fragmentation, uneven quality and inhibited technology transfer, (3) lack of a system for control of individual laboratory size and Technology Base in-house/contract ratio and (4) under utilization of junior officer personnel in the laboratories and overdependence on Naval Officers for positions of senior technical responsibility.

The Air Force laboratories were characterized as follows by the ODDR&E study: (1) they generate and execute an innovative, well structured Technology Base program; (2) they utilize military personnel in the laboratories effectively; (3) they specialize in Technology Base programs thereby isolating them from Air Force problems and making their contributions less visible and (4) they pay all salaries out of 6.1 and 6.2 funds, including the salaries for people working in other budget categories, thus causing an unacceptable drain on Technology Base funding. The Air Force study recommendations are generally endorsed and the following additional recommendations are provided: (1) salary support for personnel working on non-exploratory development projects should be supplied from those projects, and (2) controls should be placed on laboratory size consistent with Air Force needs and the anticipated RDT&E budget.

The ODDR&E study provided additional recommendations for improved laboratory management. The concept of a customer-supplier relationship between Program Managers and the laboratories was endorsed as the most appropriate arrangement for work in support of system development. However, it was felt that an effective means was needed to prevent complete subjugation of the laboratories to the Program Managers. To provide a form of "checks and balances" it was recommended that a formal, unedited laboratory comment on the technical risks of any new program be required in the DCP/DSARC process. An appropriately selected laboratory would prepare a Technical Assessment Annex (TAA) for DCP's and Program Memoranda for new programs. The TAA would address any areas of technical risks remaining in the new program and describe plans for addressing these risks. It is believed that this addition to the acquisition process would serve to stimulate involvement between labs and Program Managers. It would also provide a means for monitoring the technical expertise of the laboratories and the quality of their participation in the systems planning and acquisition process. Another conclusion of the service studies endorsed by ODDR&E was that a means be found to operate the laboratories by specifying only their maximum allowable level of in-house funding and leaving decisions on the mix and number of personnel to the laboratory director. Personnel and procurement changes were also recommended.

The in-house to contract funding ratio for laboratory programs was considered carefully in regard to issue (3) by the ODDR&E staff. Funding for DoD research and exploratory development has been essentially flat for the last decade. Meanwhile, inflation has driven the salaries of the personnel performing research and exploratory development activities in the DoD laboratories up by about 40 percent. Since the number of people in the in-house laboratories has decreased only about 10 percent, the in-house costs have escalated, forcing research and development support in industry and the universities to be reduced. This situation has raised serious concern about the balance between in-house activities and the industrial and academic activities. Since each of these contributors bring special strengths to the program, a proper balance must be restored and maintained. Since the imbalances become progressively worse with time, it was concluded that the issue needs addressing now.

The ODDR&E staff examined the in-house-to-contract ratio in research and in each of eight technology areas in exploratory development. It was concluded that there is excessive in-house effort in each of the services: Army, in materials and structures, electronics, conventional weapons and research; Navy, in materials and structures, electronics and conventional weapons; Air Force, in research. If the burden is not to be shifted elsewhere, readjustment of the in-house excesses can only be done by reducing the number of personnel in these technical areas while retaining the associated funds. It is therefore recommended that the Service terminate a sufficient number of low priority efforts to reduce the number of in-house personnel working in the Technology Base (especially in those areas identified above) by a total of approximately three thousand during FY 1976 and an additional 1600 in FY 77. The savings therefrom should be applied to new starts in the contract program.

As part of the Laboratory Utilization Study, examinations were made of the trends in the growth of the in-house laboratory program relative to the size of the DoD budget, and of the content of some of the work in the laboratories. We found that the in-house laboratory share of the DoD budget has increased by about 15% in the past 6 years. No compelling reason for increasing the laboratories' budget was found. To the contrary, there was some evidence of the laboratories being under strain to stay fully employed. Based upon some Service studies and personal visits to most of the laboratories, it is believed that a modest reduction in the size of the in-house laboratories, beyond that required to adjust the in-house/contract ratio in the Technology Base, could produce some savings and eliminate some excessive competition. In order to assess the impacts of various levels of reduction, we examined the laboratory complexes of each of the three Services, and made

cursory impact assessments of levels of reduction. The possibility of reorganizing into single laboratories serving multiple Services in certain areas was also considered. The conclusions were as follows: (1) Implementing the recommendations of the AMARC Study should ultimately produce substantial reductions in personnel in the Army, primarily by the large-scale consolidations of the proposed Armaments Development Center and Harry Diamond Development Center; (2) a drawdown could also be taken in Navy laboratories - either by closing some laboratories and consolidating the work in those remaining, or by selective program elimination or reduction - and would help reduce the inter-laboratory competition to a more appropriate level; (3) the Air Force laboratory system is already quite small and will be decreased by about 10 percent in FY 1975 and 1976.

The examination of the possibility of multi-Service laboratories showed that, if the foregoing reductions were taken first, little additional manpower savings would accrue from multi-Service consolidations. Furthermore, as long as certain weapons are acquired separately by each of the Services, the technical support for this acquisition process makes it highly desirable to keep some supporting technical capability. However, certain streamlining is possible and is being looked at under separate study commissioned by the Joint Logistics Commanders.

As a result of all the foregoing considerations, this study has recommended a decrease of 10 to 15% of the people in the DoD laboratory system (present strength is about 56,000) to take place in FY 76 and 77, to include the Technology Base reduction discussed above.

1. INTRODUCTION

This study of the utilization of DoD in-house laboratories was initiated in April 1974 by a memorandum to the Assistant Secretaries of the Military Departments (R&D) from Dr. M. R. Currie, DDR&E (reproduced in Appendix A) in response to a management objective of the Secretary of Defense. Subsequently, a Coordinating Board, chaired by the Deputy Director (Research & Advanced Technology), ODDR&E and consisting of members from the Military Departments,[1] was formed and initiated the study by a Study Charter issued on 20 June 1974.

1.1 SECDEF Charge

The charge for the study was (1) to determine the requirements for DoD laboratories, (2) assess the capability of the laboratories to meet these requirements, (3) identify excess capacity, overlapping capabilities, shortfalls or instances where R&D could be contracted to industry at a savings, and (4) define a program to upgrade the quality of the laboratories. The study was to be completed and a plan of action to correct any deficiencies identified submitted by 1 January 1975.

1.2 Study Approach

The modus-operandi adopted for the Laboratory Utilization Study (LUS) was:

(1) First, each Service would conduct its own study. In recognition of the well-recognized problem (reference 1)[2] of quantification of R&D performance, it was agreed that they would rely primarily on peer review and user opinions. Involvement of persons from the other Services' laboratory systems was encouraged for cross-fertilization since each Service's laboratories are organized and operated differently from the others.

(2) Maximum use of previous studies (e.g. references 2-16) would be made.

(3) Services' studies would be coordinated by the tri-Service/OSD Coordinating Board.

1/ See Appendix B for membership
2/ See bibliography for references.

(4) Service studies would serve as an input to a follow-up ODDR&E study to assimilate and critique the Service Studies and to carry out any additional investigations needed.

The Army was already involved in an extensive evaluation of their entire materiel acquisition process (AMARC Study, reference 17) which served as the Army input to this study. The Navy and Air Force activated special study teams. Their reports were provided to ODDR&E during September 1974 (references 18 and 19).

The LUS focused on four principal issues in response to the charge:

(1) .Could the DoD function satisfactorily without in-house laboratories?

Assuming the answer to (1) is no:

(2) How can we best organize and operate the Services' RDT&E structure to get the most out of the laboratories?

(3) What is the best division of effort between the in-house laboratories, industry, the universities, and other performers in the various technical areas of the R&D program?

(4) What is the proper size of the laboratory complex in view of the foregoing considerations?

2. FEATURES OF EXISTING SERVICE LABORATORY SYSTEMS

The DoD "in-house" R&D laboratories are a big business (see reference 20) - in FY 73 they had a $2.8 billion cash flow, employed approximately 57,000 civilians and 8,000 military and represented a $2.6 billion investment in facilities and equipments. About 25% of the DoD RDT&E program is funded through the in-house laboratories and about 12% is done in-house. They are obviously a major factor in shaping the nature of the DoD RDT&E program and in determining its quality.

As a first step in evaluating the existing Service laboratory systems, data were collected on the nature of the present system, how it operates and is managed, and how it relates to its parent Service and other sponsors. Existing documents were studied, most of the laboratories were visited separately by both the appropriate Service study teams and by DDR&E representatives and dialogues were carried on with various headquarters personnel. In addition, of course, most of the

people involved had first hand familiarity with the laboratories (see Appendix K for the study memberships).

It was decided at the outset that this study would be limited to the Physical Sciences & Engineering (PS&E) laboratories and their portion of the Service's RDT&E management structure, excluding the personnel and medical type laboratories. This was done to limit the technical range required of the study team. Those laboratories that were included are indicated in Appendix J. The personnel and medical laboratories will be similarly studied in 1975.

2.1 Air Force Laboratory System

The smallest laboratory system is that of the Air Force. Figure 2-1 indicates its salient characteristics. There are 14 Air Force laboratories, two devoted to medical R&D, one to human factors. The remaining 11, the subject of this study, are organized along technical area lines. The total laboratory system has about 10,000 personnel, 70% civilian, 30% military, and an annual budget of slightly over $600M. These laboratories are principally devoted to "Technology Base"[3] activities. About 50% of the laboratories' funds are from the research (6.1) and exploratory development (6.2) budget categories - mostly the latter - and 35% from other RDT&E categories, mostly advanced development (6.3). Only 15% of the laboratories' funding is from non-RDT&E work such as technological support to existing systems and to procurement of new systems. The Air Force, as a matter of policy, depends on industry for most of its Technology Base effort with only 30% of the 6.1 and 6.2 work and 5% of total RDT&E being done in-house.

It should be recognized in comparing the Air Force laboratories with those of the other Services that several other activities participate in the Air Force RDT&E process, contributing manpower comparable to that of the laboratories. The Air Force supports five Federal Contract Research Centers[4] (FCRCs), three of which can be classed as Physical Sciences & Engineering - oriented. These three employ about 5,300 people. In addition, the direct responsibility for

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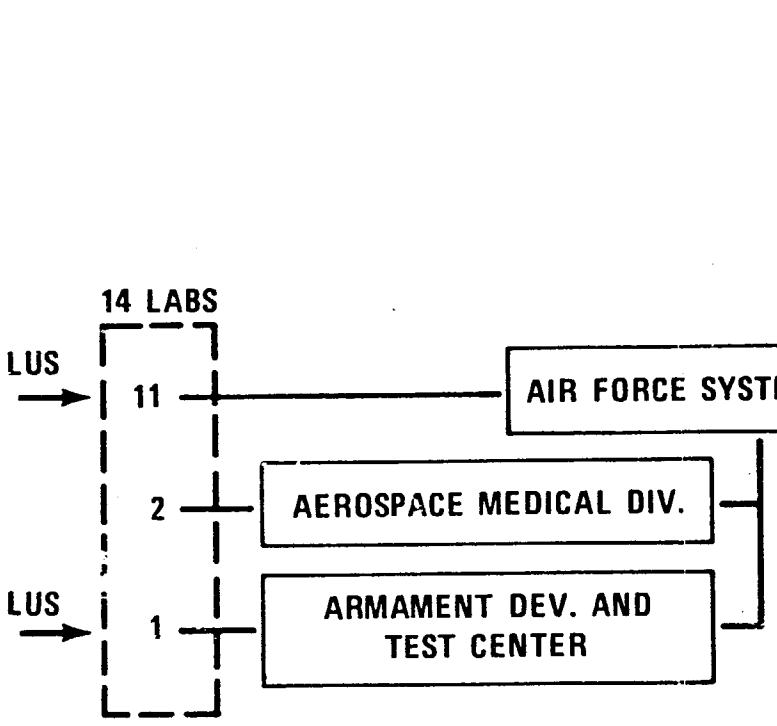
3/ Devoted to the development of technology, including new components, devices, subsystems and demonstration models of potential systems (i.e., budget categories 6.1 (research), 6.2 (exploratory development) and the more technology-oriented part of 6.3 (advanced development)).

4/ Aerospace Corp., Mitre Corp., MIT Lincoln Laboratory, Rand Corp. and Analytical Services, Inc. The first three are PS&E-oriented.

FIGURE 2–1

AIR FORCE LABORATORIES COMMAND CHAIN



	TOTAL	LUS LABS
TOTAL PERSONNEL	≈ 10000	≈ 9000
BUDGET ($)	≈ 630M	≈ 600M
FACILITIES & EQUIP ($)	≈ 550M	≈ 520M

SOURCE OF LAB FUNDS

≈ 50%	6.1 + 6.2
≈ 35%	OTHER RDT&E
≈ 15%	NON-RDT&E

LAB I.H. DISPOSITION FUNDS

≈ 30%	OF 6.1 + 6.2
≈ 6%	OF TOTAL SERVICE RDT&E

system development rests with the "Product Divisions" (Electronic Systems Division (ESD), Aeronautical Systems Division (ASD), and the Space and Missile Systems Organization (SAMSO)) which in toto exceed the laboratories in size. Finally, the Air Force Logistics Command also has an engineering staff of over one thousand.

The funding, program planning and approval system of the Air Force laboratories is the simplest of the three Services, in part a result of the Air Force laboratories concentration on the Technology Base. It is indicated schematically in Figure 2-2. The laboratories are "single program element funded" for their exploratory development work and block funded for any research activities (i. e., they receive the bulk of their 6. 1 and 6. 2 funding in a lump sum). The detailed planning of the Technology Base program is done by the laboratories in response to policy guidance from the Director of Science & Technology (DS&T) in a formal system (reference 21) which provides for advisory inputs from potential customers and other laboratories. The Technology Base program approval authority in the Air Force resides in the first echelon over the laboratories in the office of the DS&T in the Air Force Systems Command headquarters.

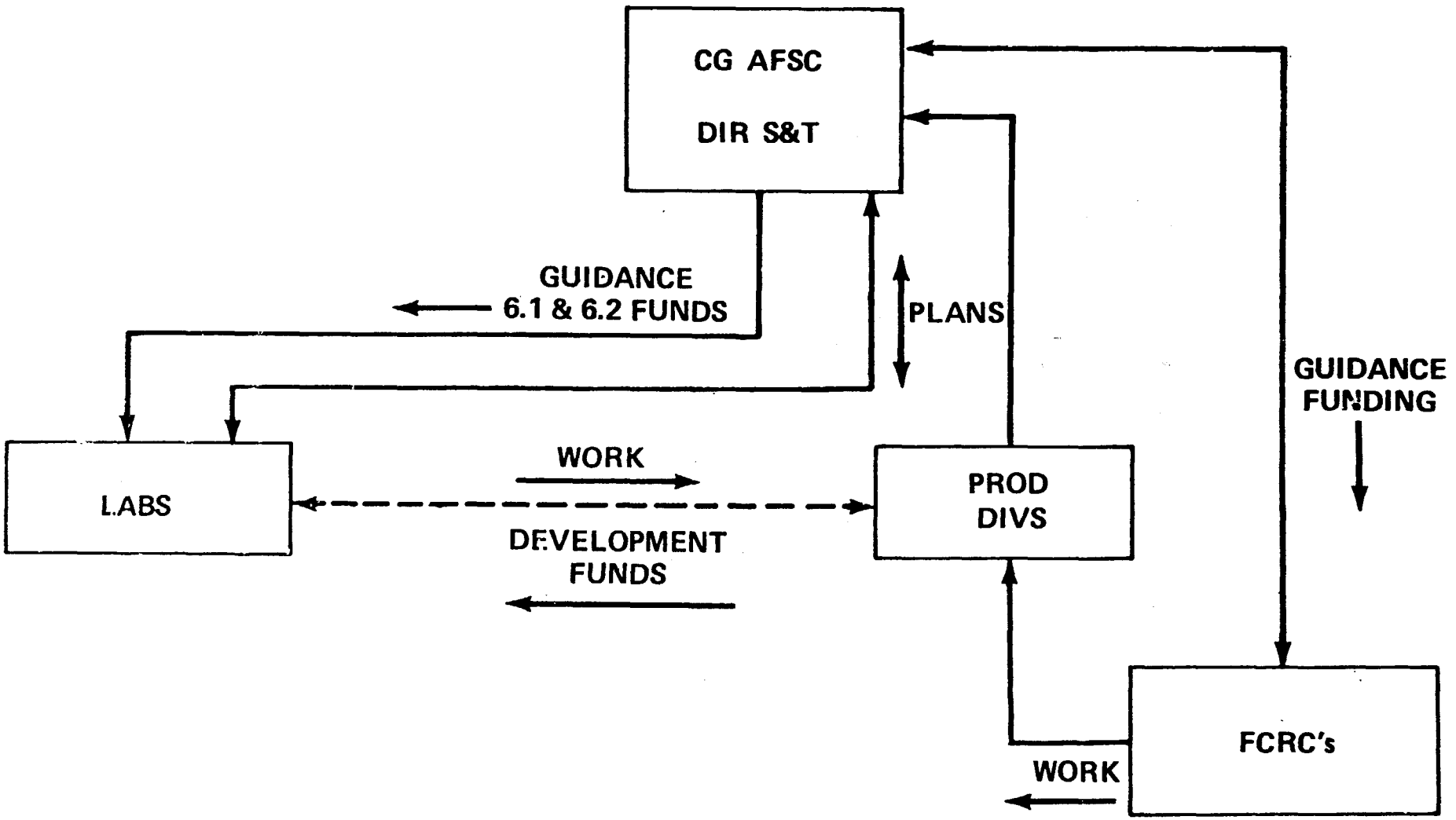
The laboratory's direct support to the system development process (the latter stages of category 6. 3 and category 6. 4 engineering development) is estimated at about 25%. It is provided mostly at little or no cost to the Product Division customers, with the salaries of those so engaged paid from the block funded (6. 1 and 6. 2) program elements.

The Air Force has an R&D officer career pattern unique among the Services which usually features post graduate education, an early tour in a Laboratory as a "bench-level" engineer or scientist and usually includes duty in program management as well as more responsible laboratory positions. The career pattern appears successful in that a survey (Appendix H) indicated about 20% of Air Force officers who became laboratory commanders (as colonels) in the past ten years were promoted later to general officer.

Most, but not all top positions in the Air Force laboratories are held by Air Force officers. There are enough civilians in top jobs to lend some credence to the Air Force claim of selecting the "best man for the job." The intermingling of military and civilians is evident at all levels and appears to work more smoothly than in the other Services.

FIGURE 2–2

AIR FORCE LAB INTERACTIONS



2.2 Navy Laboratory System

The salient characteristics of the Navy laboratory system are indicated in Figure 2-3. This is the largest laboratory system of the three Services, employing approximately 32,000 personnel, 93% of them civilian. It had an annual budget of approximately $1.2B in FY 73. There are 27 designated Navy laboratories but many of these are small medical laboratories. About 90% of the manpower is in the eight laboratories reporting to the Chief of Naval Material (CNM) and the one laboratory (NRL) reporting to the Chief of Naval Research (CNR). This study principally concentrated on these nine laboratories. They are large RDT&E centers, most of which are engaged in a full spectrum of technological activities covering all categories of R&D, engineering support to fielded systems and occasional direct participation with operational forces. As indicated on the figure, about 20% of the laboratory funding is from 6.1 and 6.2, 40% other RDT&E categories and 40% from non-RDT&E funding, such as O&M and procurement funds. About 50% of 6.1 and 6.2 and 20% of total Navy RDT&E is done in-house. In addition to approximately 30,000 people in these PS&E laboratories, the Navy has three FCRCs,[5] two of which are PS&E-oriented with a staff of 2440.

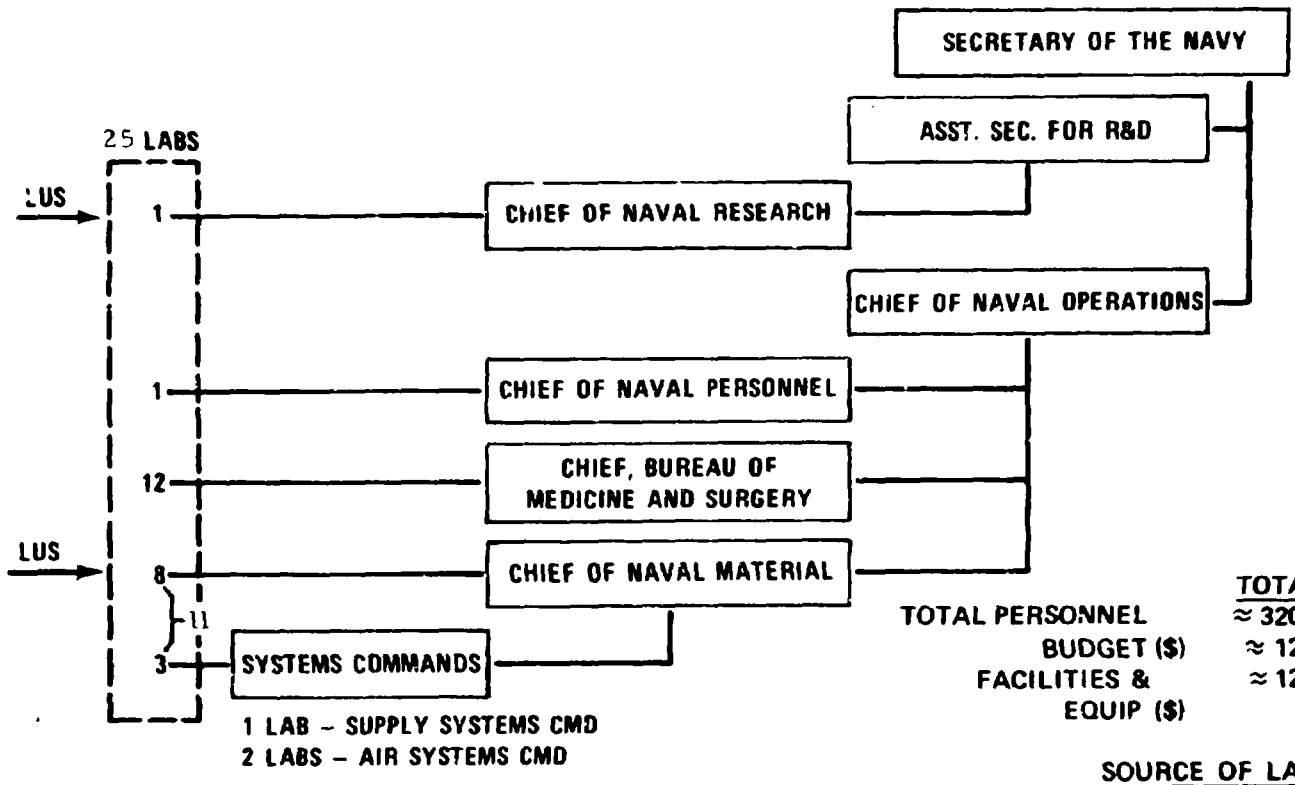
The Navy laboratory operation is largely a "free enterprise system" in which the laboratories sell their services on an industrially funded basis to potential customers, most of whom are offices of the Navy System Commands. Although there are limiting mission statements for each of the laboratories, the laboratories are encouraged to compete with one another with little regulation. The result is a system which exhibits an aggressive vitality in soliciting work. However, several years of such competition has led to a diffusion of capabilities and a plethora of alternate sources for almost any technology. Figure 2-4 indicates the degree of this multiple involvement as indicated by a recent Navy study of laboratory "product lines" (reference 22).

The Navy funding, program planning and approval system is the most complex of the three Services. The ODDR&E perception of it is indicated in Figure 2-5. Separate organizations have cognizance over research, over exploratory development and over other RDT&E work. The cognizant organizations for each category put most of their

5/ John's Hopkins University Applied Physics Laboratory, Penn State University Applied Research Laboratory and the Center for Naval Analyses; the first two are PS&E oriented.

FIGURE 2–3

NAVY LABORATORIES COMMAND CHAIN



	TOTAL	LUS LABS
TOTAL PERSONNEL	≈ 32000	≈ 30000
BUDGET ($)	≈ 1200M	≈ 1100M
FACILITIES & EQUIP ($)	≈ 1200M	≈ 1150M

SOURCE OF LABS FUNDS

≈20% 6.1 + 6.2
≈40% OTHER RDT&E
≈40% NON-RDT&E

LAB I.H. DISPOSITION OF FUNDS

≈50% OF 6.1 + 6.2
≈20% OF TOTAL SERVICE RDT&E

FIGURE 2-4
PRODUCT AREA OVERLAP
IN NAVY LABORATORIES*

Limited to product areas funded ≥ $25M, labs with ≥ 10% of product funding.

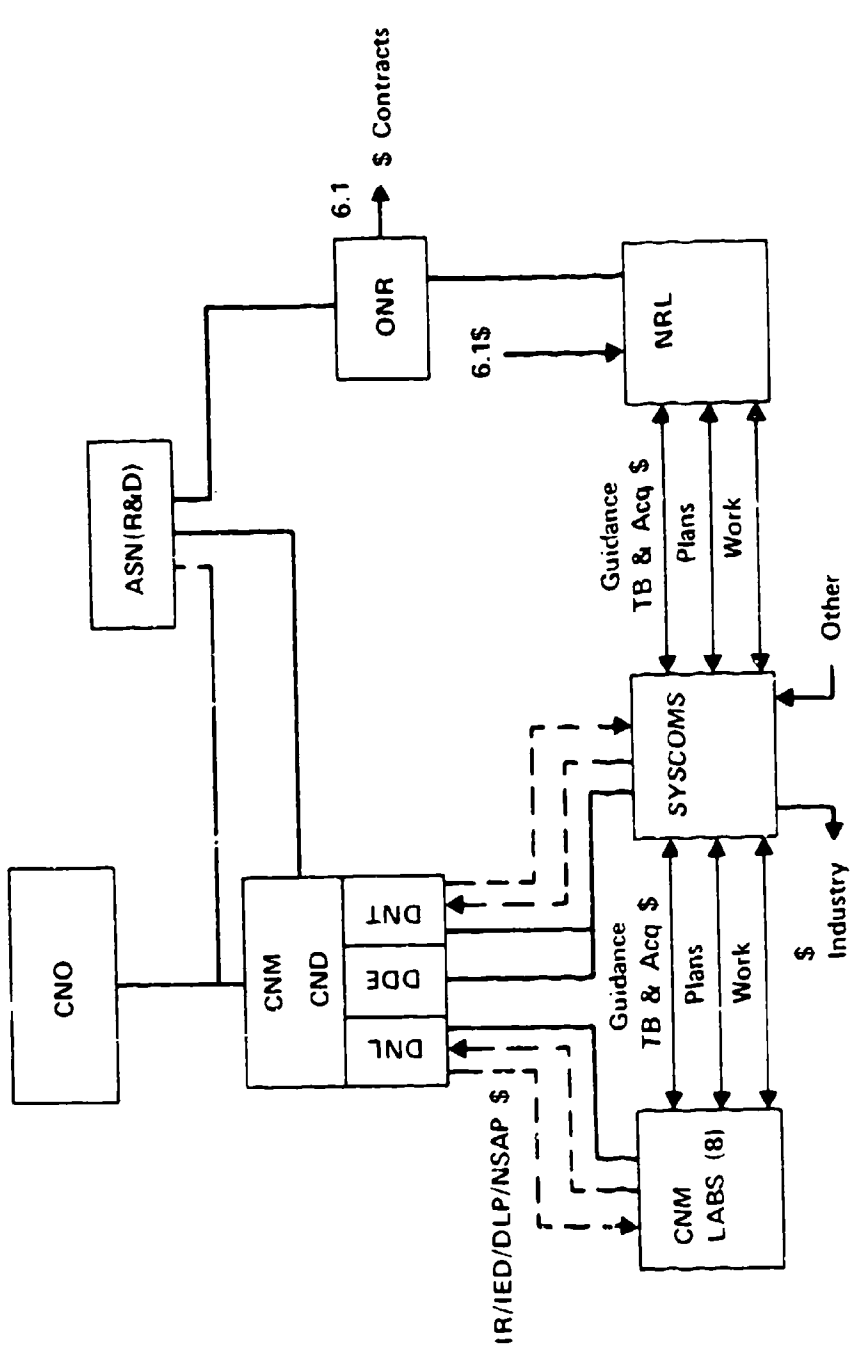
Product Area \ LAB	NADC	NWC	NSRDC	NOL	NWL	NCSL	NELC	NUC	NUSC	ARL	APL	NRL
ACOUSTIC SENSORS	XXXX							XXXX	XXXX			XXXX
COMMAND CONTROL	XXXX						XXXX		XXXX			
COMMUNICATIONS	XXXX						XXXX		XXXX			XXXX
CM & DECOYS					XXXX	XXXX		XXXX	XXXX			
ELECTRONIC WARFARE		XXXX			XXXX							XXXX
ELECTRO-OPTICS	XXXX			XXXX								XXXX
FIRE CONTROL		XXXX			XXXX				XXXX		XXXX	
GUNS & AMMO		XXXX		XXXX	XXXX							
MINES				XXXX								
MISSILES		XXXX									** (XXXX)	
TORPEDOES				XXXX				XXXX	XXXX	XXXX		
EM SURVEILLANCE							XXXX					XXXX
SEA VEHICLES			XXXX									

*Abstracted from the Hollingsworth Report (ref. 19)

**APL had less than 10% of the Navy missile funding in the year in question, but is normally more heavily involved therein.

FIGURE 2-5

NAVY LAB INTERACTIONS



money into the System Commands who in turn distribute the funding to the Navy laboratories and other participants.

In the case of system development work, the system is fairly straight forward with the program managers for the major programs (located either in the System Commands or in Naval Material Command Headquarters) running the programs and using the laboratories in a manner deemed most fitting to their particular purposes and perceptions. Lab involvement in this type of work varies widely from deep and extensive to non-existent, reflecting the program manager's convictions and past experience.

In the case of the Technology Base work, the system is more complicated. Research funding originates from CNR and is passed to contractors, NRL, the Systems Commands and to the Director of Navy Laboratories (DNL) for his In-House Laboratory Independent Research (ILIR) fund. Exploratory development is managed by the Chief of Naval Development (CND) who assigns most of the funds to the System Commands and a small amount to the DNL for the Laboratory Independent Exploratory Development (IED) fund. DNL is charged with the administrative responsibility for the laboratories and dispenses and administers the ILIR & IED funds. The bulk of the Technology Base funding is in 19 exploratory development program elements officially administered by the CND staff but in actual fact parceled among the System Commands in the manner indicated in Table 2-1. This funding is in turn parceled out among the various offices within the System Commands and then to the laboratories and contractors in work units that average $100K each.

The responsibility for structuring a cohesive Technology Base program responsive to Navy needs and for implementing this program in the laboratories is thus spread among several organizations.

Virtually all of the lab staffs and the majority of the CND and System Command staffs are civilian. The use of junior officers as practicing technologists in the labs is uncommon, so few senior officers have any appreciable "bench experience." It is Navy policy, however, to place a Naval Officer in charge of each laboratory - with a civilian Technical Director - and to fill most of the key System Command positions similarly. The Navy RDT&E system is thus almost totally civilian at the lower and intermediate levels and totally military - with civilian technical advisers - at the top.

TABLE 2-1

DISTRIBUTION OF 6.2 PROGRAM ELEMENT FY'75
($ In Thousands)

	PROGRAM ELEMENT	ONR	AIR	ELEX	FAC	SEA	SUP	BUMED	BUPERS	NAVMAT DLF	NAVMAT IED/AP	Total
1.	Aircraft	550	19,916									20,466
2.	Msle Propulsion Tech		4,387			2,679						7,066
3.	Strike Wrfr Weap Tech	1,119	15,304			13,433				4,414	2,480	36,750
4.	Nuclear Propulsion					24,412						24,412
5.	Ships, Subs & Boats	165				15,737				2,100	2,285	20,287
6.	Undersea Wrfr Weap Tech	117	128			15,554				2,300		18,099
7.	Undersea Target Surveill	2,734	7,413	3,116		7,223				2,970		23,456
8.	Surf/Aerospace Tgt Surveill	2,631	4,692	3,931		1,995				1,016		14,265
9.	Command & Control Tech	2,308	4,605	7,318		1,921						16,152
10.	Countermeasures Tech	1,141	4,343	2,436		4,095				921		12,936
11.	Biomedical Tech	50	644				450	6,338				7,482
12.	Ocean & Atmosp Spt Tech	3,324	2,489	2,725	1,278	4,492				3,161		17,469
13.	Logistics Tech		2,116	390	2,706	2,459	2,760					10,431
14.	Materials Tech	105	2,965	310	318	9,048				660		13,406
15.	Electronic Device Tech	1,080	1,910	6,247		1,075				2,740		13,052
16.	Human Resources	948	3,424	810		680			2,086	1,500		9,448
17.	Chem/Bio Defense Tech									150		150
18.	Energy & Envir Prot Tech	1,142	463		2,957	1,396	419	410				6,787
19.	Lab Indp. Explo Dev										13,094	13,094
	Totals	17,414	74,799	27,283	7,259	106,199	6,748	6,748	2,086	21,932	17,859	285,208

2.3 Army Laboratory System

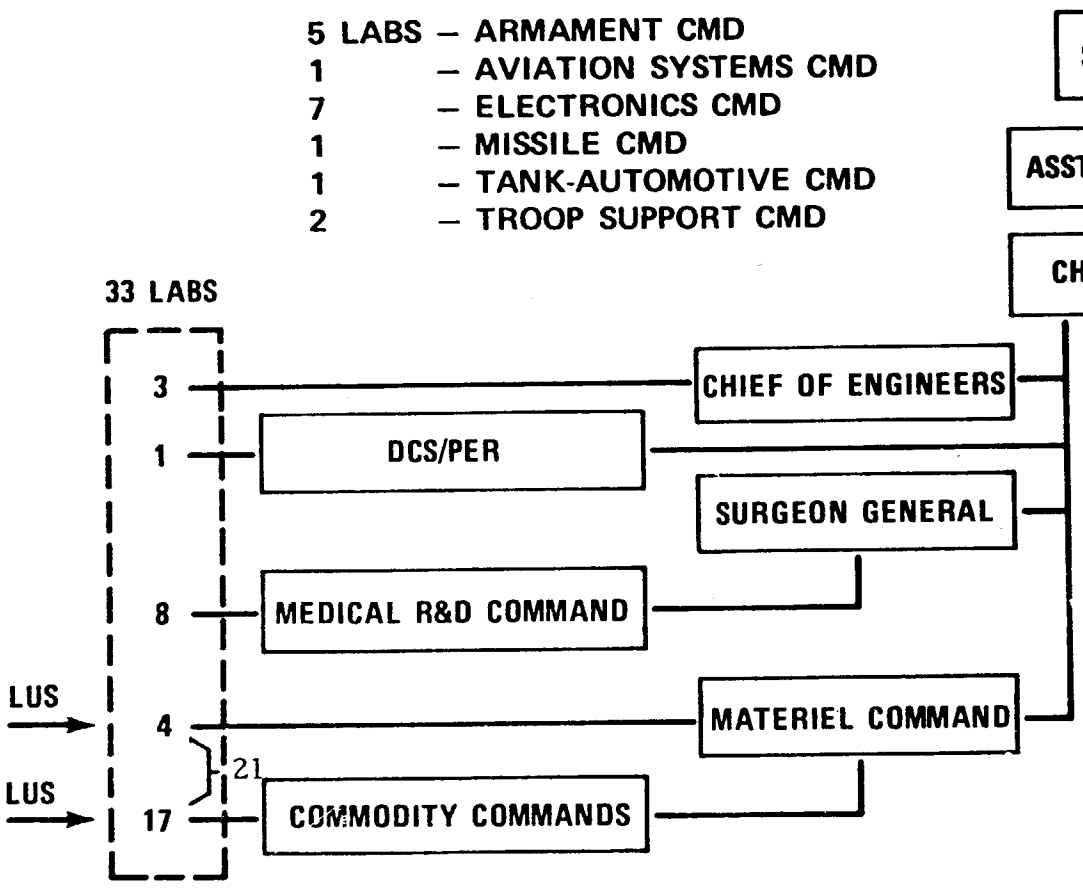
The Army laboratory system is intermediate in number of personnel with approximately 23,000 personnel, 90% of which are civilian, located in 33 laboratories as indicated in Figure 2-6. The LUS concentrated on laboratories reporting to the Army Materiel Command (AMC) excepting the Human Engineering Laboratory which will be included in the later study. The laboratories are typically small but many of them are organizationally and geographically amalgamated by Commodity Command into larger functional units. They are involved in a spectrum of activities, having more full spectrum capability than the Air Force laboratories but concentrating more on RDT&E work than the Navy laboratories. Thirty percent of the laboratory funds are from categories 6.1 and 6.2 and 45% from other RDT&E categories. The Army laboratories have the highest in-house ratio of the three Services with about 62% of the 6.1 and 6.2 being done in the laboratories and 23% of the total Service RDT&E. The Army no longer has any FCRCs or any other appreciable engineering capability outside the laboratories.

The program initiation, approval and funding system incorporates features from both the Navy and Air Force systems and is indicated schematically in Figure 2-7. Work in support of systems planning and development is industrially funded by the program managers. Competition is controlled by the alignment of laboratories with Commodity Commands, but stimulated by the alternate sources of technological support represented by the corporate laboratories (HDL, BRL, AMMRC and HEL). The Technology Base is block funded to the laboratories with each laboratory receiving funds from one or at most a few program elements. Lead laboratories are designated for major technology areas and all funds for that area are assigned by the lead laboratories. Program planning and program execution responsibility resides in the lead laboratory. The program planning for the Technology Base is initiated at the level of the RDT&E director for each Commodity Command. The involvement of the laboratories differs between Commodity Commands with some Commands using the laboratories extensively in the Technology Base planning process and some using them little. The appropriate Commodity Command and then Headquarters AMC approve the resulting plans, except in the case of the Corporate Laboratories which report directly to AMC.

The military civilian interface is similar to that of the Navy in that i.e., very few officers acquire a working-level laboratory experience in their careers, so many of the senior officers in the laboratories must function without this background. However, at the top levels, there is a mixture of military and civilians with about half the top RDT&E positions filled from each group.

FIGURE 2–6

ARMY LABORATORIES COMMAND CHAIN



	TOTAL	LUS LABS
TOTAL PERSONNEL	≈23000	≈18000
BUDGET ($)	≈1000M	≈900M
FACILITIES & EQUIP ($)	≈ 850M	≈725M

SOURCE OF LAB FUNDING

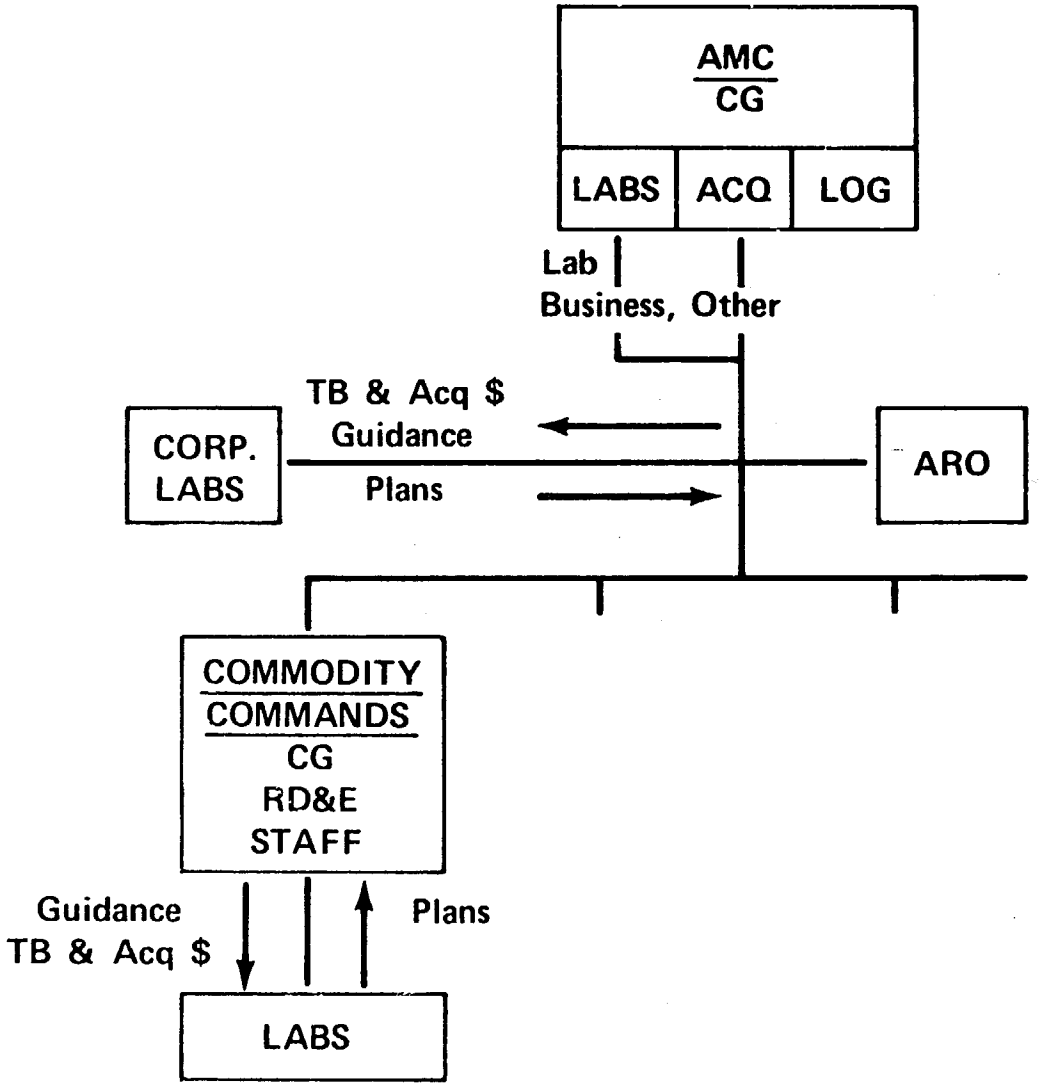
- ≈ 30% 6.1 + 6.2
- ≈ 45% OTHER RDT&E
- ≈ 25% NON-RDT&E

LAB I.H. DISPOSITION OF FUNDS

- ≈ 62% OF 6.1 + 6.2
- ≈ 23% OF TOTAL SERVICE RDT&E

FIGURE 2–7

ARMY LAB INTERACTIONS



3. OVERVIEW OF SERVICE STUDIES

In order to keep the summary of the Service studies reasonably short, extensive use is made of the usual abbreviations for laboratories and other RDT&E organizations in this section. The bewildered reader will find the glossary of abbreviations (pages iv-viii) helpful.

3.1 Army Study

The Army input to the LUS was the AMARC Study (reference 17), which provided a comprehensive review of the entire materiel acquisition process. The AMARC membership is given in Appendix K.

The major recommendation of AMARC relevant to laboratories was that the current laboratory system be reorganized into six (6) mission oriented Development Centers (Ground Mobility, Air Mobility, Armament, Communications, Electronics and Missiles) and the remaining organizations (Natick, MERDC, AMMRC, HEL) which do not specifically fit these mission areas be designated as corporate laboratories (see Figure 3-1). Implementation of these recommendations implies substantial personnel reductions as the Development Centers are established and duplicative support functions are reduced or eliminated. Additionally, an organizational change was proposed (see Figure 3-2) to reduce management layering by separating the development and logistics functions within the Commodity Command so that the Development Center would report directly to headquarters AMC.

Additional recommendations by the Science and Technology Team were:

(1) Assign combat officers with appropriate experience to act as consultants on user aspects of the program at development centers. Also, scientific and engineering personnel should have the benefit of more contacts with operational exercises and tests.

(2) Make better use of other government laboratories. Management checkpoints should be established to assure that consultation and coordination with other Army, Defense or Federal laboratories is not overlooked in planning R&D tasks. It is expected that the additional "job security" afforded by mission responsibility ("lead lab") assignments made in recent years will make the laboratories less reluctant to interact with other laboratories.

FIGURE 3–1

CONSOLIDATION OF AMC LABORATORIES AND RD&E ACTIVITIES INTO DEVELOPMENT CENTERS

DEVELOPMENT CENTERS	GROUND MOBILITY	AIR MOBILITY	ARMAMENT
ILLUSTRATIVE MAJOR MATERIEL MISSIONS	Ground Vehicles Tanks Materials Handling Equipment Earth-Moving Equip Propulsion & Suspension Tech	Air Mobility Tech Rotary Wing Tech Army Air Operations Air/Ground Avionics Drones	Weapons & Wpn Sys Nucl & Conv Ammo Fire Control Equip Mines, Grenades Pyrotech, Smoke Chemical Materiel Def Bio & Rad Mats

RD&E ACTIVITY CONSOLIDATIONS:

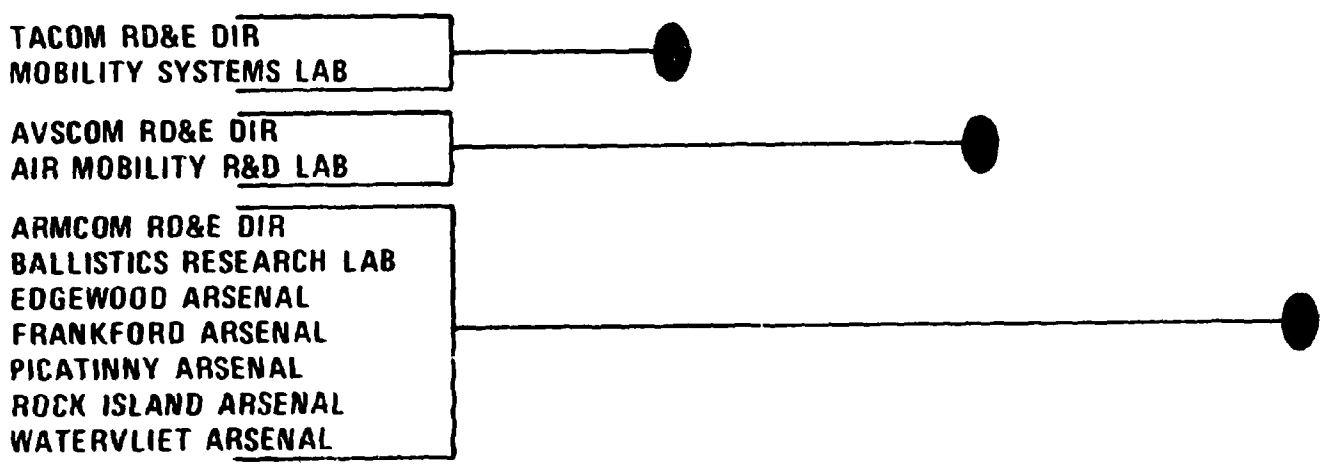


FIGURE 3–1
CONTD

CONSOLIDATION OF AMC LABORATORIES AND RD&E ACTIVITIES INTO DEVELOPMENT CENTERS

DEVELOPMENT CENTERS	COMMUNICATIONS	ELECTRONICS	MISSILE
ILLUSTRATIVE MAJOR MATERIEL MISSIONS	Tactical Communications Strategic Communications Satellite Communications ADP Equipment IFF Systems	Surveillance/Sensor Night Vision Electronic Fuzes Electronic Warfare Atmospheric Sciences	Free Rockets Guided Missiles Ballistic Missiles Air Defense Msls Missile Fire Control Guidance Technology

RD&E ACTIVITY CONSOLIDATIONS:

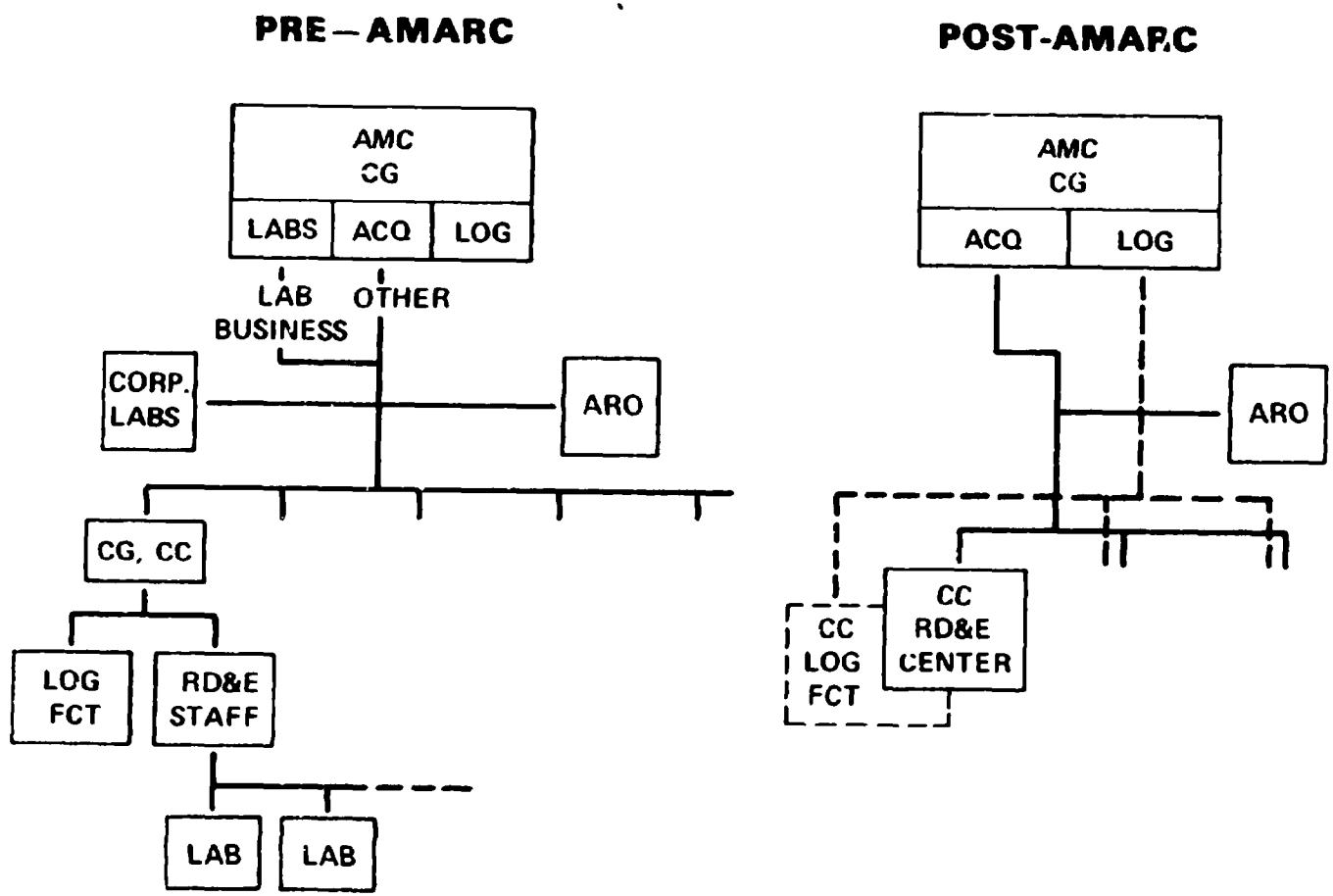
- ECOM RD&E DIR
  COMMUNICATIONS ADP LAB
  ELEC TECH & DEVICES LAB
  AVIONICS LAB
  ELEC R&D TECH SPT ACT
  SATCOM RD&E ELEMENTS
- HARRY DIAMOND LAB
  COMBAT SURVEILLANCE
  NIGHT VISION LAB
  ELECTRONIC WARFARE
  ATMOSPHERIC SCIENCES
- MISSILE RD&E LAB

NATICK LAB
MERDC
MATERIALS & MECHANICS
HUMAN ENGINEERING

NOTE: No changes anticipated; established as Corporate Laboratories

FIGURE 3–2

AMC LAB/CENTER ORGANIZATIONAL CHANGES PROPOSED



(3) Continue to appraise the "worth" of the new Army development centers systematically and regularly in AMC headquarters.

(4) Maintain a climate in the laboratories favorable to innovation useful to the Army. The team recommended especially that middle management should be advised that the absence of a specific Army requirement does not, in itself, suffice to justify the termination of a research or exploratory development effort; however, the absence of any conceivable Army application should continue to require the termination of a research or development effort.

(5) Try harder to overcome the Civil Service constraints.

(a) The Secretary of Defense was urged to work in a vigorous and a positive way with the Congress and with the Civil Service Commission to seek needed reform in Civil Service. In addition, the Secretary of the Army should continue action to insure that internal Army practices do not make the situation even more restrictive than Civil Service regulations allow.

(b) Special teams consisting of selected personnel experts and successful R&D directors and managers were suggested to visit Army installations to train and advise R&D managers on successful ways of dealing with Civil Service manpower problems. It was suggested that such teams could also advise OSD on specific Civil Service problems and reforms which would serve as the basis of DoD proposals to the Congress or the Civil Service Commission for change.

(6) Consider possibilities of contractor operations at development centers, if Civil Service restrictions and internal Army problems continue to interfere with the attainment of high performance.

(7) Maintain a strong Technology Base. It was felt that Army decision makers need to be more aware of the need for maintaining a constructive Technology Base in order to assure the future effectiveness of Army's weapons and materiel. In order to stop the current trend of funding erosion of one-third in real dollars in 10 years, a more aggressive and positive approach was recommended with both OSD and the Congress for 6.1 and 6.2 funding. "Single Program Element Funding" for research and exploratory development was endorsed.

(8) Delegate authority to AMC to either lease or buy laboratory computers depending on need because of the present 40 month lead time for purchase. Approval authority for scientific and laboratory computers needed by the laboratories was recommended to be delegated to AMC up to $200,000 annual lease or $500,000 purchase.

(9) Raise procurement dollar thresholds to catch up to and keep pace with inflation. The funding threshold for R&D contracts requiring Army Secretarial D&F approval should be raised to $250,000 from the current $100,000 level. The current "small purchase" limit of $2,500 should be raised to $10,000.

3.2 Navy Study

The members of the Hazen Study (see Appendix K for membership) examined previous reports relating to the Navy laboratories, and conducted interviews with people in the administrative chain of the Navy's RDT&E efforts from DDR&E to the top and middle management of a variety of laboratories and test facilities. In addition, the Study Team was briefed on the procedures of the other services and visited a number of their laboratories. The objective of these investigations was to determine the nature of the utilization of the Navy laboratories, and to identify factors that might inhibit this utilization.

The group concluded that (reference 19):

(1) the Navy laboratories and test facilities appear to be reasonably matched to the Navy's requirements without unreasonable duplication of facilities and services available elsewhere;

(2) they are performing their functions of assuring technologically up-to-date Naval forces, avoiding the possibility of technological surprise, exploiting new technology, maintaining a technical memory, and aiding in the weapons acquisition process in a relatively effective manner;

(3) the costs of their activities are reasonable and seem comparable to those that would be incurred in industry for similar functions. Only about 1/4 of the total Navy RDT&E budget is spent in-house in the laboratories, the rest either being contracted out directly from headquarters or through the laboratories themselves. It was felt that less than this amount spent for in-house technical work would begin to hamper the laboratories' abilities to perform their missions. No separate examination was made of the Technology Base in-house/contract ratio.

The major in-house laboratories (the nine NAVMAT[6] laboratories and NRL) have much broader mission assignments than the laboratories of the other services, generally spanning the spectrum of RDT&E funding categories and including significant amounts of non-RDT&E funds as well. Their activities are generally Navy mission rather than technology-oriented, and are a mixture of platform, warfare area, functional and technological concerns which equip them well to be of assistance in weapons acquisition from initial concept to in-service engineering.

The team concluded that there seemed to be no fundamental problems in the RDT&E process of such a magnitude as to preclude the Navy's successful pursuit of programs leading to new hardware and software systems. However, the Committee did observe a number of areas where substantive improvements might be made, particularly in a climate of diminishing resources, increasing costs, and the resultant necessity for more options but fewer commitments to engineering development and production.

The current mode of operation in the 6.2 funding area was observed to have a subtask orientation rather than broad program objectives. This fact coupled with the need to obtain funding for the laboratories, was felt to create an atmosphere that provides a permissive license to expand the technical spectrum beyond reasonable mission assignments and to result in duplication and detrimental competition within the in-house laboratories.

It appeared to the group that the greatest potential improvements in laboratory utilization could be made in the management of the RDT&E process. There was felt to be little policy guidance from the upper echelons downward, but a tendency for excessive micromanagement by everyone from DDR&E down through the SYSCOMs, leaving the laboratory management little ability to affect the process "except by indirection."

There was also judged to be little coupling between the 6.1 research programs and the remainder of the Navy RDT&E programs, the in-house laboratories, or the SYSCOMs. Because of difficulty in effecting transition between funding elements, planning has tended to become an element funding process rather than a broad program development effort. There was observed to be a strong tendency to view each Advanced System Concept as a candidate for eventual production instead of regarding 6.3 programs as generating options and

6/ Since reduced to eight by consolidation of NWL and NOL into the Naval Surface Weapons Center (NSWC).

alternatives. The decision process by which 6.4 Engineering Development programs are initiated was judged as particularly fuzzy.

In addition to these management problems, the Study found that there were a number of special facilities problems that affected the RDT&E processes adversely. These included the operation, maintenance and updating of T&E ranges, the difficulty of obtaining ship and submarine services for the RDT&E community, the length of time required to obtain military construction funds and the problems associated with obtaining computers for R&D purposes.

The Study proposed that these problems be addressed by combining the planning and management of the 6.1 and the 6.2/6.3A programs under a single command to be entitled the Chief of Naval Research and Technology (CNR&T) who would be in charge of Research and Technology for the Naval Material Command. Programmatic control would be handled by an Office of Research and Technology and implemented through the SYSCOMs and the laboratories. It was recommended that the role of the laboratories in the planning and management (but not necessarily the execution) of the 6.1 program should be increased significantly.

Corresponding to the Office of Research and Technology would be an Office of Laboratory and Range Operations charged with responsibility for policy matters relating to laboratory and T&E facility operations, management, organization, facilities and staffing. This office would also coordinate all Navy RDT&E MILCON requirements and plans as well as control and manage the RDT&E Management and Support (6.5) appropriation.

It was further proposed that along with these changes in the management organization a new Technology Baseprogram planning process be developed that encourages informal discussion, but inhibits low-level person-to-person commitments between the performer and sponsor; heavily involves middle and upper management, especially at the laboratories; results in a package that is negotiated personally by top management within the laboratory and the SYSCOMs; and which is funded and managed as much like a single item as possible without sub-breakdowns against which controls are exercised external to the laboratory.

To improve the effectiveness of this procedure and provide better focus on Navy "needs," program elements should be realigned with the SYSCOMs missions, and a "General Advanced Development Support" element line for each SYSCOM be created to be administered

by ASN(R&D) through the CNR&T, and used to encourage the transition from exploratory development to more advanced phases. These steps would, it was felt, permit better focus of laboratory programs and reduce the existing fragmentation.

It was observed that there currently exist a variety of different methods of developing and training personnel within each of the laboratories and SYSCOMs, ranging from relatively formally structured programs to total laissez-faire. In a period when personnel reductions will undoubtedly be required, it was felt increasingly important that the quality of the people in the laboratories and headquarters be of the highest possible, so the Study recommended the creation of uniform procedures and programs across the entire RDT&E community encouraging the development of technical and managerial talents, giving people the possibility of being exposed to a wide variety of experiences, and clearly linking their achievements to their career pattern and growth.

Because of the importance of maintaining at all times the quality of the work performed in the in-house facilities, the Study urged that the current system of advisory boards be augmented by a quality assessment group including, as required, people drawn from the operating forces, industry and universities to serve as a staff function to the CNR&T.

3.3 Air Force Study

Members of the Air Force study group (see Appendix K) visited all laboratories and facilities specified in their charter. The group examined the "customer/product division" view of the laboratories through visits, discussions and a formal questionnaire solicitation. These fact-finding techniques plus the diversity and depth of background of the study group members provided a comprehensive perspective on the problem.

The Air Force in-house laboratories were viewed by the Air Force system development community in a favorable light although it was felt that the laboratory role was not well understood by many in the Air Force. The former conclusion was derived from a survey questionnaire of seventeen laboratory customer organizations. Generally speaking, the users were very positive in their respective assessments of Air Force in-house laboratories. These laboratories are judged to have competent personnel; to be responsive to requests for support; to be unbiased, objective and motivated by Air Force best interests; and to be at least as good as non-Air Force organizations which provide similar categories of technical support. In the way of

improvements, the responders suggested better communications between laboratories and users. Also recommended were greater visibility control of laboratory projects in the system development area. A flow of personnel from laboratories to project offices was urged, as was the improved transition of technology into new weapon systems.

A projection of Air Force requirements for technical support to future systems development was attempted in the study. The study group concluded that some Air Force laboratories are marginally manned or under-manned for the work they are currently performing toward command, control, and communications systems, the one area where the level of technical support is not sufficiently large.

Civilian leadership in the laboratories was judged to be weaker than desirable. There were felt to be too many senior grade employees who are not well qualified. Civilian grade structure is generally higher in the laboratories than in other Air Force RDT&E organizations, representing a barrier to employee mobility. Civilian personnel turnover in the laboratories is very low, and consequently, average age among civilian scientists and engineers is higher than in other comparable institutions in the United States.

Considerable improvement is possible in inter-Department coordination of RDT&E activities and this is probably best done at the laboratory level. The study group strongly resists centralization of research under OSD to achieve such coordination.

The study group concluded that Air Force laboratories, although small, are of acceptable quality, and very useful in providing a technical capability pertinent to Air Force interests. The Air Force should sustain a strong commitment to its laboratory complex.

It was concluded that the AF 6.1 program could achieve greater results for resources expended and should be better coordinated with other DoD research. A single manager was recommended with a gradual phasing out and redirection of current in-house research laboratories; i.e., phase out ARL and fund CRL out of 6.2.

It was recommended that the AFSC product divisions control the 6.3 and 6.4 funds expended in the laboratories. The intent is to improve relevancy of the projects, bring the laboratories closer to system planning and acquisition, and provide a direct link for the transition of technology.

The study group suggested that some laboratories be affiliated with product divisions: AFATL remain with ADTC; AFAPL, AFFDL, AFAL, and parts of ARL combine into one new laboratory associated with ASD; a part of AFCRL (restructured), RADC and RML affiliate with ESD; and AFRPL with SAMSO. The long range objective is to create a center of technology behind each product division to insure Air Force technical competence in the key product areas of interest. The AFSC product divisions should control the advanced and engineering development funds expended in these laboratories, although the laboratories would continue to report to DS&T. Part of AFCRL, devoted to environmental sciences, would be in this group. The study group recommended no changes in the organizational arrangements under which the MIT Lincoln Laboratory operates, but did recommend a shift of project emphasis toward ESD programs. The laboratories, in the opinion of the study group, are worth the investment of 3% of the Air Force's total funding. It is felt that forcing closer ties with AFSC product divisions should increase the value of this investment.

In the management area, the study recommended greater use of term appointments for senior civilians, a career development plan for RDT&E civilian employees with progression linked to broadening experience outside the laboratories, and a major adjustment of super-grade positions within AFSC.

The use of financial management of manpower rather than manpower ceilings was strongly recommended, but with specific controls over how this authority is used.

It was felt that the use of the laboratories to train military officers in the Research and Development career field should continue.

Finally, the suggestion was made that the current mission of the in-house laboratories should be re-examined, in the light of long-term Air Force system development needs. Although most members of the study group supported the concept of laboratory involvement from basic research to end item feasibility including a specific role in system development and acquisition, the study group recognized that Air Force organizational arrangements and current laboratory capabilities are not compatible with the implementation of such a concept on a broad scale. The study group urges that the in-house laboratory system be recognized for what it is: A collection of small laboratories capable of undertaking or sponsoring good scientific or technical work of interest to the Air Force, and of providing useful in-house consulting and other services to the system developers. It is not a set of "full spectrum" laboratories, nor does it have any major system development capability.

The Air Force has implemented a number of action teams to develop the specifics relative to implementation of the study recommendations.

4. ODDR&E STUDY

Following the completion of the Service studies, the Service outputs were reviewed and critiqued by ODDR&E and additional inquiries carried out in areas where it was deemed necessary or advisable. For the additional work, the professional personnel of the Office of the Deputy Director (Research and Advanced Technology) (R&AT) whose normal responsibility is the management of the Technology Base, were used. There are 17 professionals on the R&AT staff whose backgrounds span the disciplines of DoD RDT&E. Sixteen have advanced degrees and six have Ph. D's. The average experience is 22 years, about evenly divided between industry, in-house laboratory and OSD (see Appendix B for names and additional details). In addition, other DDR&E personnel and the DARPA staff were surveyed to assess their view of the laboratories and the Services' RDT&E management structure.

The principal questions addressed in the ODDR&E study were the same as those the Services were directed to examine: (1) Do we really need in-house laboratories?; (2) If the answer to (1) is yes, are the laboratories organized and operated in a manner consistent with getting the most return on our investment?; (3) Are we properly apportioning the program between the in-house laboratories and the other participants, notably industry and the universities; and (4), Is the size of the laboratory complex appropriate for what it is expected to do?

4.1 Need for the In-House Laboratories

Justification of the existence of the in-house laboratories in a nation dedicated to free enterprise requires demonstration that they do or can provide something that is (a) vital to the system, and (b) not satisfactorily available from other sources such as industry, universities, FCRCs, Headquarters staffs, System Commands, etc.

The in-house laboratories differ from industrial organizations in that (1) they have no profit motive, (2) as part of the Government, they are allowed virtually unlimited information access, and (3), they enjoy a close relationship with their parent Military Service and, consequently, have extensive exposure to and familiarity with Service problems. They also differ from universities in the latter two facets. As a result, the labs should have a better perception of how to bring

technology to bear on the problems of their Service than would industry or the universities and a less biased position than industry.[7] They share the above attributes with Headquarters and System Command staffs, but differ in kind from both of these groups in that the laboratory personnel are actively and intimately engaged in evolving technology and thus represent a degree of familiarity with contemporary technology not usually available from these other "in-house" organizations.

An activity most appropriate for the laboratories as a result of this unique combination of attributes is the vital function of providing technical input to the military planning function, especially to the planning of systems development, acquisition and usage. In addition, of course, the laboratories can and do serve as vital adjuncts to the Services day-to-day technical problems in helping them to be "smart buyers" by providing technical advice and supervision for the Services' interaction with industry. Both of these functions could be provided by Headquarters and System Command staffs, if the staffing policies of these organizations were changed with emphasis placed on current technological competence. Such a change would necessitate staffing these organizations largely with people on rotation from technical organizations (as currently done in ODDR&E, for example). If there were no in-house labs to draw on, these people would have to come from outside the Services. These staffs would then lose much of their depth in knowledge of Service problems and people, reducing their effectiveness as "corporate memories." Only in the in-house labs can we expect to consistently and continually combine both contemporary technical expertise and an in-depth familiarity with Service problems.

The laboratories also represent an alternative source of technology and of at least limited production in some technical areas, so that their very existence serves as a stimulus to industry to perform well for the DoD.

Finally, the in-house laboratories represent technical organizations that can be directed to become centers of technical excellence in areas of little or no industrial interest, such as explosive ordnance disposal technology, nuclear vulnerability and hardening of electronic devices, chemical and biological defense research, military explosives, large caliber guns, etc.

We consequently believe that the current system could not function without the in-house laboratories. It is recognized that there are some program managers in the system that can and do function

7/While the labs lack a profit motive, they do have a strong instinct for self survival, so the degree to which they are truly unbiased really depends upon their assured level of support vis-a-vis their size.

well without any laboratory support. We believe, however, that even these people benefit indirectly from the fact that the laboratories' existence serves as a stimulus to increased industrial performance in many ways. Thus, we conclude quite unequivocally that the in-house laboratories are, in principle, capable of meeting vital DoD needs that are not generally met by other sources. The fact that the laboratories are sometimes not well used or in some specific cases fail to perform, does not affect the validity of the argument for their existence. It does, of course, bear upon the question of their proper size, management and constitution.

4.2 Management of the In-house Laboratory Complex

The ODDR&E personnel have had extensive exposure to the differing structures and methods of management of the three Services' laboratory complexes and related facilities, since many of the staff came from in-house laboratories and all of the staff have daily interactions with them. They also have some familiarity with laboratories outside DoD. This background was applied to the question of how best to operate the DoD laboratories since many are directly involved in intra-governmental technology coordination.

It is evident that no one existing Service laboratory system is clearly the best in all regards, even within the context of its own Service. Rather, it is our belief that a better system can be evolved from an intermingling of the best features of all the systems examined, tailored to the particular environment of DoD and each Service.

Two extreme styles of management for R&D organizations are (1) that in which the laboratories serve as closely directed performers of explicitly formulated tasks, largely under the control of external customers and (2) those in which the laboratories are given broad responsibilities and entrusted to carry out these responsibilities with minimal detailed guidance but with a careful attention to results. Neither of these extremes are, in their entirety, well-matched to the totality of DoD needs. The latter style has generally been most productive in producing innovative new ideas and new technology. The former style recognizes that as a mission oriented agency, there are some specific jobs in RDT&E that need to be done in response to detailed headquarters direction.

We have considered all these factors and derived a set of management principles that state a philosophy of management for DoD PS&E-oriented laboratory/technical centers that we believe to be consistent with DoD needs, reasonably free of internal inconsistencies and

capable of improving the productivity and morale of the laboratories. These are described and defended in Appendix J and summarized in Tables 4-1 and 4-2. They reflect what we believe to be the best features of all systems examined. They have been widely discussed and debated with the DoD RDT&E community and reflect the integrated wisdom of many experienced and thoughtful R&D people. The major feature is that they place the responsibility on the laboratories for the more innovative phases of technology, but make them dependent upon - and responsive to - headquarters directions in support of the development of new systems and the support of existing materiel. They are based upon the observations that most outstanding laboratory systems share three attributes: (1) The assignment to each component of an important job to dc; (2) The attraction and retention of good RDT&E leadership; and, (3) The provision of a sufficient flexibility in the system to allow the leadership to most effectively use its talents to accomplish the job assigned.

The details behind the summary statements of Tables 4-1 and 4-2 are in Appendix J and will not be repeated here. However, it seems appropriate to elaborate upon the distinction in how we view the proper laboratory role in the materiel acquisition support function and in the execution of the Technology Base program.

Since Congress has made clear its intention that DoD R&D has no mission to support science or scientific training beyond DoD's own needs, materiel acquisition support (i. e., the support to system planning, development, acquisition, and effective use) must be viewed as the principal raison d'etre of the PS&E laboratories and the ultimate performance measure of importance in assessing the contributions of the laboratories, and indeed of the entire RDT&E establishment, to the DoD.

Recognizing that the primary responsibilities for most materiel acquisition work rests with designated Program Managers, the laboratories should operate their materiel acquisition work on an industrially funded basis in a customer/supplier relationship with the appropriate Program Managers. The degree of their involvement should ultimately be governed by the customers' satisfaction with their contribution to his program. In order to preclude the laboratories being completely subjugated to the Program Managers, however, it is proposed under items 16, 17, and 18 of Table 4-1 to provide some offsetting checks and balances. Perhaps the most important step recommended is that indicated in item 18: To assure that (1) full consideration is given to the use of the laboratories as adjuncts to Program Managers and (2) the laboratories' technical opinions are made available to and evaluated by senior Service management and OSD, we propose to require the appropriate laboratory to formally contribute to the Decision

TABLE 4-1

LAB MANAGEMENT PRINCIPLES

MATERIEL ACQUISITION SUPPORT IS THE END OBJECTIVE OF THE LABORATORIES

1. Labs need a demanding, important mission/product responsibility.

2. Services need multiple sources of technical advice.

3. Lab/Centers should have "full spectrum" involvement.

4. Materiel acquisition and improvement work should be task funded, including overhead, by the customer ("industrially funded").

THE TECH BASE IS A LONG RANGE INVESTMENT IN INCREASING THE SERVICES CAPABILITY IN MATERIEL ACQUISITION

5. Technical area responsibilities should be assigned to each lab appropriate to their mission/product responsibility.

6. 6.1 and 6.2 should be block funded; 6.3 Advanced Technology Demonstrations should be task funded, but from 6.3 funds controlled by the Services' Technology Base managers.

7. Initial Technology Base program planning should be done by Labs.

8. Approval and appraisal chain for the Tech Base program must provide for wide spectrum of advisory inputs, but approval chain must be short, very competently staffed.

9. Responsibility for execution of the agreed program should be assigned to labs; they should be given latitude to achieve endorsed goals; their performance periodically evaluated.

CONTROLS ARE NEEDED ON THE LAB'S SIZE

10. Total Tech Base funding for each lab should be formally controlled as part of budget process.

TABLE 4-1
CONTD

LAB MANAGEMENT PRINCIPLES

11. In-house/contract ratio of block-funded work should be similarly controlled.

12. A total dollar ceiling on each Lab's in-house effort should be set each year by the Services.

13. No additional controls should be placed on the number or distribution of personnel.

14. Improve salary incentives for senior positions is badly needed to assure quality.

15. Lab directors that prove ineffective should be replaced.

CHECKS & BALANCES

16. The Services should assure that labs have access to a multiplicity of customers.

17. Senior people in Service acquisition structure should monitor labs performance.

18. Lab input to the materiel acquisition (DCP/DSARC) process should be requested.

TABLE 4-2

LAB PERSONNEL/PROCUREMENT PRINCIPLES

MILITARY/CIVILIAN INTERFACE

1. Lab staffs should be mixture of military and civilian at all levels.

2. Same qualifications should be required of military and civilians for same job.

MOBILITY IN RDT&E

3. Lab personnel should be encouraged to serve tours in headquarters and on operational staffs.

4. We should provide for continual retraining of lab and Headquarters technical staffs.

MANAGEMENT SUPPORT

5. Personnel policies and regulations should be tailored.

6. Procurement processes should be expedited.

7. Labs should be allowed to have all the support activities they will pay for within their total in-house expenditure ceiling.

Coordinating Paper (DCP) for each new system going to DSARC I and II (see reference 23). Their contribution would be in the form of a Technical Assessment Annex giving their opinion of the technological risk involved in the program and describing the plans for addressing any such risks. More details of this plan are given in Appendix M.

The Technology Base is viewed as a long range investment by the Services and by the laboratories in the Services' future capability to provide more effective materiel and materiel support. A major part of the responsibility for the wise management of this investment should, we believe, be vested in the laboratories, since only they have people of sufficient talent available in large enough numbers to do the demanding task of structuring an integrated, innovative and responsive Technology Base program. The approval and appraisal responsibility for the Technology Base program should be vested in a small, highly competent headquarters staff, and monitored via the present budget approval process by ODDR&E(R&AT).

The laboratories should be controlled by financial controls only, eliminating redundant and often conflicting controls on manpower and financial resources. Control would be exercised by instituting explicit additional financial controls on in-house activities as indicated in items 10, 11, and 12 of Table 4-1 as part of the yearly budget process.

4.2.1 Army Laboratory Management

The impressions that the ODDR&E study received of the Army laboratories can be summarized as follows:

(1) The current system of operating the Army laboratories is the one most nearly in agreement with the management principles of Tables 4-1 and 4-2. They have moved in recent years to adopt what were perceived to be the best features of the Air Force and Navy systems. For example, for the most part, their laboratories have full spectrum involvement, use industrial funding and the customer/supplier relationship in the materiel acquisition phase and a block funded Technology Base. The Technology Base planning process is not as readily discernible as that of the Air Force, however, and it is not clear who is actually doing the planning (it apparently varies between Commodity Commands).

(2) The Army may have the widest span of laboratory quality of all the three Services. Some Army laboratories are regarded as among the better laboratories in the country. On the other hand, several past studies, including AMARC, have been very critical of some of the Army laboratories, a view shared by the ODDR&E and DARPA staffs.

(3) Part of the resolution of the seeming inconsistencies of (1) and (2) above lies in the fact that the Army has been taking aggressive and innovative actions in recent years to upgrade their laboratories. The operating system of item (1) above is quite new in most of the laboratories, based upon a successful trial of several years duration at MERDL. MERDL is regarded as one of the better Army labs, in part as a result of experience under this new approach to lab management.

The AMARC recommendations and the Army's reaction thereto indicate that the Army is aware of its problems and working aggressively to improve the laboratories. We concur in principle with the AMARC-proposed regrouping of the laboratories and the shortening of the reporting chain above the laboratories. The only long term concern regarding the regrouping is that it will diminish competition. However, the Army recognizes this fact and is considering means for overcoming this problem including the AMARC-recommended use of other Government laboratories. The Army's recognition that much can be done to provide increased personnel management flexibility within the existing Civil Service System and its actions to educate its key personnel in how to do so is a commendable practical approach to a difficult problem that we have recommended to the other Services.

Only three shortcomings in the AMARC Study and the Army follow-on actions have been identified by ODDR&E as needing explicit attention. We recommend that the Army develop and document a system for financial control of the sizes of the laboratories/centers and develop and document a formal planning process (perhaps modeled on the Air Force process of reference 21) for the Technology Base and spell out the program approval authority. We also strongly recommend that the Army develop a research and development career pattern for some of its officers with emphasis on advanced technical training and laboratory experience during their early careers to better prepare them for senior technical assignments.

4.2.2 Navy Laboratory Management

The findings and recommendations of the Hazen Report have been taken under consideration by the Navy but no position has yet been taken.

The ODDR&E impressions of the Navy laboratories can be summarized as follows:

(1) They are an integral part of the Navy, deeply involved in the day-to-day programs thereof and depended upon to help keep the fleet operating.

(2) They possess a large reservoir of technical experience including many internationally recognized scientists and engineers. However, the usage of this talent to aid the system planning and development process in the Navy is not all it should be, based upon the laboratories size and technical quality. Both the degree of the laboratories' involvement in system development and their success has varied widely from program to program and among laboratories.

(3) The Navy Technology Base effort is fragmented, composed of an excessive number of usually under-funded programs. With only a few exceptions, it lacks cohesive planning, since the program is the result of "micronegotiation" between working level people in the System Commands and laboratories, with little benefit of the overviews possessed by the top management of any of the organizations involved. Dividing work in closely related technologies among various laboratories also impedes the transfer of technology from the Technology Base to new system developments, since no one technical organization can claim a comprehensive overview of the totality of any technology.

(4) There is, in the ODDR&E view, somewhat more capacity than can be used on meaningful work. This is leading to excess competition between laboratories in order to keep full employment[8] and contributes to the excess of small programs as individual laboratory personnel negotiate small contracts with their system command counterparts to stay funded. A recent study (reference 24) of one Navy laboratory indicated that approximately 20% of the work was of sufficiently low quality or doubtful relevance that it could be stopped without adverse impact on the Navy.

(5) There is perceived by the Hazen Committee and ODDR&E to be a less than optimum distribution of technical expertise in the system. On the average, the best technical competence is in the laboratories while most of the critical technical decisions are made in the System Commands. Significant advantages should accrue from an increase in mobility between laboratory people and the System Commands. The flow of people has been small despite the fact that the grade levels available in the System Commands usually equal or exceed those

8/Figure 2-4 is indicative of the excessive competition with 3, 4, or 5 laboratories involved in almost all end products.

in the laboratories for equivalent positions. One explanation frequently suggested for the reluctance of high quality people to move into the System Commands, despite the grade difference, is that most of the top positions therein are pre-ordained for Naval officers, limiting civilian advancement opportunities. This fact, coupled with the lack of a strong R&D pattern for Naval officers with resulting occasional mismatch between backgrounds and position, seems to be a major inhibitor to mobility. We have no quarrel with the stated need for people with operational experience in the RDT&E system. However, the combination of an improved R&D career pattern to attract and retain officers with good R&D backgrounds to these positions, coupled with "the best man for the job - military or civilian" policy for the appointment of senior personnel, should help increase the System Commands technical competence without undue sacrifice of their operational know how.

Reference to Section 3.2 describing the Hazen Report (reference 19) shows that we are in general agreement as to what the problems of the Navy RDT&E structure are. Consequently, we recommend that the Navy take vigorous steps to correct the following problems of its existing RDT&E system:

(1) Excessive redundancy in functions/platform assignments and concomitant excessive interlaboratory competition for available funds.

(2) Technology Base fragmentation, uneven quality and ineffective technology transfer.

(3) The under-usage of junior officer personnel in the laboratories and the overdependence on Naval officers for positions of senior responsibility.

The Navy should also consider how it will control the size of the laboratories and the Technology Base in-house/contract ratio in a manner consistent with changes made in response to the above recommendations, since current controls would probably be nullified.

4.2.3 Air Force Laboratory Management

The impressions gained of the Air Force laboratories are:

(1) They are reasonably effective at generating an innovative, well-structured Technology Base program and getting it executed, mostly by industry. They are selective in what they undertake and tend to adequately fund programs for the most part.

(2) The heavy military involvement in the laboratories seems to work well. There is a not unreasonable mix between military and civilian personnel in key positions and those military that occupy key positions have had experience "at the bench" early in their military careers and understand how laboratories should function. The R&D career pattern is well developed and has been demonstrated to be an attractive career pattern in terms of promotion potential.

(3) The specialization of the laboratories to the Technology Base makes their contribution to the Air Force less visible to key personnel than would be the case if they were involved more heavily in system development, acquisition and day-to-day problem fixing. This lack of perception of their value could have serious consequences in any future Air Force reductions.

4.2.4 Common Concerns

There are several problems and areas of concern common to all or most Services and therefore are most appropriately addressed by OSD. These are summarized in this section with additional details given in Appendix M.

In section 4.2 it was proposed that the laboratories be included in the DCP/DSARC process by requiring that their comments on the degree of technical risk involved in new program undertakings be formally required. OSD should modify DoD Instruction 5000.2 (reference 23) in the manner indicated in more detail in Appendix M.

All Services recommended and ODDR&E concurs that redundant controls on manpower and funding of the laboratories should be removed. Since all the military departments operate under manpower ceilings, it is desirable to coordinate any experiment in operation without ceilings in the laboratories on a department wide basis. The problem of implementing such controls are discussed in more detail in Appendix M.

Almost all laboratories visited in the course of the study identified personnel practices and regulations and procurement delays as two of the major problems in laboratory operation. OSD should take the lead in attempting to improve these two areas. Some preliminary thoughts on what might be done are given in Appendices E and F.

4.3 Laboratory Size and In-House/Contract Ratio Considerations

The questions of the appropriate size of the laboratory complex and the appropriate in-house/contract ratio are closely related. We will consequently intermingle the discussion of these two points.

The in-house/contract ratio in systems development work is under the control of the appropriate Program/Project Managers. Since most of the system development work is done in industry, the in-house/contract ratio in this area is very small. In fact, the problem in system development is currently one of trying to stimulate the use of the laboratories by the Program/Project Managers rather than preventing excessive in-house involvement.

In the Technology Base, the problem is substantially different. The ratio is substantially larger than in system acquisition. In both the Army and the Air Force the amount of work done in-house has to some extent been left to the discretion of the laboratories. In the Navy, the ratio is presently controlled by the System Commands but would come more directly under the control of the laboratories if the recommendations of the previous section are implemented. For these reasons, the in-house/contract ratio of most concern to this study is that of the Technology Base and it is this ratio to which the study was directed.

Several different approaches were used to assess the appropriateness of the current laboratory division of effort and overall size. The three principal approaches were:

(1) Available data on the size of the Laboratories and their division of effort were collected and analyzed for trends. Most of the data used were taken from two sources The principal source was the series of documents compiled by the Department of the Army on behalf of OSD, giving personnel and budget data for the laboratories, based upon data submitted by individual RDT&E organizations. [9] Unfortunately, the information in those reports does not separate out Technology Base activities and only separates 6.1 and 6.2 since 1971. In order to estimate the in-house/contract ratios, we used OSD (Comptroller) totals of all contracts categorized as either research or exploratory development to derive the in-house/contract ratio. This omits those 6.3 programs which are properly part of the Technology Base. To minimize the effect of this omission

9/ The data used were mostly that of reference 20; the totals of Tables 1A, 3A, and 5A for Army, Navy and Air Force, respectively.

and the effect of varying interpretations by the laboratories on the data for the aforementioned reports, the analysis concentrated on historical trends, rather than absolute values. The data were aggregated by Service with no attempt to examine the trends of individual laboratories (see Appendix D for detailed in-house/contract data).

(2) We conducted a survey of the opinions of appropriate people in OSD, concentrating on the staffs of ODDR&E and DARPA. These people combine the attributes of (a) familiarity with laboratory programs and capabilities; (b) adequate personal technical expertise and management experience to be capable of judging good R&D; (c) a position of responsibility for the productivity of some part of the R&D effort; and (d) a freedom from responsibility for the maintenance of full employment in the laboratories.

(3) The Navy and Air Force were requested to do assessments of 10-20-30% reductions as part of their study. No assessments were received from the Navy and Air Force so an exercise was carried out by ODDR&E in which gross assessments were made of the potential impacts of various degrees of reduction in the size of the laboratories. The Army had already examined the impact of a large reduction in the AMARC study.

The results of these three efforts and the conclusions drawn therefrom are summarized below.

4.3.1 Trend Analysis

Data upon which our analysis trends are based are summarized in Figures 4-1 through 4-4. The time span shown is bracketed by the earliest and latest Management Analysis Reports (reference 20) available (data for FY 67 were subsequently found but is not significantly different from that of FY 68).

Figure 4-1 compares the trends in the DoD total obligational authority (TOA), the DoD RDT&E budget, the number of civilian personnel in the laboratories and the total in-house program dollar value. Also shown is the growth in Civil Service salaries (ignoring the supergrade ceiling limit which should have a negligible effect due to the small number of people involved).

FIGURE 4–1

TRENDS IN IN-HOUSE LABORATORY SIZE

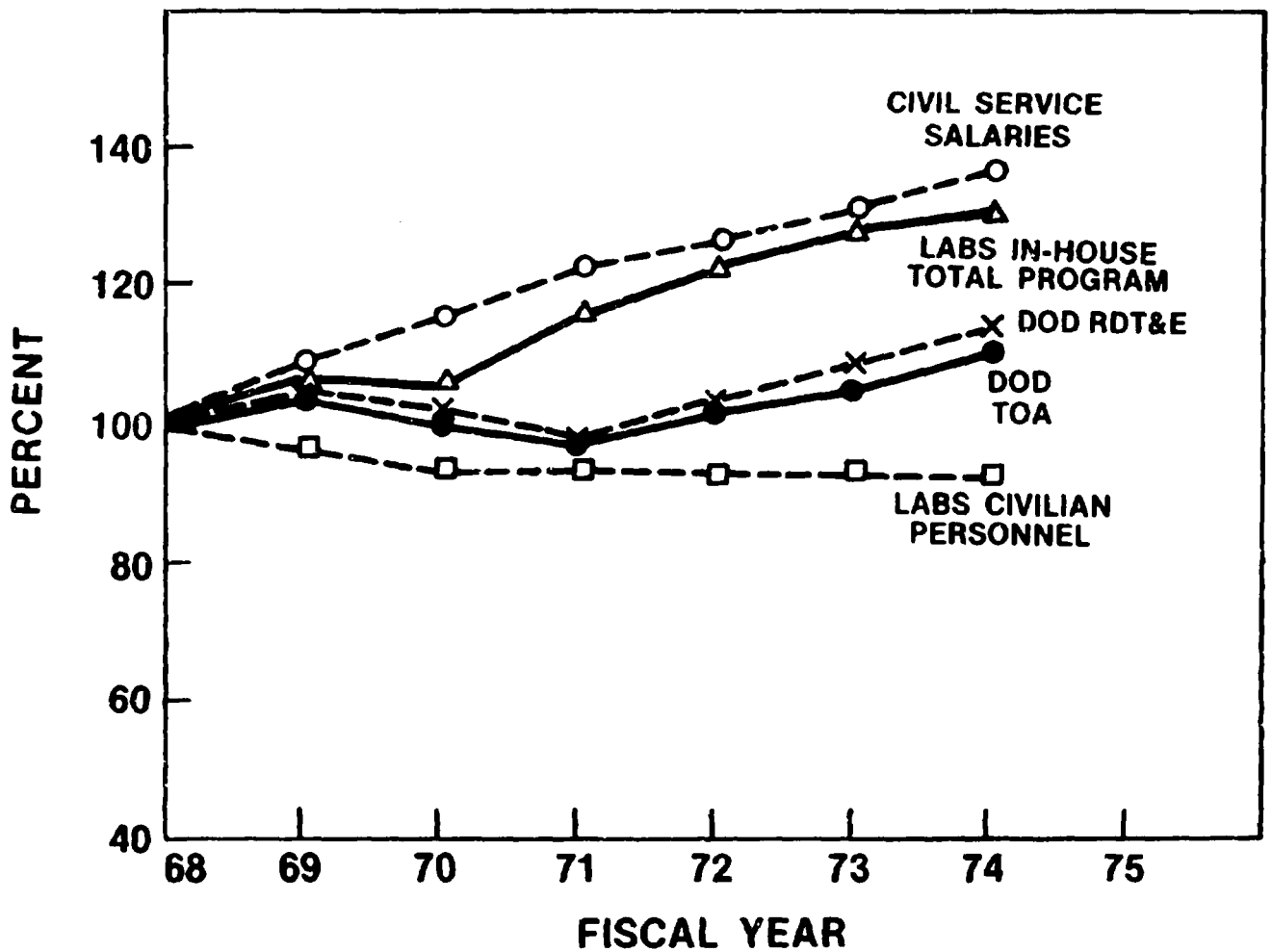


FIGURE 4–2

PERCENTAGE OF RSCH & EXPL. DEVEL. DONE IN DOD IN-HOUSE LABS

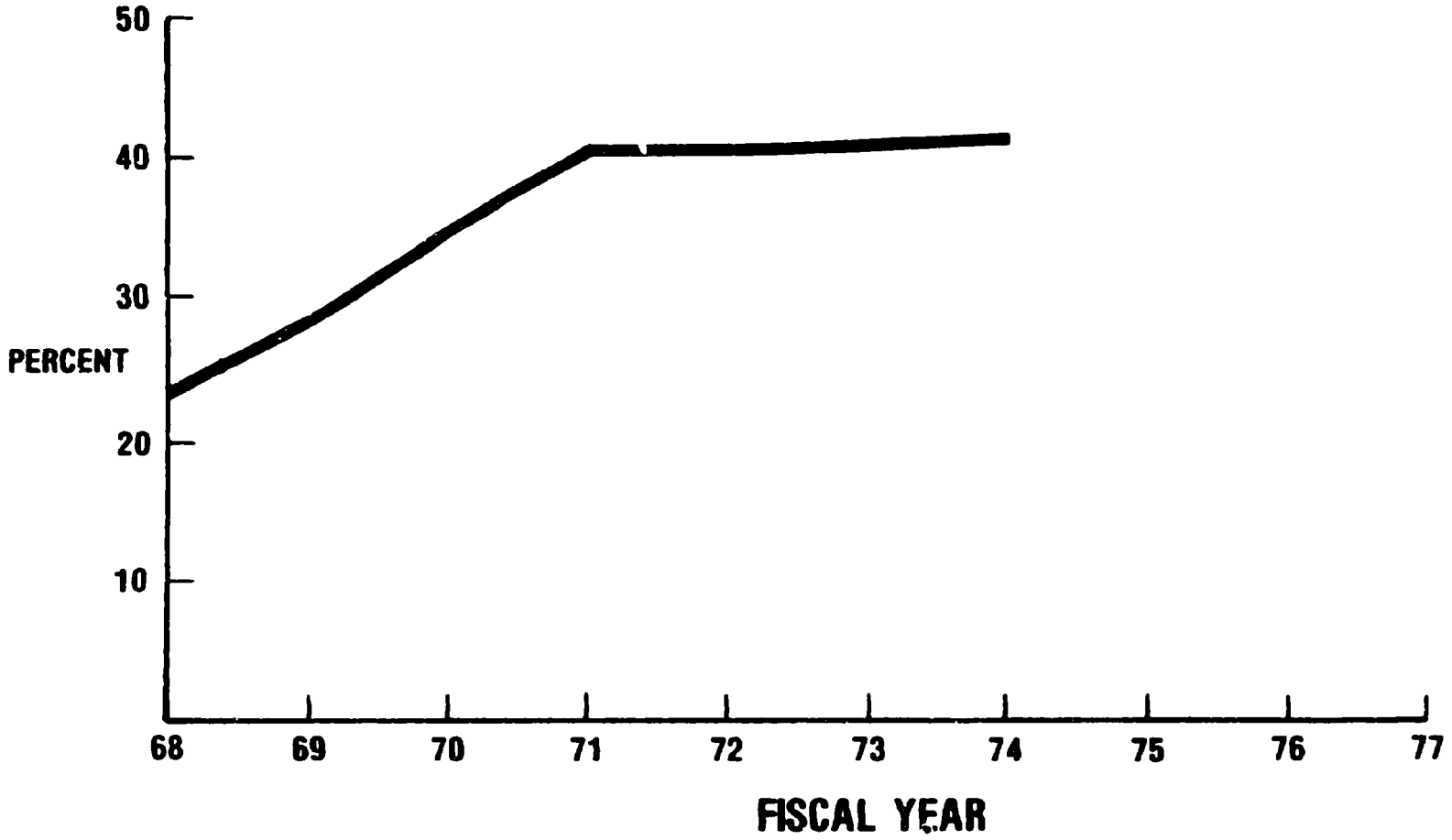


FIGURE 4–3

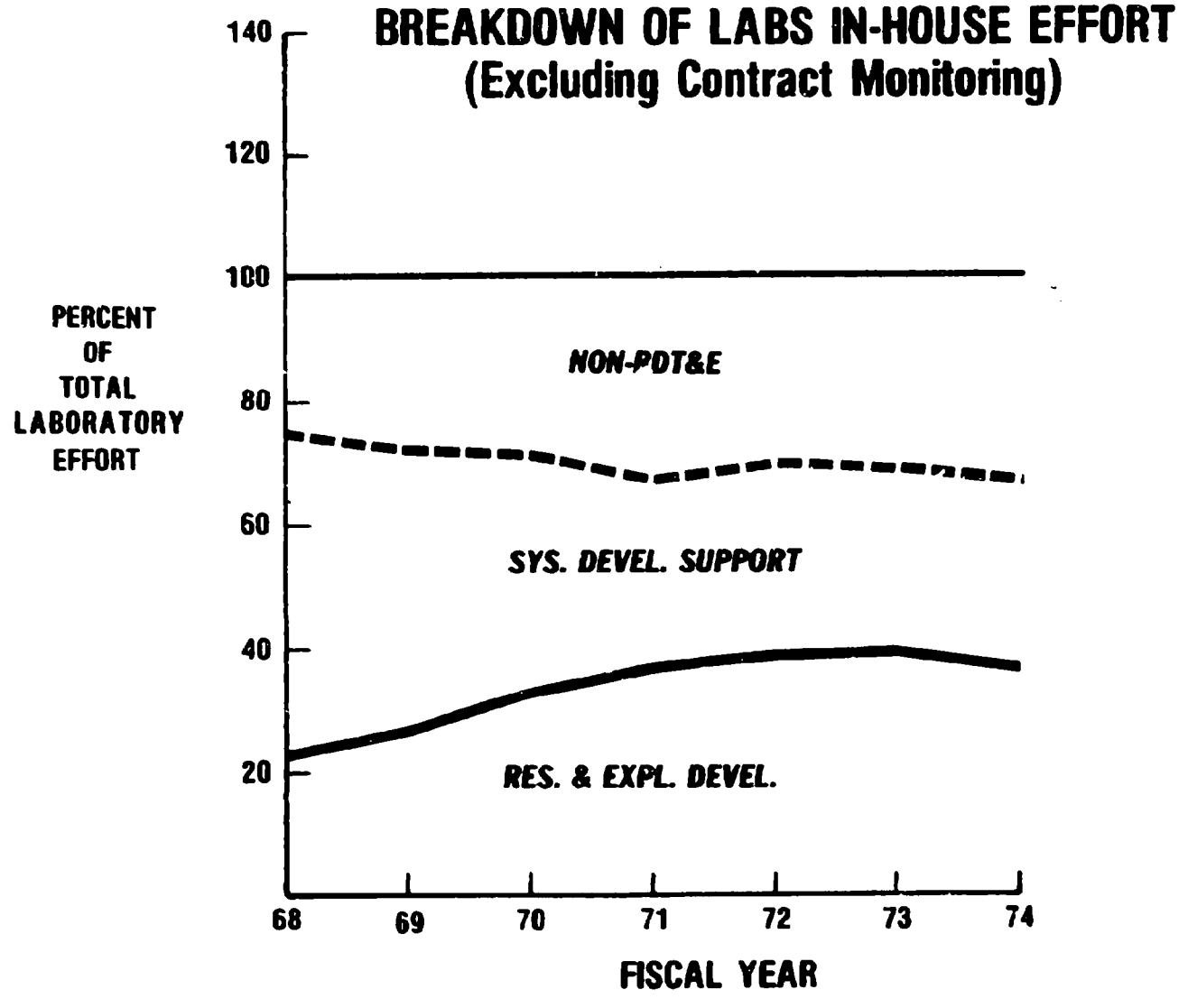
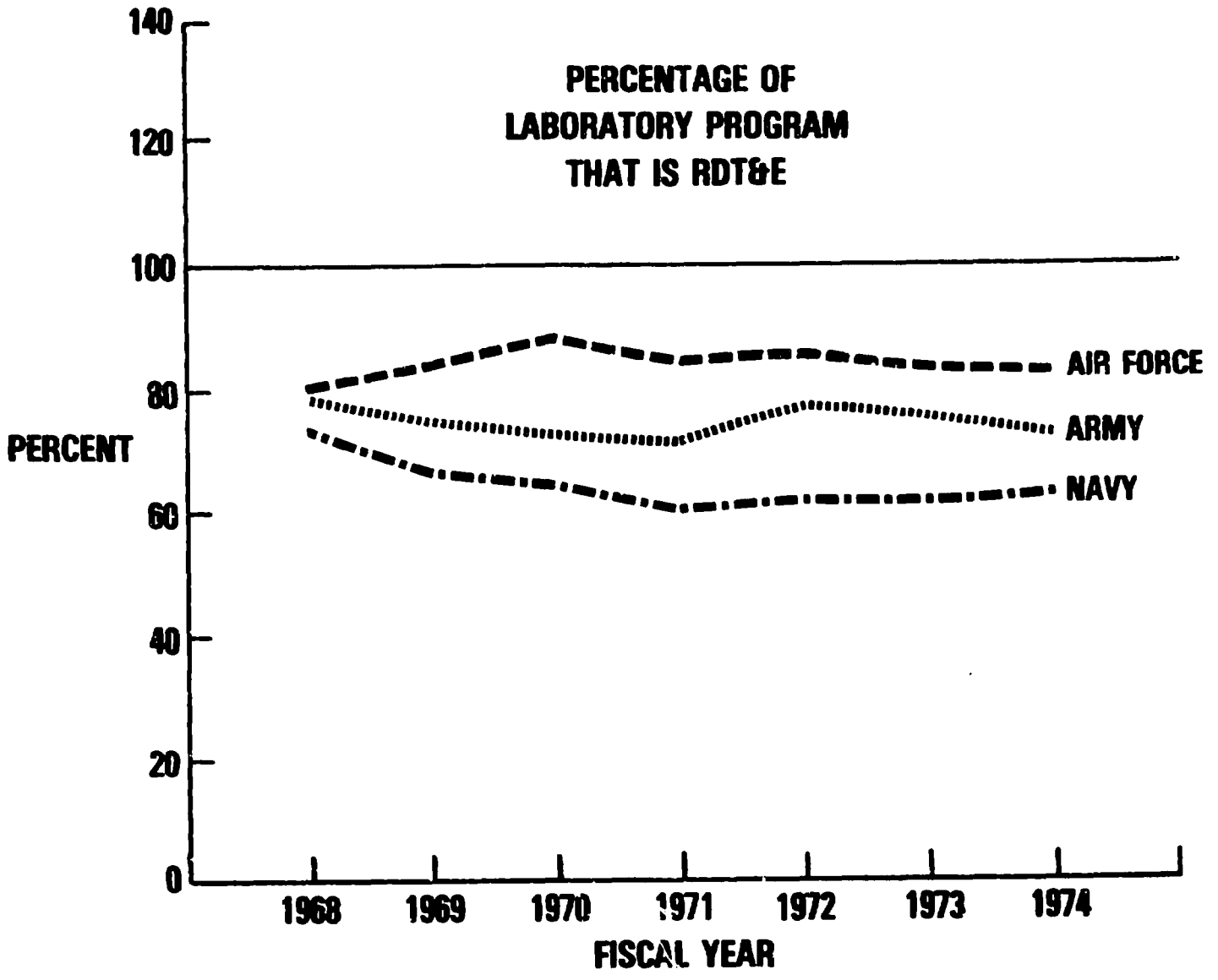

BREAKDOWN OF LABS IN-HOUSE EFFORT
(Excluding Contract Monitoring)
PERCENT OF TOTAL LABORATORY EFFORT
140
120
100
80
60
40
20
NON-PDT&E
SYS. DEVEL. SUPPORT
RES. & EXPL. DEVEL.
68
69
70
71
72
73
74
FISCAL YEAR

FIGURE 4–4


PERCENTAGE OF
LABORATORY PROGRAM
THAT IS RDT&E
140
120
100
80
60
40
20
0
PERCENT
AIR FORCE
ARMY
NAVY
1968
1969
1970
1971
1972
1973
1974
FISCAL YEAR

The figure shows that the contraction in the size of the laboratories has not been sufficient to offset the growth in Civil Service salaries and, consequently, the in-house program had increased in cost by 33% from FY 68 to FY 74, while the DoD RDT&E budget had increased only 15% over the corresponding period and the total DoD budget had increased 12%. Both the in-house program and the DoD RDT&E budget have tracked the Civil Service salary scales fairly well since 1971 so that the in-house program share is no longer increasing.

Figure 4-2 shows the fraction of 6.1 and 6.2 done in the in-house labs, as derived from the Comptroller's figures. The in-house fraction almost doubled between FY 68 and FY 71.

Figure 4-3 explores the breakdown of in-house work in the laboratories. Whereas 6.1 and 6.2 activities accounted for only about 22% of the in-house program in 1968, they now account for almost 40%. Also shown on the figure is the non-RDT&E portion of the in-house program. These activities have increased from about 25% in 1968 to 32% in 1974. Figure 4-4 breaks the latter category down by Service and shows that most of this increase has been in the Navy laboratories. The remaining work we have chosen to characterize as "System Development Support" since it covers 6.3, 6.4 and 6.5 and represents for the most part that portion of the in-house work being done in direct support of the development and acquisition of new systems. This activity, which we consider the raison d'etre for the laboratories, is now down to about half of the level of 1968.

The data of Figure 4-2 indicates the following trends:

(1) A decreased usage of laboratories for support in the Systems Development process.

(2) A tendency to take more of the 6.1 and 6.2 work in-house, and

(3) A growth in support to operational systems and units to offset the decrease in Systems Development work.

Both of the latter categories of work are appropriate for a laboratory but the trends among the three categories are of concern. Some support to operational systems and units and to on-going procurements is vital to maintaining a contemporary knowledge of the problems of one's Service. However, it does not seem appropriate to allow the laboratories to become principally occupied with such support.

Similarly, it is recognized that the laboratories need to do some in-house Technology Base work to maintain competence. In many technical areas, however, most of the significant innovations in the Technology Base have come from contracted R&D. Among the possible reasons for this are:

(1) The number of R&D people expert in most technical areas is greater in industry than in the laboratories so that by selectively contracting with industry we achieve access to a larger variety of ideas than are available from the in-house staffs.

(2) The competitive proposal approach to contracting provides a strong incentive for fresh approaches to problems for those types of problems for which it is appropriate.

(3) In many technologies the state-of-the-art has advanced to the point where unusual fabrication equipment is required for even experimental type work (e.g., integrated circuit fabrication capability for electronic systems, precision manufacturing capability for experimental turbine engines), and these unique facilities and the specialists to operate them are mostly - but not always - found in industry.

One might therefore conclude that almost all of the Technology Base work should be done in industry except for a small level of effort to keep the laboratories current with the state-of-the-art. There are offsetting considerations, however. There are some areas in which the in-house competence matches or exceeds that of industry or the universities. In these areas, one obviously gets the most productive work by keeping the bulk of the effort in-house. Furthermore, there are facilities in some of the in-house laboratories not duplicated elsewhere. Finally, there is diminishing industrial interest in some technical areas that remain of importance to DoD. In these areas, we must, of necessity, bring more work in-house. However, this latter trend has yet to be felt in sufficient strength to justify the large increase in in-house Technology Base activities shown in Figures 4-2 and 4-3.

In summary, based upon the belief that the principal reason we have PS&E laboratories is to support the Systems Development process, it follows that this category of work should be the dominant factor in the laboratories. If the trends of Figure 4-3 accurately reflect the interest in laboratory support on the part of Program Managers, our laboratories are too large and should be reduced by reducing their activities in the Technology Base and non-RDT&E work to restore the balance.

4.3.2 Survey Results

Opinions about the Technology Base in-house productivity vs. contractor productivity, as well as opinions about the proper in-house to contract ratio were solicited from the professionals within the ODDR&E(R&AT) and the DARPA staffs. The DARPA replies are oriented to functional or mission areas whereas R&AT replies are oriented toward Technology Base technology areas. Detailed results appear in Appendix C.

In general, contractors are considered more productive by the DARPA staff but the DARPA replies generally indicated satisfaction with the performance of the in-house laboratories in the Air Force and Navy but dissatisfaction with the Army laboratories.

The ODDR&E(R&AT) staff responses to the survey looked at the technology areas within the Technology Base programs. In the opinion of the R&AT staff, the Technology Base has in general become too much in-house overall, and especially so in some specific areas (see Section 4.3.4).

The estimated ratio of in-house to total activity is shown in Table 4-3, broken down by technology area.[10] Those 6.3 programs regarded as part of the Technology Base are included. The Army and Air Force entries are ODDR&E(R&AT) estimates; the Navy entries have been mutually arrived at by ODDR&E and the Director of Navy Laboratories. The particular areas judged by R&AT to be excessively in-house are underlined; none are judged too little in-house.

4.3.3 Impacts of Potential Drawdowns

In order to assess the impact of potential levels of drawdown, the feasibility of closing laboratories in areas where each of the Services had multiple laboratories with overlapping or closely-related capabilities was considered.

The Army projected that a 20-30% reduction was possible through the consolidation of the Armaments Command laboratories and the formation of the Harry Diamond Development Center. In the case of the Navy, consideration was given to selectively eliminating laboratories in those areas where there were multiple sources of similar end products

10/ The entry "research" covers that part of the 6.1 program not explicitly directed toward one of the other specific areas shown (e.g., it includes the more general disciplines such as mathematics, physics and chemistry research).

TABLE 4-3

TECHNOLOGY BASE % IN-HOUSE BY TECH AREA

	ARMY	NAVY	AIR FORCE
PROPULSION TECHNOLOGY (MISSILE)	50%	40%	30%
MATERIALS & STRUCTURES	80%	55%	20%
AIRCRAFT PROPULSION	30%	15%	20%
AERONAUTICAL VEHICLE TECHNOLOGY	40%	45%	55%
ENVIRONMENTAL SCIENCES	75%	45%	70%
ELECTRONICS	70%	50%	30%
SURFACE VEHICLES	60%	25%	
WEAPONS	70%	60%*	40%
RESEARCH	80%	60%	65%

Note: Underlined areas considered by ODDR&E to be too much in-house.

*High Energy Laser R&D excluded.

(Figure 2-4), based upon qualitative judgments by the R&AT staff that the remaining assets would be sufficient to carry on a minimal program to meet the Navy's needs. In the case of the Air Force, all growth in the laboratories under Project REFLEX was removed, some duplication of technological capability felt by the R&AT staff to exist was eliminated, and one laboratory closed completely on the basis of marginal size, despite the feeling that its work was acceptable and important. The end result was a crude indication that a reduction of up to 20% (approximately 12,000 positions) in the size of the DoD laboratories could be sustained with considerable strain but without a complete overhaul in the Services' system development and procurement methods. The dollar savings would be less than 20%, since some of the work would have to be put out on contract. We could not estimate without a detailed study what fraction would be saved.

We then examined the possibility for consolidation across Service lines by selection of lead Service for systems developments now done in more than one Service (e.g., aircraft, missiles, electronics, etc.). There were three principal results of this portion of the exercise: (1) It was found that the preceeding reduction exercise within each Service had already eliminated much of the similar technical capabilities across Service lines and an additional reduction of only about 1400 people appeared likely beyond the aforementioned 12,000; (2) Service personnel queried felt that the complete loss of readily available technical expertise was intolerable in any area in which they retained responsibility for procurements and thus, if faced with the choice between (a) having fewer laboratories (covering fewer technical areas) but each laboratory of essentially the current size or (b) keeping the current number of laboratories and going to much smaller laboratories, would opt for the latter. (3) The DDR&E staff felt that the elimination of essentially all competition between DoD laboratories would be counter productive in the long run.

The conclusions of this drawdown exercise thus were that (1) without major restructuring of the DoD weapon system acquisition structure, drawdowns in excess of 20% would be inadvisable if not impossible, (2) multi-Service consolidations were not recommended under current procurement practices since the Services did need technical support in areas where they have substantial acquisition responsibility and the DoD needs competition at least between Services.

Explicit study was given to the possibility of a Tri-Service contract research program. We concluded (see Appendix N) that, in the long run, the existence of more than one Contract Research Program is desirable and that the smaller programs of the Army and Air Force should be strengthened to be more comparable to the Navy program.

4.3.4 Conclusions and Recommendations: In-House/ Contract Ratio

The foregoing analysis has established that a reduction in the in-house effort in the Technology Base is warranted. The two questions that need to be addressed are: (1) the overall level of in-house Technology Base effort; and (2) the balance in this effort as indicated in Table 4-3.

The examination of the balance lead to the conclusion that we are excessively in-house oriented in the technical areas of materials and structures, electronics, and weapons in both the Army and Navy laboratories and in the research area in the Army and Air Force. The basis for the judgment differs from area-to-area. The materials work in the Army is too much in-house across-the-board, although we acknowledge that an in-house ratio a bit higher than in most areas is appropriate since AMMRC possesses some facilities not generally available elsewhere. A decrease of at least 20 percent ($2.5M per year) of the in-house activities in this area in the Army is recommended. In the case of the Navy materials and structures (M&S) work, the level of in-house efforts in support of missiles and aircraft M&S is felt appropriate. However the effort in ships and submarines M&S is almost entirely in-house, which is felt to be too high a level. To encourage more industrial competence in an area in which essentially all production is industrial, we recommend that the in-house effort in M&S for ships and submarines be reduced by a minimum of 20 percent ($2M) resulting in a 10 percent reduction in the in-house portion of the overall Navy materials and structures program. In the electronics area, the existence of a large and vigorous industrial capability argues against the current size of the in-house effort. It is recommended that the Army reduce its in-house effort by at least 20 percent ($12M) and the Navy by at least 10 percent ($7.6M). In the case of conventional weapons R&D, it is felt that the Army in-house effort has become marginal in productivity and the growth of a larger industrial base should be encouraged by decreasing the Army's in-house activity by at least 20 percent ($17M). The Navy's efforts in conventional weapons, especially in torpedoes and fire control systems is spread among a multiplicity of laboratories, as indicated in Figure 2-4. Some of this diffusion of effort should be eliminated and a minimum reduction of 15% (~ $15M) in the in-house effort is recommended. In research, in order to strengthen the Tri-Service contract programs for the reasons described in Appendix N, it is recommended that the Army decrease its in-house research and increase its Contract Program by $15M per year and the Air Force by $30M. $20M of the Air Force increase

should be achieved by funding Cambridge Research Labs from 6.2 instead of 6.1 as suggested by the Air Force study but without decreasing the level of the total 6.1 program. The additional 6.2 funds required for CRL should be made available by changing the current practice of paying salaries of all development laboratory personnel out of 6.2 regardless of category of work being done.

These funding changes are summarized in Table 4-4 and the approximate Technology Base manpower reductions required indicated in Table 4-5. These were computed at $30K per person, which assumes for computation that all reductions would be a pro rata mix of professionals and support people.

These specific technical area adjustments would leave the 6.1 and 6.2 about 36 percent in-house, averaged across the three Services. Although there are reasons for a somewhat higher in-house/contract ratio now than in the past, based upon the diminishing industrial interest in certain technology areas, we believe a more modest increase from the FY 1968 base would be appropriate. We recommend an in-house ratio of about 30 percent as an objective, to be achieved by additional decreases in in-house activity, but without recommendation of specific technical area to be impacted.

The total Service funding for 6.1 and 6.2 in FY 1975 was $1058.7M so that to reduce the in-house effort from the present 43 percent to 30 percent would require a shift of $137.6M. When converted to positions at an average of $30K per position, this means that the total personnel reduction in in-house Technology Base effort would be about 4,600, necessitating an additional reduction beyond that of Table 4-5 of 1,875. We recommend the distribution of this further reduction as follows:

Army	825
Navy	750
Air Force	300

This apportionment would leave the in-house/contract ratio for the three Services at about 40 percent, 35 percent, and 25 percent vice the current levels of 60 percent, 50 percent, and 30 percent for the Army, Navy and Air Force respectively.

In order to produce the greatest change in in-house/contract ratio with the minimum of personnel disruption, the appropriate

TABLE 4-4

RECOMMENDED SPECIFIC AREA TECHNOLOGY BASE MINIMUM ADJUSTMENTS

(TECH BASE AREAS ASSESSED TO BE TOO MUCH IN-HOUSE)

	ARMY			NAVY			AIR FORCE		
TECH AREA	PRES %	PROP %	DECR. $K	PRES %	PROP %	DECR. $K	PRES %	PROP %	DECR. $K
MATERIALS & STRUCTURES	80	60	2500	55	45	2000	-	-	-
ELECTRONICS	70	50	12000	50	40	7600	-	-	-
WEAPONS	70	50	17000	60	45	14000	-	-	-
RESEARCH	80	57	15000	-	-	-	65	35	30000*
TOTALS			46500			23600			

*Obtained through shifting CRL to 6.2 (20M) without decreasing 6.1 total and ARL closure (10M)

TABLE 4-5

SPECIFIC TECHNICAL AREA TECHNOLOGY BASE MINIMUM REDUCTIONS RECOMMENDED

TECH AREAS	ARMY	NAVY	AF	TOTAL
M&S	80	70		
ELECTRONICS	400	250		
WEAPONS	570	470		
RESEARCH	500	___	385*	
TOTALS	1,550	790	385	2,725

*Closure of ARL, decrease in CRL. Remainder of $30M to come from changes in funding.

amount of the least important in-house Technology Base work should be brought to an orderly conclusion, corresponding personnel reductions made from within Technology Base efforts, and the monies thus released from in-house work used to fund the most promising efforts in corresponding technologies in industry and the universities. No savings in the overall RDT&E is intended from such Technology Base adjustments. The overall level of Technology Base funding is already marginal due to years of constant funding and consequent inflationary loss.

4.3.5 Conclusions and Recommendations: Overall Size

To adjust the division of effort within the laboratories to focus their major effort on support to Systems Development, we recommend decreasing their activities in Research and Exploratory Development per section 4.3.4 and also decreasing their non-RDT&E work so that system development support becomes the largest factor. The level of the in-hc program should then be held at approximately a constant fraction DoD RDT&E budget for the next several years. In the meantime, a .jor effort should be made to increase the laboratories' involvement in the Systems Development in an appropriate way; i.e., in the manner which complements rather than competes with industry. Including the laboratories in the DCP/DSARC process in the manner recommended will be a first step in this direction. A reexamination of the laboratory size issue should be made after about 5 years.

Our recommendation is that the overall manning of the PS&E laboratories should be reduced by 10 to 15 percent from the FY 1974 end strength with the bulk of the reduction coming in the in-house support to Research, Exploratory Development, and non-RDT&E activities. This will reduce the portion of the DoD budget going to in-house laboratory work toward the level that existed prior to the current trend away from system development support. This would reapportion the level of effort to place first emphasis on such work. These laboratories had an FY 1974 end strength of 5,418 military and 51,323 civilians distributed as indicated in Appendix L. Consequently, a 10 percent drawdown would reduce the total laboratory complex by about 5500 positions and a 15 percent drawdown will reduce by 8500 positions. The distribution of these reductions among the Services and among the various types of work is addressed below.

The Technology Base reductions of section 4.3.4 account for 4600 positions. It is also recommended that the Navy reduce its non-RDT&E involvement by about 2,000 positions (out of an estimated

Navy non-RDT&E manpower of about 11,000) reducing the Navy's non-RDT&E work from 40% to about 30% of its in-house activities. Monetary savings resulting from this should appear as reductions in required funding in appropriate categories following the reductions.

Table 4-6 indicates the approximate effect of the reduction on the division of effort within the laboratories.

The manpower reductions recommended herein should be accomplished in FY 76 and FY 77. A survey of attrition rates (Appendix G) indicates that it is unlikely that the requisite reductions can be handled by attrition, no matter how the reductions are handled. Since reductions-in-force will therefore be required, it is important that the reductions be designed to minimize the impact in areas that are necessary and functioning well. The reductions should be concentrated in weak areas or weak laboratories, not taken as across-the-board percentage cuts.

It is further recommended in the Laboratory Study that we abandon redundant controls on manpower and funding and use funding controls only. Under such a system, laboratories' in-house allowable funding levels would be controlled as part of the normal budgeting process to allow gradual adjustments to changing circumstances and forestall large reductions in force. Although all the foregoing recommendations are stated in terms of personnel decrements, they can be rapidly reconverted to appropriate changes in in-house funding. Compliance by either figure should be acceptable.

5. SUMMARY OF RECOMMENDED ACTIONS

The Laboratory Utilization Study has addressed three aspects of the DoD in-house laboratory complex, namely, (1) the management and structure of the laboratory complex, (2) the in-house/contract ratio, primarily in the Technology Base, and (3) the proper size of the laboratory complex. The following is a summary of the recommendations from the study.

5.1 Specific Recommendations with Respect to Army Laboratories

We concur in general with the recommendations of the AMARC study which proposed: (1) the restructuring of the Army's many laboratories into a smaller number of development centers and (2) a reorganization of part of the Army Materiel Command to simplify the reporting chain for the commodity command laboratories and (3) several lesser steps as outlined in section 2.3.

TABLE 4-6

APPROXIMATE

REDISTRIBUTION OF IN-HOUSE EFFORT

AS A RESULT OF RECOMMENDED REDUCTIONS

	FY 73 Level ($M)	Pre-Decrement %	Decr. ($M)	Post-Decr. Level	Post Decr. %
6.1 + 6.2	580 (est)	36	150	440	31
Sys. Devel. Supp.	535	33	0	535	38
Non-RDT&E	493	31	60	433	31

ASSUMES:

1) REDUCTION OF 5000 IN TECH BASE ($150M)

2) REDUCTION OF 2000 IN NON-RDT&E ($60M)

3) CONSTANT LEVEL OF SYS. DEVEL. SUPPORT

(BASED UPON FY 73 LEVELS)

There are other issues in the laboratory management area which were not explicitly addressed and for which follow-up actions are recommended. They are:

(1) The Army should formulate and document a system for financial control on the size of the laboratories.

(2) The Army should document the Technology Base program planning and approval authority.

(3) The Army should devise a program for the enhancement of the military R&D career pattern and include therein increased use of technically trained junior officers in the laboratories.

5.2 Specific Recommendations with Respect to Navy Laboratories

As of the writing of this report we had received no indication from the Navy of proposed actions with respect to their laboratories. Based upon ODDR&E observations of the Navy laboratories, we recommend the following actions:

(1) Reduction of the redundancy in functions/platform assignments and concomitant inter-laboratory competition for available funds.

(2) Changes in the Technology Base management and execution to correct the present fragmentation, uneven quality and ineffective technology transfer.

(3) A program for improvement in utilization of Naval personnel in the laboratories, addressing the under-usage of junior officer personnel in the laboratories and the over-dependence on naval officers for positions of senior responsibility.

5.3 Specific Recommendations with Respect to Air Force Laboratories

The Air Force proposed several constructive changes in their laboratories which are endorsed and recommended for implementation. These include:

(1) An increase in the 6.1 contract research program including a change in funding from 6.1 to 6.2 of Cambridge Research Laboratory's environmental sciences work.

(2) Increased laboratory involvement in development through demonstration of end item feasibility.

(3) Amalgamation of the laboratories into centers allied with product divisions.

(4) Product Divisions control of 6.3 and 6.4 funding to the laboratories.

(5) Greater technology focus on Command, Control, and Communications.

(6) Establishment of controls on the laboratory in-house/contract ratio.

(7) Continued emphasis on the use of laboratories for R&D officer training.

Other issues in the laboratory management area in which we believe corrective actions are needed are: (1) the Air Force should discontinue its practice of providing all salary support to laboratory people from main laboratory line program element irrespective of the task to which they are assigned, and (2) a plan for fiscal control of laboratory size in a manner responsive to the Air Force needs and the anticipated RDT&E budget is needed.

6. WHERE DO WE GO FROM HERE?

In the laboratory management area, the principal deficiency remaining in the Study is that of a well-documented plan defining steps to be taken in response to the Study, designating action agents and defining milestones for implementing the recommendations to the Study. The Services should be requested to prepare such a plan. The plan should define the end objectives, the current situation and the plan for achieving the objectives, with milestones. This plan should be a comprehensive description of how each Service intends to operate its laboratories sufficient in detail to become a useful management reference.

The Services should move expeditiously to execute the recommendations of this Study. We believe the long term result will be a significant enhancement of the return on our multi-billion dollar investment in the DoD laboratories. The short term effects are more difficult to predict.

Probably the worst thing that could happen would be to have all recommendations ignored except those to reduce the size of the laboratory complex, and to effect that reduction by an across-the-board cut levied on all laboratories. The result would be a cascading of displacements climaxing in the loss of many of our youngest and best educated scientists and engineers. There is a better way.

We recommend that the reductions be taken by elimination of duplicative or marginally necessary facilities or major portions of laboratories and not as across-the-board cuts. If this is done, it is our conviction that the management changes proposed herein can sufficiently improve the operation of the laboratories to offset the temporary disruption of the recommended drawdowns and we will gain in both the short term and the long term.

Implementation of the recommendations of this study will require a minimum of 2-3 years to fully implement. The process should be watched in the Services and in ODDR&E to insure that the necessary changes are implemented. The effects of the changes should begin to become apparent 3-5 years hence and the situation should be re-examined then. There should be no problem with unintentional changes in the spectrum of work in the laboratories if the controls recommended here are implemented. However, at that time we will have several years of experience at trying to stimulate the interests of Program/Project Managers in the use of the laboratories and the results of that effort should be carefully assessed and the future directions of the laboratories rechartered based upon that assessment.

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5. SECDEF Memorandum of 20 November 1964 to DDR&E with reference (a), "A Plan for the Operation and Management of the Principal DoD In-House Laboratories," of 16 November 1964 (Sherwin Plan)

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10. "Profile of Civilian Scientists and Engineers in Field RDT&E Activities of the Department of Defense," DDR&E MAR 69-1, 1 July 1969

11. "Proceedings of Symposium on Education and Federal Laboratory-University Relationships," Federal Council for Science and Technology, 29-31 October 1968

12. "Allocating Work, Funds and Manpower to Department of Defense Laboratories," DDR&E MAR 69-7, 18 December 1969 (Project REFLEX)

13. "Report to the President and the Secretary of Defense on the Department of Defense," Blue Ribbon Defense Panel, 1 July 1970

14. "Report of the Task Group on Defense In-House Laboratories," 1 July 1971, with Annexes A, B, D, E, and F. Annex C summarized significant laboratory accomplishments and is classified Secret (Glass Report)

15. "Relationships between Peer Ratings and Quantitative Properties of Defense In-House Laboratories," DDR&E MAR 71-1, Volumes I and II, 15 November 1971

16. "Report of Defense Science Board Committee on In-House Laboratories," 19 August 1966 (Sheingold Report)

17. 'Report of the Army Materiel Acquisition Review Committee (AMARC)," 1 April 1974

18. "Report of the Special Study Group on The Utilization of the Air Force Laboratories," August 1974

19. "Naval Research Advisory Committee Ad Hoc Subcommittee for the Study of Navy Laboratory Utilization, August 1974

20. Department of Defense In-House RDT&E Activities Management Analysis Reports - Annual 1966 - 1973

21. Handbook for Laboratory Planning, February 1974, Air Force Systems Command

22. A Review of Laboratory Missions and Functions (Navy/Hollingsworth Report), August 1974

23. DoD Instruction 5000.2, "Decision Coordinating Paper (DCP) and the Defense Systems Acquisition Review Council (DSARC)," of 21 January 1975

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APPENDIX A

TASKING MEMO &
SECDEF MANAGEMENT OBJECTIVE

A-1

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON, D. C. 20301

28 FEB 1974

MEMORANDUM FOR ASSISTANT SECRETARIES OF THE MILITARY DEPARTMENTS (R&D)

SUBJECT: Utilization of In-House Laboratories

The DoD laboratories play a vital and pervasive role in the DoD RDT&E effort. They are especially prominent in the execution of the research and exploratory development work which represents the foundation for our next generation of military systems. About forty-three percent of this work is presently done "under roof" by the laboratories.

It is clear, then, that the quality and vigor of our R&D programs are presently highly correlated with the health of our labs. Consequently, we cannot ignore the fact that there are those who contend that the capability of the labs, especially as leaders in advancing technology, is inferior to that available elsewhere. If this allegation is valid, we must either upgrade our labs, if practical, or reduce our dependence upon them, if upgrading is impractical.

I would like a re-examination of our strategy for laboratory utilization. I recognize that most of the laboratories' problems have been identified by past studies, and the fact that some of these problems remain is not due to a lack of recognition or understanding. Rather, the residuum is largely a result of the fact that the solutions of some problems require changes in our operation; these, in turn, require actions or approvals at high levels of government (e.g., changes in Civil Service procedures or transition to a Government-owned, contract-operated laboratory system). The practical problems of effecting such changes are formidable. Whether the potential payoff would justify such steps is a matter to be carefully determined. To guide our planning, we must carefully investigate whether the lab quality is indeed inferior to that available elsewhere, and, if so, assess the comparative benefits of major changes in the method of lab operation versus the alternative of reducing the level of laboratory involvement in the RDT&E process.

The organization and staffing of such an investigation requires careful deliberation and planning. The peculiar problems of each Service must

be recognized and accounted for. Full use must be made of prior related investigations as well as those that are currently underway, such as the Army's AMARC Committee. I would like you to appoint a member of your staff to work with ODDR&E to draft a plan for such an investigation. In order that this team may avail itself of the output of the AMARC Committee which is due to report 1 April, I would like the team to report its recommendations to the Research and Engineering Policy Council by 1 May. I have tasked the Deputy Director (R&AT) to coordinate the DoD-wide aspects of the planning and to accept overall responsibility for preparing the plan for us. A planning goal for completing any subsequent investigation is 1 Dec 1974.

s/ Malcolm R. Currie
Malcolm R. Currie

SECDEF MANAGEMENT OBJECTIVES

Objective Number: 3

Action Number: 3 Determine the requirements for DoD laboratories and assess the capability of present laboratories to meet the requirements. Identify excess capacity, overlapping capability, shortfalls and instances where R&D could be contracted to industry at a savings. Define a program for upgrading the quality of the laboratories. Plan of action by 1 January 1975.

Synopsis: By memorandum of 28 February DDR&E established a tri-Service study on utilization of in-house laboratories. The modus operandi of the study will include the assimilation of the pertinent results of the Army's AMARC study and the conduct of individual laboratory utilization studies by the Navy and the Air Force. The results of these three individual efforts will then be reviewed by a Coordinating Board chaired by DD(R&AT) which will integrate the findings resulting in a consolidated DoD position. The consolidated report will then be presented to the REPC for approval. A plan of action to implement the recommendations of this study will be completed by the end of 1974. Further details are contained in DD(R&AT) memorandum of 20 June attached.

Milestone Schedule	Target Date
Service commitees organized and chartered	1 May
Working group studies initiated	1 May
Working group studies completed	1 July
Coordinating Board review and rework of working group output	1 August
Draft report for coordination	1 September
Coordinated report to R&E Policy Council	1 December
Plan of action	1 January 1975

APPENDIX B

LABORATORY UTILIZATION STUDY COORDINATING COMMITTEE: R&AT STAFF STATISTICS

LABORATORY UTILIZATION STUDY COORDINATING COMMITEE

OSD Members

Dr. J. L. Allen	ODDR&E(R&AT)	Chairman
C. W. Clewlow/ W. C. Valdes	OASD(M&RA)	
E. A. Rogner/ P. J. Fliaks	OASD(I&L,	

Service	Asst Secy Office Rep	Dir of Laboratories
Army	Dr. K. C. Emerson	Dr. R. B. Dillaway replaced by Mr. N. L. Klein
Navy	Dr. S. Koslov	Dr. J. S. Lawson replaced by Mr. J. H. Probus
Air Force	Mr. D. R. S McColl replaced by Dr. W. R. Beam	Dr. A. M. Lovelace replaced by Brig Gen G. K. Hendricks, USAF

Name	Position	Highest Degree Year, School	Experience - No of years, Category (Ind., In-House Labs, OSD, FCRCs, Other)
Allen, John L.	Deputy Director ODD(R&AT)	Ph.D., 1968 MIT	Industry - 4 In-House Labs - 3 OSD - 1 FCRC - 13
Charvonia, David A.	Acting AD(E&PS)	Ph.D., 1959 Purdue	Industry - 14 In-House Lab - 1 OSD - 3 University - 5
Dashiell, Thomas R.	Staff Specialist for Chemical Technology	BS-Biology 1950 (Western Maryland College) BS-Ch'E-Chem Engr. (Johns Hopkins Univ.)	In-House Lab - 11 OSD - 5
Kaehn, Albert J., Jr.	Military Assistant for Environmental Sciences ODDR&E	BA (Math) 1951 State Univ. of NY MA (Math) 1952 State Univ. of NY BS (Meteorology) 1953 Penn State Univ. 63 credits (Meteor) 1964 NYU 25 credits (Oceanography) 1972 (US Naval Postgraduate Sch)	OSD - 3 Services Other - 17
Makepeace, G.R.	Assistant Director, Engineering Technology, ODD(R&AT)	B.S., Caltech 1942	Industry - 19 In-House Lab - 8 OSD - 6

Name	Position	Highest Degree Year, School	Experience - No. of years, Category (Ind., In-House Labs, OSD, FCRCs, Other)
McCambridge, John J.	Military Assistant to Dep Dir (R&AT) and Acting AD (F&LS)	Ph. D. Cand. - 1966 U. C. L. A.	Industry - 1 University Labs - 3 OSD - 4 Air Staff - 5 Other Air Force - 8
Myers, Edwin N.	Staff Specialist (Electronic Sciences)	MS, 1961 MIT	OSD - 9 Services Other - 14
Osborne, Bartley P., Jr.	Staff Specialist for Aeronautics, OAD/ET	Master of Science in Aerospace Engineering 1962, Univ. of So. Calif.	Industry - 17 OSD - 5
Persh, Jerome	Staff Specialist for Materials and Structures, OAD/ET	M. S. 1958 University of Maryland	Industry - 6 In-House Labs - 4 OSD - 7 Services RDT&E - 5 NASA - 6
Peterson, P. W.	Special Assistant	Ph. D., 1957 Iowa State University	Industry - 11 University - 10 FCRC - 3 1/2
Standahar, Raymond M.	Staff Specialist for Aero Propulsion, OAD/ET	Master of Science, 1951 Case Institute of Tech Mechanical Engineering	Industry - 4 OSD - 16 NASA - 12
Taylor, Henry L.	Military Assistant for Human Resources	Ph. D., 1965 Florida State Univ.	In-House Labs - 5 OSD - 3 Services Other - 7

Name	Position	Highest Degree Year, School	Experience - No of years, Category (Ind., In-House Labs, OSD, FCRCs, Other
Terrell, James H., Jr.	Special Assistant DD(R&AT)	MBA (w/honors) (R&D Management) University of Chicago 1960	In-House Labs - 3 OSD - 4 Services RDT&E - 6 Services Other - 12
Thorkildsen, Ray	Staff Specialist for Ordnance Technology OAD/ET	B. Chemical Engineering, Polytechnic Institute of Brooklyn 1950	Industry - 2 OSD - 12 Services Other - 11
Whitaker, William A.	Military Assistant (Research)	Ph.D., 1963 University of Chicago	In-House Labs - 16 OSD - 2 University - 2
White, Stanley C.	Military Assistant for Medicine and Life Sciences	MD - 1949, University of Cincinnati, College of Medicine MPH - 1954, Johns Hopkins Univ. School of Public Health & Hygiene Board of Certification in Preventive Medicine (Aviation Medicine) 1956	In-House Labs - 11 NASA - 9

Name	Position	Highest Degree Year, School	Experience - No of years, Category (Ind., In-House Labs, OSD, FCRCs, Other
Young, Leo	Staff Specialist (Electronic Systems Technology)	Ph.D., 1959 Johns Hopkins	Industry - 13 In-House Lab - 1 OSD - 1 University - 2 Research Institute - 12
Ziem, Robert W.	Staff Specialist for Surface Vehicles OAD/ET	M.S. Chemistry, 1950 Kansas State University	Industry - 10 OSD - 3 1/2 NASA - 11

APPENDIX C

DDR&E/DARPA SURVEY

APPENDIX C

DDR&E/DARPA SURVEY

Part of the DDR&E study included the solicitation of opinions of those having knowledge about the laboratories and the DoD Technology Base program, as well as opinions of those who could be classified as users of the laboratories.

Opinions relative to the Technology Base in-house productivity vs contractor activities as well as opinions relative to the in-house to contractor ratio were solicited from the professionals within the DDR&E/R&AT and the DARPA staffs. Comparison of the DARPA and R&AT replies is not possible as the DARPA replies are oriented toward technology areas.

In general, contractors are considered more productive by the DARPA staff but with the exception of the Army, the DARPA replies generally indicated satisfaction with the in-house performance of the laboratories.

The DDR&E/R&AT staff responses to the survey looked at the technology areas within the Technology Base programs. With regard to in-house productivity, the survey results are mixed. The results of the survey of opinions about the in-house to contract ratio was that the "laboratories" have turned too far in-house in the opinion of the R&AT staff, in the areas of materials, electronics and weapons areas in the Army and Navy laboratories and the research area in Army and Air Force. These areas are considered major because of the heavy funding involved.

The second part of this survey involved the solicitation of opinions from the DDR&E staff (other than R&AT) responsible for the programs beyond the technical base (6.3B+) relative to in-house laboratory involvement in their programs. Of the 27 replies, it was interesting to note that the Navy laboratories had the most involvement (84%) with those who replied, the Air Force laboratories next (63%) and the Army laboratories last (44%). In those programs where the laboratories were involved, there was generally satisfaction with the Navy (67%) and Air Force (76%) while the Army laboratories came out with 50% about right and 50% too much involvement. The quality of the laboratory support was by in large considered average to excellent.

Tabulation of the results of the surveys are attached.

TECHNICAL BASE IN-HOUSE TO CONTRACT ACTIVITY
(DDR&E/R&AT Replies)

	ARMY				NAVY				AIR FORCE			
Technology Areas	A	B	C	D	A	B	C	D	A	B	C	D
Missile Propulsion		X				X				X		
A/C Propulsion		X				X				X		
Aerospace Vehicles		X				X				X		
Materials	X					X				X		
Electronics	XX	X			XX	X			X	XX		
Biological/Chemical Warfare		X				X				X		
Environmental Qual.	X					X			X			
Surface Vehicles		X				X						
Medicine & Life Sciences		X				X				X		
Human Resources	X						X			X		
Environmental Sciences		X				X				X		
Weapons	X				X							
Research	X					X			X			

A - Too much in-house
B - About Right
C - Too much contractor activity
D - No opinion

IN-HOUSE TECHNICAL BASE PRODUCTIVITY VS CONTRACT ACTIVITIES
(DDR&E/R&AT Replies)

	ARMY					NAVY					AF				
Tech. Areas	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Missile Prop.					X			X					X		
A/C Prop.		X					X					X			
Aero. Vehicles		X				X						X			
Materials		X					X						X		
Electronics	X		XX				X	XX					xxx		
CW/BW					X				X					X	
Environmental Qual.							X								
Surface Vehicles					X					X					
Medicine & Life Sciences	X					X					X			6.	36. 2
Human Resources					X		X							X	X
Env. Sciences	X					X					X				
Research			X					X			X				

A - In-house more productive
B - About same
C - Contractor more productive
D - No substantial in-house
E - No substantial contractor activity

TECHNICAL BASE IN-HOUSE TO CONTRACT ACTIVITY
(DARPA Replies)

	ARMY				NAVY				AIR FORCE			
	A	B	C	D	A	B	C	D	A	B	C	D
Strat. Tech. Office	5	2			2	5			1	7		
Tact. Tech. Office	4	2	1	1	3	6	1	1	2	4	1	1
Info. Processing		3		2	1	3	1			4		1
Materials	1				1					1		
Nuc. Monitoring				2	1	1		1		3		1
Human Resources		1	1	1		1	1	1	1	1	1	
Management	2	1			1	1				3		

A - Too much in-house
B - About right
C - Too much contractor
D - No opinion

IN-HOUSE TECHNICAL BASE PRODUCTIVITY VS CONTRACT ACTIVITIES
(DARPA Replies)

	ARMY				NAVY				AIR FORCE			
	A	B	C	D	A	B	C	D	A	B	C	D
Strat. Tech. Office			6	1		1	5	1	1	3	4	1
Tact. Tech. Office			7	1	1	5	3	2	1	2	3	2
Info. Processing			1	4			4	1		1	3	1
Materials			1				1				1	
Nuc. Monitoring			1	1	1	1		1	1	2		1
Human Resources		1	1	1	1		1	1			2	1
Management			3			1	2				3	

A - In-house more productive
B - About same
C - Contractor more productive
D - No substantial in-house activity

IN-HOUSE LABORATORY INVOLVEMENT

	ARMY	NAVY	AF
About Right	6 (50%)	16 (67%)	13 (76%)
Too Much	6 (50%)	6 (25%)	2 (12%)
Too Little		2 (8%)	2 (12%)

Number of Survey Forms Returned - 27

QUALITY OF LABORATORY SUPPORT

	Poor	Average	Excellent
Consultation	2	18	6
Analyses	4	17	7
Research	4	12	7
Exploratory Dev.	3	18	6
Hardware Dev.	9	14	2
Test & Eval.	6	10	4
Op. Command Support	3	11	7
Production Support	3	13	
Facility Development	3	6	2

DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON D C 20301

19 SEP 1974

MEMORANDUM FOR DARPA AND ODDR&E PROFESSIONAL STAFF

SUBJECT: Data for Laboratory Utilization Study

As part of the ODDR&E Laboratory Utilization Study, in order to assess the degree of esteem in which the laboratories are held and the degree to which they are used, we would like to conduct a "peer review" type survey making use of the expertise of the DARPA and ODDR&E staffs.

DD(R&AT) has prepared two questionnaires, one related primarily to system development problems and one related primarily to technology base efforts. The first of these is being sent to all professional personnel in TWP and S&SS; the second to all professional personnel in ODD(R&AT) and DARPA. The forms are quite simple and require little time to work. However, since your evaluation will play a significant role in the direction the DDR&E recommendations from the laboratory study will take, I would appreciate your giving a few minutes careful thought to filling out the questionnaire.

ODDR&E personnel should return the completed questionnaire directly to DD(R&AT) in Room 3E 144 ten days after the date of this memorandum. DARPA personnel should return their forms to Dr. Niedenfuhr by the same date.

Malcolm R. Currie

Enclosures

C-9

TWP
S&SS

NAME _____
OFFICE _____

1. What is your area of technical concern (25 words or less)?

How large an effort (total dollars) is involved?

2. In your area of technical concern, the involvement of the in-house labs in RDT&E activities includes:

Army	Navy	Air Force	
____	____	_____	a. Significant non-involvement.
____	____	_____	b. Occasional consultation only.
____	____	_____	c. Continuing <u>paid</u> tech. support to PM/SPO.
____	____	_____	d. Item c plus some in-house supporting R&D.
____	____	_____	e. Item d plus full breadboard development.
____	____	_____	f. Item e plus pre-prod. development.
____	____	_____	g. Item f and production.

3. How familiar are you with the involvement of in-house labs in your area of technical concern?

____	____	_____	a. Minimal
____	____	_____	b. General
____	____	_____	c. In detail

4. I believe the amount of in-house involvement is:

____	____	_____	a. About right
____	____	_____	b. Too much
____	____	_____	c. Too little

5. How would you characterize the quality of the laboratories' support?

	Poor	Average	Excellent
Consultation	____	_____	_____
Analyses	____	_____	_____
Research	____	_____	_____
Exploratory development	____	_____	_____
Hardware development	____	_____	_____
Test and evaluation	____	_____	_____
Operating command support	____	_____	_____
Production support	____	_____	_____
Major facility development and operation	____	_____	_____

Comments if desired: (use reverse if needed)

6. Indicate number of years since Bachelor's degree you have spent in:

Government labs _____ Industry _____

FCRC's _____ OSD _____

Universities _____ Other (specify) _____

C-11

R&AT
DARPA

NAME _____
OFFICE _____

What is your area of technical concern?

How large a program (total dollars) do you manage in this area?

In your technical area:

(1) Compare the productivity of the in-house TB activities with the contract activities (check one)

Army	Navy	Air Force	
____	____	____	In-house much more productive
____	____	____	In-house more productive
____	____	____	About same
____	____	____	Contractor more productive
____	____	____	No substantial in-house activity
____	____	____	No substantial contractor activity

(2) How do you feel about the ratio of in-house to contractor activity in TB in your area?

____	____	____	Too much in-house
____	____	____	About right
____	____	____	Too much contractor activity
____	____	____	No opinion

(3) What is approximate tech base ratio (in-house/total)(ODDR&E only)

____ ____ ____

Indicate number of years since Bachelor's degree you have spent in:

Government labs _____ OSD _____

Industry _____ Universities _____

FCRC's _____ Other (specify) _____

Comments if desired: (use reverse if needed)

APPENDIX D

INDIVIDUAL LABORATORY IN-HOUSE/CONTRACT RATIO

APPENDIX D

INDIVIDUAL LABORATORY IN-HOUSE/CONTRACT RATIO

One of the first tasks of the DDR&E study was to collect and tabulate in-house/contract data relative to the individual Service laboratories being addressed by the study. While there has been some individual shifts in the in-house/contract ratio, the laboratories as a total did not show a significant percent change to in-house.

The data used were made available fro.n the Department of the Army which maintains the data file. The data are collected from the Services on an annual basis in accordance with DODI 700. 9; subject: Research and Development Data for In-House RDT&E Activities dated 26 August 1970. The only data currently available covers the actual funding of FY 72 and 73 with FY 74 planned funding. The collection of actual FY 74 figures is currently underway. The following pages cover most of the laboratories of interest during the FY 72/73 period.

ARMY
FY 72 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Air Mobility	6.1 + 6.2	10487	11456	21943	48%
R&D Lab	RDT&E	12638	30183	42821	30%
Atmospheric	6.1 + 6.2	3666	137	3803	96%
Science Lab	RDT&E	7968	1185	9153	87%
Avionics Lab	6.1 + 6.2	4080	940	5020	81%
	RDT&E	11294	1405	12699	89%
Ballistics	6.1 + 6.2	16494	8406	24900	66%
Research Labs	RDT&E	19043	9238	26281	72%
Benet	6.1 + 6.2	4193	811	5004	84%
Weap Lab	RDT&E	8272	1559	9831	84%
Combat Surv &	6.1 + 6.2	5000	800	5800	86%
Tgt Acq Labs	RDT&E	13500	19500	33000	41%
Comm. ADP	6.1 + 6.2	4100	1600	5700	72%
Lab	RDT&E	13800	17600	31400	44%
Edgewood	6.1 + 6.2	18633	1022	19655	95%
Arsenal	RDT&E	26748	2320	29068	92%
E. W. Lab	6.1 + 6.2	999	1338	2337	43%
	RDT&E	14980	17248	32228	46%
Elect. Tech &	6.1 + 6.2	11000	6119	17119	64%
Device Lab	RDT&E	12170	9115	21285	57%
Frankford	6.1 + 6.2	10398	2022	12420	84%
Arsenal	RDT&E	22524	8908	31432	72%
Harry Diamond	6.1 + 6.2	15343	6254	21597	71%
Labs	RDT&E	32871	12378	45249	73%
Human	6.1 + 6.2	2517	308	2825	89%
Eng Lab	RDT&E	2832	376	3208	88%
Materials &	6.1 + 6.2	10965	14000	24965	44%
Mech Res Ctr	RDT&E	13173	14120	27293	48%

FY 72
Army (Continued)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Missile R&D & Eng Lab	6.1 + 6.2	18895	25291	44186	43%
	RDT&E	29108	43828	72936	40%
Mobility Equip R&D Center	6.1 + 6.2	4923	7387	12310	40%
	RDT&E	18835	25890	44725	42%
NATICK	6.1 + 6.2	10109	5636	15745	64%
	RDT&E	14828	8239	23067	64%
NVL	6.1 + 6.2	8205	1924	10129	81%
	RDT&E	15727	16927	32645	48%
Picatinny Arsenal	6.1 + 6.2	15360	4440	19800	78%
	RDT&E	55200	43900	99100	56%
Rock Island Arsenal	6.1 + 6.2	3098	1266	4355	71%
	RDT&E	8928	5190	14118	63%
Tank Auto Labs	6.1 + 6.2	4393	1117	5510	80%
	RDT&E	16659	29632	46291	36%
TOTALS	6.1 + 6.2	182849	102274	285123	64%
	RDT&E	371098	318741	689839	54%

NAVY
FY 72 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Naval Air	6.1 + 6.2	1186	1291	2477	48%
Eng Center	RDT&E	8162	5876	14038	58%
Naval Elec.	6.1 + 6.2	9970	409	10379	96%
Lab Center	RDT&E	29981	2793	32774	91%
Naval	6.1 + 6.2	67612	686	68298	99%
Res. Lab	RDT&E	107679	686	108365	99%
Naval Ships	6.1 + 6.2	17543	9199	26742	66%
R&D Center	RDT&E	26703	47033	73736	36%
Naval Weapons	6.1 + 6.2	5199	2633	7832	66%
Lab	RDT&E	19469	9900	29369	66%
Naval Air	6.1 + 6.2	17000	9768	26768	64%
Dev Center	RDT&E	35564	32779	68343	52%
Naval Civil	6.1 + 6.2	5054	2373	7427	68%
Eng Lab	RDT&E	6139	2851	8990	68%
Naval Coastal	6.1 + 6.2	3572	549	4121	87%
Supt. Lab	RDT&E	6301	1079	7380	85%
Naval Ord	6.1 + 6.2	18809	9824	28633	66%
Lab	RDT&E	42357	35107	77464	55%
Naval Undersea	6.1 + 6.2	15538	4673	20211	77%
Center	RDT&E	31291	17488	48779	64%
Naval Underwater	6.1 + 6.2	9881	2430	12311	80%
System Center	RDT&E	39445	9698	49143	80%
Naval Weapons	6.1 + 6.2	21054	9426	30480	69%
Center	RDT&E	68527	36926	105453	65%
TOTALS	6.1 + 6.2	192418	53261	245679	78%
	RDT&E	421618	202216	623834	68%

NOTE: It is pointed out that while these data represent the RDT&E picture at individual laboratories, the Navy laboratory picture must include the SYSCOM 03s, who contract a significant portion of the technology base funds. Laboratory in-house funding accounts for approximately 50% of the total Navy technology base funds. Additionally, the laboratories receive a significant amount (approx 40%) of their funding from non-RDT&E sources.

AIR FORCE
FY 72 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Aero-Propulsion	6. 1 + 6. 2	5323	23550	28873	18%
Lab	RDT&E	5377	55062	60439	9%
Aerospace	6. 1 + 6. 2	8078	4659	12737	63%
Res Lab	RDT&E	8095	4659	12764	63%
Armament	6. 1 + 6. 2	8211	4220	12431	66%
Lab	RDT&E*	-	-	-	-
Avionics	6. 1 + 6. 2	5087	34369	39456	15%
Lab	RDT&E	7124	93734	100858	7%
Cambridge	6. 1 + 6. 2	31115	12307	43422	72%
Res Labs	RDT&E	31347	14837	46184	68%
Flight Dynamics	6. 1 + 6. 2	20533	15904	36437	56%
Lab	RDT&E	23647	43992	67633	35%
Human Resources	6. 1 + 6. 2	3214	1601	4815	67%
Lab	RDT&E	3214	6601	9815	49%
Materials	6. 1 + 6. 2	9703	19499	29202	33%
Lab	RDT&E	9703	34641	44344	22%
Rocket	6. 1 + 6. 2	10368	12250	22618	46%
Propulsion Lab	RDT&E	10614	14004	24618	43%
Rome Air	6. 1 + 6. 2	26652	14375	41027	65%
Dev Center	RDT&E	31574	50957	82531	38%
Weapons	6. 1 + 6. 2	14174	12697	26871	53%
Lab	RDT&E	23835	40449	64284	37%
TOTALS	6. 1 + 6. 2	142458	155431	297889	48%
	RDT&E	162741	363156	525897	31%

*Data supplied was for the Armament Development Test Center (ADTC) and the amount allocated to the Armament Laboratory is not broken out separately. It was assumed that the 6. 1 and 6. 2 went solely to the laboratory.

NOTE: It is pointed out that AF labs are institutionally funded and that the 6. 1 or 6. 2 program element assigned to a specific laboratory pays the in-house

bills for maintaining the staff and facilities of that laboratory. This accounts for the fact that there is minimal difference between in-house funds in 6.1 and 6.2 and in-house RDT&E.

ARMY
FY 73 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Air Mobility R&D Lab	6.1 + 6.2	9971	11678	21649	46%
	RDT&E	12377	25554	37931	33%
Atmospheric Science Lab	6.1 + 6.2	4362	488	4850	90%
	RDT&E	8426	1129	9555	88%
Avionics Lab	6.1 + 6.2	4009	1276	5285	76%
	RDT&E	10464	2273	12737	82%
Ballistics Res. Lab	6.1 + 6.2	17863	9670	27533	65%
	RDT&E	20998	9976	30974	68%
Benet Weapons Lab	6.1 + 6.2	3359	691	4050	83%
	RDT&E	8034	2006	10040	80%
Combat Surv & Tgt Acq Lab	6.1 + 6.2	5350	1135	6485	82%
	RDT&E	14200	26538	40738	35%
Comm ADP Lab	6.1 + 6.2	3400	700	4100	83%
	RDT&E	10900	10700	21600	50%
Edgewood Arsenal	6.1 + 6.2	17013	507	17520	97%
	RDT&E	25126	2137	27263	92%
E. W. Lab	6.1 + 6.2	1808	886	2694	67%
	RDT&E	14776	17368	32144	46%
Elec Tech & Device Lab	6.1 + 6.2	7878	5625	13503	58%
	RDT&E	8395	6019	14414	58%
Frankford Arsenal	6.1 + 6.2	7850	2880	10730	73%
	RDT&E	19128	6481	25609	75%
Harry Diamond Labs	6.1 + 6.2	14107	10263	24370	58%
	RDT&E	22671	19850	42521	53%
Human Eng Lab	6.1 + 6.2	3132	934	4066	77%
	RDT&E	4689	1400	6089	77%
Materials & Mech Res Ctr	6.1 + 6.2	8804	7697	16501	53%
	RDT&E	11277	7722	18999	59%

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Missile R&D & Eng Lab	6.1 + 6.2	12432	15999	28431	44%
	RDT&E	26811	37566	64377	42%
Mobility Equip R&D Center	6.1 + 6.2	5683	11727	17410	48%
	RDT&E	19000	30710	49710	38%
NATICK	6.1 + 6.2	11466	4276	15742	73%
	RDT&E	15553	7204	22757	68%
NVL	6.1 + 6.2	6706	2007	8713	77%
	RDT&E	16007	22192	38199	42%
Picatinny Arsenal	6.1 + 6.2	12600	4900	17500	72%
	RDT&E	42000	38000	80000	53%
Rock Island Arsenal	6.1 + 6.2	3453	321	3774	91%
	RDT&E	9505	4756	14261	67%
Tank Auto Labs	6.1 + 6.2	5593	4797	10390	54%
	RDT&E	14885	19153	34038	44%
TOTALS	6.1 + 6.2	166839	98457	265296	63%
	RDT&E	355222	298734	633956	53%

NAVY
FY 73 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTAL $	%I. H.
Naval Air Eng Center	6.1 + 6.2	787	966	1753	45%
	RDT&E	6859	2934	9793	70%
Naval Electronics Lab Center	6.1 + 6.2	8558	3377	11935	72%
	RDT&E	22465	9602	32067	70%
Naval Research Lab	6.1 + 6.2	68946	1470	70416	98%
	RDT&E	147518	1470	148988	99%
Naval Ships R&D Center	6.1 + 6.2	16797	8653	25450	66%
	RDT&E	41997	50236	92233	46%
Naval Weapons Lab	6.1 + 6.2	9031	2053	11084	81%
	RDT&E	30570	7300	37870	81%
Naval Air Dev Center	6.1 + 6.2	13903	13414	27317	51%
	RDT&E	42313	44896	87209	49%
Naval Civil Eng Lab	6.1 + 6.2	7133	373	7506	95%
	RDT&E	9260	983	10243	90%
Naval Coastal Supt Lab	6.1 + 6.2	5003	613	5616	89%
	RDT&E	9050	1430	10480	86%
Naval Ordnance Lab	6.1 + 6.2	17827	6088	23915	75%
	RDT&E	41515	31913	73428	57%
Naval Undersea Center	6.1 + 6.2	13931	3096	17027	82%
	RDT&E	33204	17069	50273	66%
Naval Underwater Systems Center	6.1 + 6.2	10537	1913	12450	85%
	RDT&E	40356	7328	47684	85%
Naval Weapons Center	6.1 + 6.2	16716	6271	22987	73%
	RDT&E	59992	34405	94397	64%
TOTALS	6.1 + 6.2	189169	48287	237456	80%
	RDT&E	485099	209566	694665	70%

FY 73
Navy (Continued)

NOTE: It is pointed out that while these data represent the RDT&E picture at individual laboratories, the Navy laboratory picture must include the SYSCOM 03s, who contract a significant portion of the technology base funds. Laboratory in-house funding accounts for approximately 50% of the total Navy technology base funds. Additionally, the laboratories receive a significant amount (approx 40%) of their funding from non-RDT&E sources.

AIR FORCE
FY 73 (RDT&E FUNDS)

LAB		I. H. $	O. H. $	TOTALS $	%I. H.
Aeropropulsion	6.1 + 6.2	7762	21245	29007	27%
Lab	RDT&E	8282	45011	53293	16%
Aerospace	6.1 + 6.2	6481	4759	11240	58%
Research Lab	RDT&E	6481	4759	11240	58%
Armament	6.1 + 6.2	8691	4817	13508	64%
Lab	RDT&E*	-	-	-	-
Avionics	6.1 + 6.2	10348	33888	44236	23%
Lab	RDT&E	11874	91762	103636	11%
Cambridge Res.	6.1 + 6.2	32977	14468	47445	70%
Labs	RDT&E	33142	15655	48797	68%
Flight Dynamics	6.1 + 6.2	22057	10280	32337	68%
Lab	RDT&E	23131	25215	48346	48%
Human Resources	6.1 + 6.2	4450	1468	5918	75%
Lab.	RDT&E	4450	8668	13118	34%
Materials	6.1 + 6.2	10210	17510	27720	37%
Lab	RDT&E	10210	24824	35034	29%
Rocket	6.1 + 6.2	9360	13040	22400	42%
Propulsion Lab	RDT&E	9561	13930	23491	41%
Rome Air	6.1 + 6.2	16782	35000	51782	32%
Dev. Center	RDT&E	21959	72236	94195	23%
Weapons Lab	6.1 + 6.2	17751	14510	32261	55%
	RDT&E	28959	49141	78100	37%
TOTALS	6.1 + 6.2	146869	170985	317854	46%
	RDT&E	166740	356025	522765	32%

*Data supplied was for the Armament Development Test Center (ADTC) and the amount allocated to the Armament Laboratory is not broken out separately. It was assumed that the 6.1 and 6.2 went solely to the laboratory.

NOTE: It is pointed out that Air Force labs are institutionally funded and that the 6.1 or 6.2 program element assigned to a specific laboratory pays the in-house bills for maintaining the staff and facilities of that laboratory. This accounts for the fact that there is minimal difference between in-house funding in 6.1 and 6.2 and in-house RDT&E.

APPENDIX E

PERSONNEL MANAGEMENT PROBLEMS

PERSONNEL MANAGEMENT PROBLEMS

INTRODUCTION

Organization of Appendix

The problems in personnel management which have surfaced in the Laboratory Utilization Study are listedin Figure E-1 and are discussed in this appendix. They are separated into two sections for discussion purposes:

Problems Inherent in the Civil Service and;

Problems Arising from Service Management Policies and Practices

Some of the problems in personnel management have been solved or ameliorated by techniques pioneered successfully in one service and entitled:

Personnel Techniques Pioneered in one Service of Potential Benefit to the Others

Background

The principles under which Civil Service operates can be stated briefly. Personnel management within the Executive Branch of the Government is administered through a variety of laws, regulations and policies emanating from the Congress, President, Civil Service Commission, and employing Federal Departments and Agencies. Under the principles of the Civil Service Act the Executive Branch must seek, select, develop, and retain, on the basis of merit and fitness, the best persons available from the standpoint of knowledge, skills, integrity, and suitability.

Generally, statutory authority is provided in title 5, USC; Civil Service Commission regulations are promulgated in the Federal Personnel Manual; and agency policy and regulations are issued by directives, instructions and other regulatory issuances. Those matters prescribed by law can only be changed through Congressional action and the Civil Service Commission must, of course, authorize any changes or deviations in its regulations which are not founded on law or Presidential Executive Order. Agency policies and regulations which go beyond statutory or Commission regulatory requirements can be modified or changed by the agency.

FIGURE E-1

PERSONNEL PROBLEMS DISCUSSED IN THE MILITARY SERVICE LUS REPORTS

	ARMY	NAVY	AIR FORCE
Civil Service System Origin, Primarily			
RIF Procedures	X		
Termination for Cause	X		X
Average Grade Reduction	X		X
Manpower Ceilings	X		X
Salaries for Top Managers		X	X
Low Entrance Salaries	X		
Military Service Origin, Primarily			
Hiring	X		X
Job Classification	X		
Recruitment	X		
Mobility		X	X
Career Development Planning		X	X
Transfer			X
Promotion	X		X
High Average Age			X
Grade Structure Unbalance (organizationally)			X
Organizational change approval	X		
Turnover Rate (too low)			X
Leadership in Senior Positions			X
Retraining Technical Personnel		X	

Prior Work

Considerable effort was expended in the period 1960 to 1970 on resolving personnel problems in the management of defense in-house laboratories. The results of these efforts are reported in the documents listed in the bibliography of this appendix. The problems identified in that time period are nearly the same as the problems identified in the LUS reports prepared by the Services. Progress has been made toward resolving or ameliorating many of the management problems, but it has been slow. The changing environment has changed the emphasis on some of the problems. Many RIF's have been and are being conducted, particularly in the Army, so the problems in that area are foremost in the Army report. The $36,000 ceiling on salaries has remained fixed and the ravages of inflation have made the ceiling a serious problem in hiring and retaining top managers. And the problem of the marginal employee has been exacerbated by rapid progress and change in technology.

The personnel management system for the laboratories can only be improved by continual effort to design and institute changes, using prior work as a foundation.

PROBLEMS INHERENT IN THE CIVIL SERVICE SYSTEM

PROBLEM: RIF Procedures

DISCUSSION: The problem is described in the AMARC report as follows: "The current method of administering Reduction In Force (RIF) actions have a devastating effect on any organization. They disrupt operations, lower morale, create uncertainty, and necessitate a chain of unpleasant personnel actions. MICOM had a major RIF in June 1970 which resulted in the abolishment of 1162 jobs. Before all actions were completed approximately 360 incumbents were externally transferred, retired or died. The elimination of the remaining 800 spaces required more than 2500 personnel changes. This is a ratio of one RIF action affecting three personnel. Interviews at other commands indicated the ratio could be as high as 1 to 5. The cause of this is the "bumping" process, or the act of an individual with seniority replacing a person with less seniority. Theoretically a 20 to 30% reduction could cause displacement of 100% of the civilian work force at any one activity. However, this does not actually happen since some people are displaced more than once while others are not affected at all. Even so, the time, cost and re-training requirements could be staggering. The young technically qualified civilians usually are the most affected. If they are not in a training program, they are usually bumped by senior people who may have less capability for the jobs."

"Relief must be sought from current Civil Service inflexibilities in the selection-out procedures during RIF situations and other personnel reduction programs. The objective must be to obtain efficiency by weeding out the low-producers, rather than the current experience of obtaining "trimmed-down" organizations with distorted capabilities."

In a reduction-in-force, regulations prescribed by the Civil Service Commission are used to separate employees because of reduced workloads, reorganizations, budgetary restrictions, etc. Generally, employees are grouped on retention registers based on their grade levels and interchangeability among similar positions. These groupings are identified as competitive levels, e.g., all Clerk-Typist, GS-3, employees are in the same competitive level. Ranking within competitive levels is based on seniority, veterans preference, performance rating and tenure with the lowest ranking employees separated from their positions first. Employees being separated from their competitive

levels have a further right to "bump" or "retreat" into other positions for which they are qualified occupied by employees with lesser retention rights. The reduction-in-force procedure is quite automatic once competitive levels are established leaving little discretion to identify specific employees for separation action.

There are two methods of ameliorating the impact of RIF actions. One method which applies to recently hired personnel is to use the authority in FPM chapter 351. 4. 3b and 7-6a to place trainee positions in separate competitive levels and to minimize bumping and retreating to these positions. The intern and training programs can be designed to extend for three years. The second method is to make full and proper use of the existing authority to reorganize job differences in establishing competitive levels, positions in the same series and grade levels should be reviewed.

The Assistant Secretary of Defense (M&RA) has proposed to the Chairman of the Civil Service Commission,in a memo dated 19 January 1970, several recommendations which are quoted below:

> "Reduction-in-force procedures. With regard to the limited management flexibility in reduction-in-force procedures and the problems caused by widespread bumping, the following recommendations are proposed for consideration.
>
> a. In order to reduce bumping by employees eligible for optional retirement, revise the reduction-in-force regulations to provide that such retirement eligibles will compete only within their competitive levels and if reached for RIF will not be accorded "bumping" or "retreat" rights. While in one respect this limitation could be considered discriminatory toward an employee eligible for retirement, it is so only with regard to "bumping" employees in other competitive levels--the employee would retain his rights to retention based on veterans preference, service, status, etc. within his competitive level. The difference is that if reached for separation in his competitive level, he would retire. This narrowing of "bumping" rights could be justified on the basis that an alternative to the displacement of other employees is available to the retirement eligible employee whose position is no longer required and that narrowing of such "bumping" rights is a desirable step toward minimizing the disruptive effects of "bumping" on an organization. Then reassigning the employee to such vacant positions as may be available for which he qualifies.

b. Make provision for greater recognition of relative job performance in determining the retention rights of employees. The practicial effect of the current performance rating system and reduction-in-force procedures is that there is minimal recognition of merit and of the needs of the agency in determining which employees will be retained. While a small percentage of employees have four years added to their length of service for an Outstanding Performance Rating, the balance are grouped in the broad Satisfactory level (with the exception of those few instances where an intermediate rating has been authorized). Increasing the number of rating levels and the point weights assigned to them, on the surface presents an attractive means for providing more weight to performance in determining retention standings. The value of such an approach, however, is wholly dependent upon a performance rating system which is valid in discriminating among levels of employee performance. We are doubtful that we have such a system in the Federal civil service and are concerned that assigning additional weight to ratings which are not valid will only create greater inequities. We recognize that this is a complex problem and suggest that the Commission initiate a study of the present performance rating system and the weight given employee performance in retention and endeavor to produce a system which will make performance and capability a more significant factor in reduction in force.

c. Another aspect of the problem of recognizing management's need to retain its most competent employees is the difficulties which arise from marginally qualified employees "bumping" into key positions and displacing better qualified employees. We recognize that current reduction-in-force regulations provide that the employee "bumping" into a position must be qualified and able to perform the work without undue disruption. There is, however, no provision for considering the relative qualifications of the employees involved. Experience also indicates that it is often difficult to sustain, on appeal, objections to placement of marginally qualified employees. In many positions this does not create a serious problem and mangement can lean in the direction of permitting an employee to "bump" into a position and through subsequent training and experience attain a fully satisfactory level. This becomes a much more serious matter, when this procedure results in the displacement of a highly qualified employee in a key position. We suggest the Commission consider ways to broaden and strengthen the provisions of FPM Chapter 351. 7-6 and 7-7 to give more emphasis in its interpretation of this section in appeal cases to management's need to retain highly

qualified employees. Such interpretations should take into account the differences between situations involving key positions in which the retention of the most qualified employee available is of importance to mission capability and those positions where the current standard of displacement of a better qualified employee by a qualified employee does not involve such serious consequences. We recognize that there may be other solutions to this problem which can be developed within the framework of existing law, and urge the Commission give careful consideration to all possibilities.

PROBLEM: Termination for Cause

DISCUSSION: The Air Force study of laboratories emphasized the difficulty of termination of managers employment for cause as stated in the following quote "Civil Service salary and tenure procedures mitigate against development from within adequate numbers of civilian managers with the capability of their industrial counterparts. At least two of the most important incentives to performance are missing: top salaries and termination of employment." The procedures used for termination for cause are described in the following paragraph.

During the first year after initial appointment (probationary period) employees may be separated for reasons related to inadequate performance or suitability by a rather simple procedure, i.e., a notice specifically notifying the employees of the reasons for his proposed separation, an opportunity for him to respond, and a notice of final decision without further appeal rights. However, after completion of one year's probation, the procedures become more complex. An advance notice of 30 days proposing separation is required and must state specifically and in detail the reasons for the proposed removal. The employee may respond orally and in writing and request a hearing. A final notice of decision must then be issued to the employee who may, if the decision is adverse, appeal to the Civil Service Commission. While many employees are removed under this procedure, each case requires substantive reasons and evidence attesting to the employee's unsatisfactory performance or his unsuitability for continued Federal employment. It is difficult to say the least to remove an employee for marginal performance.

Admittedly, the procedures to separate employees, either for personal or non-personal reasons, are not appropriate for getting rid of marginal performers or dead wood, unless specific substantive reasons supporting removal can be developed which can stand up under the appeal system. Reduction-in-force is not recommended

as a means to separate such employees because, (1) the employee whom management may want to separate may not be reached in the reduction-in-force action and (2) even if he is reached for action, he may bump an otherwise well-qualified employee or be placed elsewhere in the organization or within the Department.

Within the existing system the following are some actions which may be taken to separate employees from positions in which their performance is marginal:

(1) Reassignment to another position of equivalent grade, salary and rank in which they may perform adequately.

(2) Providing retirement counseling, without coercion, to emphasize benefits of retirement.

(3) Consider the use of trial retirement and partial retirement programs to encourage increased retirements.

(4) And, of course, encourage managers to counsel marginal performers to point out their shortcomings and make a positive attempt to improve their performance.

Report (g) in the Bibliography recommended the following. "The Military Departments should promptly initiate a concerted effort to remove or reassign annually the least effective in-house laboratory personnel and replace them with higher quality people. A goal of 5 percent of the technical staff members would be reasonable."

PROBLEM: Manpower Ceilings

DISCUSSION:

(1) Average grade. The constraints on average grade are considered to present problems in personnel management the Army LUS reports. The AMARC report states: "The goals of reduction in force, average grade reduction and maintenance of qualified personnel are not necessarily compatible" ". . . commodity commands. . . have had superimposed upon them both manpower ceilings and reductions in average grade with very serious effects on the retention of "new blood." In the meantime, OMB has lifted the requirements on average grade and DoD has, in turn, eliminated requirements on the Services. Average grade will be monitored as before, but there are no requirements to reduce it. However, increases in average grade will probably cause controls to be re-established.

(2) Manpower ceilings. The AMARC study states "The efficiency of in-house activities is often damaged by the imposition of independent mandates on manpower tasks and funds" and concludes "consider application of the REFLEX program to all research, development, testing and engineering positions." The Air Force report discusses the experimental application of REFLEX in three Air Force laboratories as follows "REFLEX improved the planning for and matching of funds, workload, and manpower. Delegation of responsibility and authority to lower management levels was encouraged. Management was provided with a wider range of make or buy options. Costly and time-consuming administration associated with personnel ceilings was reduced. Efficiency and productivity was enhanced because of the increased ability to acquire employees with appropriate skills and levels of experience to organize them in balanced working groups." The Air Force report concludes "The laboratories need the authority to adjust manpower in relation to their total funding. Control of the ratio of in-house to out-of-house effort is necessary to preclude abuses of the authority" and this is called "modified REFLEX authority." The report concludes "a modified REFLEX within the existing total laboratory manpower ceiling should be authorized for the laboratories."

PROBLEM: Salaries for Top Managers

DISCUSSION: Regarding salaries the AMARC report states "...the composition and size of the work force is dictated by arbitrary ceilings, averages, and pay scales rather than by the needs of the R&D facility." The Navy report states "...Technical Directors salaries were somewhat low to attract many of the truly competent people from industry" and "...the subcommittee recommends that the salary scales for top managerial posts be increased...." The Air Force Report states the following: "Civil Service salary and tenure procedures mitigate against development from within adequate number of civilian managers with the capability of their industrial counterparts. At least two of the most important incentives to performance are missing; top salaries and termination of employment."

Existing statutory limitations have imposed a $36,000 ceiling on Federal civilian salaries; only Congressional action to increase Congressional salaries or otherwise increase Executive Level V which is the statutory ceiling for General Schedule employees will correct this situation. Recent attempts to adjust the ceiling have been unsuccessful.

PROBLEMS ARISING FROM SERVICE MANAGEMENT POLICIES AND PRACTICES

INTRODUCTION

The DoD and, in turn, the military services add rules, policies, and practices to the Civil Service laws and regulations. Often the practices followed by the services are far more restrictive than intended by the Civil Service Commission (CSC). To reduce these added restrictions, the CSC published a booklet entitled "How to Make the Most of the Merit System, Understanding and Using Flexibilities in the Federal Personnel System," Personnel Management Series No. 19, February 1968. The problem is greatly exacerbated in the Army and the Air Force because the personnel offices in those services are not a part of the laboratory staff and are not under the supervision of the laboratory director. Hence, the recommendation is made in this report that "laboratories should be allowed to have resident Personnel. . . operations if the laboratory feels such activities sufficiently vital to its performance so that the laboratory is working to support such activities out of their (controlled) in-house funding." It is considered significant that the Navy, which does have resident personnel offices reporting to the laboratory directors, cites fewer personnel management complaints in its LUS, as depicted in Figure E-1.

ARMY PERSONNEL PROBLEMS

Internally-Generated Problems

The AMARC report discusses several problems generated or exacerbated by Army generated policies and procedures and these are tersely described in Figure E-1. Some relevant quotes from the AMARC report follow:

"There are serious and lengthy delays in manning newly formed organizations such as project management offices and task forces."

"Current job classification and recruitment procedures are too strictly enforced, so that personnel who are not fully qualified, (in the manager's opinion) fill technical positions (again seniority, not ability prevails)."

"Skillful commanders and managers who understand the Civil Service Regulations can make the system work for them on an exceptional basis."

Action Plan and Follow Through

The AMARC study produced a list of 22 actions to be taken in the personnel management field. This plan identified the problems, the actions to be taken, the responsible agencies and the suspense dates. Task groups were established to implement the actions and many have been accomplished by the publication date of this report. Written and verbal progress reports on the actions have been presented to ODDR&E(R&AT). One interesting and very productive action was to send teams to Army installations to determine what personnel problems are of concern to the laboratories. The teams then discussed with the laboratories successful ways of dealing with service manpower problems. The team visitation was followed by a series of symposiums for laboratory managers entitled "Flexibilities and Approaches to Effective Personnel Management in RDT&E Organizations." The Army has launched, as indicated above a vigoroue program to improve personnel practices.

NAVY PERSONNEL PROBLEMS

Internally-Generated Problems

The Navy LUS report described two personnel problems as listed in Figure E-1. Relevant quotations follow:

"To the degree possible, the proposed Office of Laboratory and Range Operations should initiate laboratory-and SYSCOM-wide procedures and programs encouraging the development and maintenance of technical competence, and particularly a greater mobility of individuals throughout the RDT&E community. Much can be learned from industrial practices and indeed from the military organization as well." An additional quotation is interesting. "One knowledgeable and experienced individual commented to the Subcommittee that although the Civil Service rules and regulations are complex and difficult, they permit far more to be done than most managers are aware of or ever attempt to do."

Action Plan and Follow Through

The Hazen report final recommendations are: Develop laboratory and SYSCOM-wide personnel policies, procedures and programs encouraging the development and maintenance of technical competence, and particularly a greater mobility of individuals throughout the RDT&E community. Action plans will be developed.

AIR FORCE PERSONNEL PROBLEMS

Internally-Generated Problems

The personnel problems identified in the Air Force report are identified in Figure E-1. Some of the problems are described below:

a. Air Force interpretations of regulations limit the flexibility of the laboratory director in adapting his work force to the job at hand.

b. Lack of mobility of personnel within the RDT&E community and between labs, headquarters, and project office.

c. Lack of career development planning.

d. Static workforce with little "new blood" added each year.

Action Plan and Follow Through

Action plans including suspense dates have been developed by the Air Force to correct or ameliorate the problems identified in the LUS report. These plans were forwarded to ODDR&E(R&AT) on December 24, 1974

PERSONNEL TECHNIQUES PIONEERED IN ONE SERVICE OF POTENTIAL BENEFIT TO THE OTHERS

Position Description for Laboratory Technical Director/Consultant

The Navy has pioneered the concept of writing the position description for a laboratory technical director which contains two important flexibilities: mobility between laboratories since the laboratory name is not specified and alternate responsibilities of technical director or consultant. This type of position description has been approved by the Civil Service Commission and is in use by the Director of Naval Laboratories for the CNM laboratories. It allows technical directors to be moved from one laboratory to another with a minimum of paper work. Also it permits a technical director to move into the role of consultant at the discretion of the Director of Naval Laboratories. A change in roles might be desired to accomplish a special task or in case the incumbent's performance falls below acceptance standards.

Intern Program for New Hires at Entrance Grades

The following statement is quoted from the letter from ASD(M&RA) to Chairman, CSC of 19 January 1970. "In order to help assure that reductions (RIF's) are balanced and that we continue to have input for our long range staffing needs through out various intern and training programs, - activities (are encouraged) to use the authority in FPM Chapter 351. 4-3b and 7-6a to place trainee positions in separate competitive levels and to minimize bumping and retreating to these positions." The Army has developed an extensive trainee program in the laboratories and other activities which involves a new hire for about 3 years. During this three year period the new hire is protected from bumping in any RIF which occurs. In this way new talent is retained through RIF actions.

Other services have made use of this technique to a very limited degree; and its value is not widely understood. It is recommended that all services make widespread use of this technique to protect new, young talent from the impact of RIF actions.

Tour of Duty Agreements for PL 313 Positions

The Air Force has adopted a policy concerning Public Law 313 appointments within Laboratories as quoted below:

"As a result of increased attention to civilian career development and in the interest of insuring a strong and dynamic Laboratory leadership, it is believed desirable to enunciate a policy concerning all future Public Law 313 appointments within the Director of Science and Technology, AFSC, and its assigned Laboratories. At the present time this policy cannot be applied to graded structure appointments at other levels and will be applicable only to PL-313 appointments.

All new appointments of civilians to positions in the Director of Science and Technology and its Laboratories within AFSC under the provisions of Public Law 313 will be for a specified "tour-of-duty." Such tours-of-duty will normally be for a period of from two to four years with the option of a mutually-agreeable renewal for a specified period.

In the case of temporary or term appointments given to individuals brought into the Laboratories from outside (non-career appointees), employment will cease at the expiration of the tour-of-duty unless the appointment is extended. In the case of career status appointees, the position will be vacated in conformance with the tour-of-duty agreement;

however, career appointees will be moved to another position of equal or higher level to avoid any appearance of adverse action. All specified executive level positions within the mobility program of the Director of Science and Technology, AFSC, are considered to be equal."

This policy limits the commitment to keep a manager in his job to 2 to 4 years. After that period of time he can be placed in another position not involving management if his performance is not considered adequate. His term can be renewed if his performance is adequate. This technique provides flexibility in the placement of managers and the ability to replace low performers, within the limitations of the tour of duty agreement. Other services could utilize this technique as well.

Mobility Agreement for GS-13's and Higher Grades

The Air Force has a policy within laboratories which states: "The policy of requiring a standard mobility statement connection with the acceptance of any appointment at any grade above GS-12, including supergrades, as covered in AFSC Supplement 1 to AFR 40-303 will be continued." This policy could be adopted by other services as a part of their program to encourage mobility between laboratories and headquarters RDT&E organizations.

Career Development Program

The Army has a well developed career development program in operation. The basic policies and requirements are described in CPR 950-1 entitled "Career Management." The basic components of this program include: career patterns, depicting developmental opportunities at successive grade levels, planned annual intake based on long-range forecasts of manpower needs, career appraisal providing regular evaluations of career potential and systematic personal counseling training and development, emphasizing technical and executive development of each career employee, and central inventory and referral requiring Army-wide and command-wide competition among career employees for promotion and developmental opportunities. Screening panels at command and Department levels provide multiple judgment by senior functional specialists in identifying best qualified candidates. During the past year (1973) 40% of all placements at grade 13 and above involved geographic moves, that is, someone other than a local candidate was selected - a high degree of mobility. As a part of the career appraisal record, DD Form 1559, the employee works out a career plan in which he identifies future job assignments he desires along with the knowledge and skills needed for those jobs, then work out a training and job assignment program to qualify him for the desired future job assignments.

Employee records are placed in computer memories for automatic data processing purposes.

The other services should study the effectiveness of the Army problem and adopt features which would improve their programs.

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d. "How to Make the Most of the Merit System," Personnel Management Series No. 19, February 1968, Civil Service Commission.

e. "Joint Program of the Civil Service Commission and the Department of Defense to Resolve Problems in the Management of Defense In-House Laboratories," 30 June 1969, Management Analysis Memorandum 69-2, ODDR&E.

f. "Career Management," CPR 950-1, March 1971, Department of the Army.

g. "Report of the Task Group on Defense In-House Laboratories," 1 July 1971, ODDR&E.

h. "Performance Measures for Research and Development," Vol I, May 1973, Committee on Federal Laboratories, Federal Council for Science and Technology.

APPENDIX F

PROCUREMENT PROBLEMS

PROCUREMENT PROBLEMS

I. PROBLEMS:

a. Procurement thresholds have not kept pace with inflation both in the small purchase and the Secretarial Determination and Findings (D&F) areas.

b. Computer purchase/rental justifications and approvals are time consuming and in some cases costs of personnel used in obtaining approval for small computers exceed the purchase price of the computer.

II. DISCUSSION:

a. The two procurement issues raised during the course of the study that seems to cause the most heartburn are those of (1) an unreasonably low ($2500) level of authority for Small Purchases and (2) an unreasonably low threshold (look) requirement for Secretarial D&Fs.

Fortuitously, the small purchase limit was raised from $2500 to $10,000 by a law enacted in July 1974. Additionally, H. R. 9061 - "Federal Procurement Act of 1974" is currently being drafted. This law, when enacted will make provision for a review of the small purchase threshold at least every three years with the level to be adjusted in accordance with the prevailing costs.

The specific purpose of the proposed bill (H. R. 9061) is to update the policies and procedures for procurements by Federal Agencies and is a result of recommendations of the Commission on Government Procurement. The current law allows negotiated procurements as an exception in the case of R&D vice advertised procurements. A planned negotiated procurement above $100K currently requires Service Secretarial level approval. While the Determinations and Findings is a procurement procedure, it has and is being used as a management control at the Secretarial level. H. R. 9061 recognizes negotiated procurements as a normal way of doing business and in effect does away with the D&F requirement as we now know it. The contracting officer will be required to include a statement of his reasons for not using formal advertising in the contract file.

b. With respect to the purchase of computers for R&D activities, this also breaks out into two problem areas. One is the acquisition of small (mini) computers for use in experiments, controls, etc. It is alleged that the required justification process for these mini-computers

often exceeds the actual cost of the computer. The second problem area is the purchase/lease of a large computer facility which may take several years from initiation to installation.

DODD 4105 dated 19 May 1972 provides that "selection of low cost (i. e., less than $200,000 annual lease of $500,000 purchase) may be more efficiently and effectively performed at using activities or commands under standard policy and procedural guidance to be provided by the Senior ADP Policy Official." At the present time each Service either has, or is in the process of delegating all or some portion of this authority to major command level. It would appear that any problems in the justification process for the "mini" computers are self generated. Delegation of authority to the major command level alleviates some of the problem.

The purchase/lease of large computer systems (greater than $200K annual base of $500K purchase) is the area which is not amenable to self solution since this is the area under which public law provides authority to GSA for management. The DoD Office of Deputy Comptroller for Data Automation has recognized the problem and is actively working with the Services in this area. That office has established a DoD automatic data processing (ADP) objective to reduce the time and cost of ADP equipment and service acquisition, among others and in conjunction with the Services is developing an implementation plan toward achieving this objective.

III. CONCLUSIONS AND RECOMMENDATIONS:

a. The issue of raising the Small Purchase level from $2500 to $10,000 has been eliminated and requires no further action.

As the raising of the threshold (currently $100K) for Secretarial D&Fs for R&D efforts requires congressional action, DDR&E should support the enactment of H. R. 9061 - "Federal Procurement Act of 1974." As presently drafted, this bill would eliminate the current procurement requirements for D&Fs for R&D efforts. This action does not preclude the ASXRDs from reviewing procurement actions as they desire. It would seem that a minimum level of $250K for this type review of technical base programs would be appropriate.

b. The lease or purchase of small computer capability is an area delegated to the Services. The Services either have or are in the process of delegating much of this authority to, at least, major command level. Any initiatives in this area toward additional delegation authority or financial rather than administrative control as suggested by the Navy appear to be within the authority of the Services and are to be encouraged.

The large computer facility (greater than $200K annual lease or $500K purchase) is a different problem. The problem of complex and time consuming justifications are well known. The DoD Office of Deputy Comptroller for Data Automation, in concert with his Services counterparts, is actively seeking solutions to this problem. A more active role on the part of DDR&E in supporting these efforts and to ensure that the problems of the laboratory community are factored in would be appropriate. We are unable to tell how deeply the Service Laboratories are involved in the development of ADP policy. At the present time, we see no immediate major changes in the acquisition policy for large computer facilities. DDR&E/R&AT and the Service Laboratories community should support efforts by OSD/Comptroller and their respective Services to simplify the ADP procedures and press for changes in the law where appropriate and justifiable.

IV. ACTIONS:

a. Procurement Thresholds - Support enactment of H. R. 9061: DDR&E, Services

b. Computer Procurement/Lease:

Mini-computers - encourage Service delegation of authority to lowest practical levels: DDR&E, ASXRD.

Large computer facilities - Support OSD(C)/Service efforts to simplify ADP procedures: DDR&E.

APPENDIX G

DOD LABORATORY PERSONNEL ATTRITION STATISTICS

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

3 September 1974

MEMORANDUM FOR ASSISTANT SECRETARIES OF THE MILITARY DEPARTMENTS (R&D)

SUBJECT: Request for Attrition Statistics for Laboratory Utilization Study

In order for the Lab Utilization Study to intelligently execute the charge from Secretary Schlesinger to consider how the size of the in-house laboratory complex might be reduced, it would be useful to have the benefit of the Lab's recent history and projections on attrition of civilian employees. Data for the past three fiscal years (FY 72 through 74) is requested, summarizing the number of people that have left due to (a) retirement, (b) death, and (c) resignation and, where possible, the average grade levels in each category.

In order to ensure timely completion of the study, which is already running well behind schedule due to the late completion dates of the Air Force and Navy studies, I would like to have your input by September 23rd.

John L. Allen
Deputy Director
(Research & Advanced Technology)

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE SECRETARY

MEMORANDUM FOR DIRECTOR DEFENSE RESEARCH AND ENGINEERING

SUBJECT: Attrition Statistics for Laboratories

In response to your memorandum of 3 September 1974, we have attached tables summarizing the attrition in laboratories for the last three fiscal years. The figures for average grade level are estimates. The column on transfers was added since they also represent a loss of personnel.

15 Attachments
Attrition Data Tables

AIR FORCE
ATTRITION STATISTICS*

	FY 72	FY 73	FY 74
Retirement	194	250	168
Death	21	11	16
Resignation	187	179	172
Transfer	146	125	163

*This is a consolidation of the 15 tables submitted by the Air Force

DEPARTMENT OF THE NAVY
DIRECTOR OF NAVY LABORATORIES
WASHINGTON, D. C. 20360

NOV 5 1974

MEMORANDUM FOR THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

Subj: Attrition Statistics for Laboratory Utilization Study

Ref: (a) DDR&E Memo of 3 Sep 1974; same subject

Encl: (1) Subject Statistics for the Eight CNM Laboratories and NRL

1. This replies to reference (a) which requested the Assistant Secretary of the Navy (R&D) to provide historical and projective data on attrition of civilian employees in the Navy material laboratories.

2. Enclosure (1) tabulates the requested statistics and is forwarded in accordance with reference (a).

JAMES H. PROBUS
Director of Navy Laboratories (Acting)

Copy to:
ASN (R&D)

ATTRITION STATISTICS
FOR THE EIGHT CNM LABORATORIES & NRL

1. Number of general schedule and wage board civilian employees who left laboratory employment due to:

	FY 72	FY 73	FY 74
a. Retirement	770	1,007	784
b. Death	49	62	82
c. Resignation	834	1,118	1,026

2. Average grade levels of general schedule civilian employees who left laboratory employment due to:

	FY 72	FY 73	FY 74
a. Retirement	9.71	9.67	10.49
b. Death	10.19	10.51	10.05
c. Resignation	6.94	6.49	6.09

3. Projected attrition of general schedule and wage board civilian employees due to retirements, deaths, and resignations:

FY 75	FY 76
2,098	2,085

Enclosure (1)

ARMY
ATTRITION STATISTICS*

	FY 72	FY 73	FY 74
Retirement	459	893	538
Death	56	56	52
Resignation	574	522	591

*This is a consolidation of several tables submitted by the Army

APPENDIX H

MILITARY CAREER PATTERNS

H-1

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

24 September 1974

MEMORANDUM FOR ASSISTANT SECRETARIES OF THE MILITARY DEPARTMENTS (R&D)

SUBJECT: Career Patterns of Military Directors/Commanding Officers of DoD Laboratories

As part of the Laboratory Utilization Study, we are addressing the question of the merits of military versus civilian leadership in the laboratories. One of the factors that figures prominently in the capability to attract outstanding military officers to such positions is the promotion potential therein. In order that we might render an approximate comparison between the three Services, we would like to know what percentage of those Lab Directors/Commanding Officers who have served in those positions since 1 January 1964 has gone on to become Flag or General Officers. For the purposes of this answer, consider the term "Laboratories" to include all facilities listed for your Service on the attached pages taken from "Department of Defense In-House RDT&E Activities, " dated 30 October 1973.

In order to facilitate completion of the study, we need the information on or before the 4th of October.

John L. Allen
Deputy Director
(Research & Advanced Technology)

Enclosures
(as stated)

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE SECRETARY

OCT 11 1974

MEMORANDUM FOR DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
(RESEARCH AND ADVANCED TECHNOLOGY)

SUBJECT: Career Patterns of Military Directors/Commanding Officers of DOD Laboratories

This is in response to your Memorandum of September 24, 1974 on the above subject. There are 14 former laboratory commanders who have been promoted to General Officer rank during or since their tour as commanders. This is from a total of approximately 65 officers who have been assigned as commanders in the past 10 years. Those promoted served 15% of the man-years attributed to the total period of command for the 65 officers.

These figures are not necessarily indicative of promotion opportunity because some laboratory commanders have elected to retire before completing a full 30-year career. Other officers known to have little promotion potential but with recognized excellent technical qualifications, have been assigned as laboratory commanders.

John J. Martin

JOHN J. MARTIN
Principal Deputy
Assistant Secretary
Research and Development

H-3

DEPARTMENT OF THE NAVY
OFFICE OF THE SECRETARY
WASHINGTON, D. C. 20350

15 OCT 1974

MEMORANDUM FOR THE OFFICE OF THE SECRETARY OF DEFENSE (RESEARCH AND ENGINEERING)

Subj: Career Patterns of Military Directors/Commanding Officers of DOD Laboratories

Ref: (a) OSD (Research and Engineering) memo of 24 September 1974

By reference (a) it was requested that information be provided relative to the percentage of those officers who have served since 1964 as Director/Commanding Officers of those activities listed in the enclosure to reference (a) who were subsequently promoted to flag rank.

A total of 112 officers have served as Directors/Commanding Officers of subject laboratories. Of this total, nine were subsequently promoted to flag rank, resulting in a promotion percentage of 8%. As a footnote, the Commanding Officer billet at the Naval Weapons Center, China Lake has been occupied by a flag officer since 1970.

H Tyler Marcy

H. TYLER MARCY
Assistant Secretary of the Navy
(Research and Development)

TABLE 1A. ARMY R&D LABORATORIES, PROGRAM AND PERSONNEL DATA, FY 1973

INSTALLATION		FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
		TOTAL	TOTAL INHOUSE	TOTAL R&E	INHOUSE R&E	TOTAL MIL	TOTAL CIV	PHD MIL	PHD CIV	PROF MIL	PROF CIV
AEROMEDICAL RESEARCH UNIT	FT. RUCKER, AL.	2.395	2.395	1.756	1.756	50	28	13	1	41	4
AIR MOBILITY R&D LABORATORY	MOUNTAIN VIEW, CAL.	38.423	12.869	37.931	12.377	40	598	2	24	13	253
ATMOSPHERIC SCIENCES LABORATORY	WHITE SANDS MR, N.M.	13.031	11.800	9.820	8.681	467	281	1	11	43	122
AVIONICS LABORATORY	EATONTOWN, N.J.	19.743	15.457	12.737	10.464	13	249	0	5	18	151
BALLISTICS RESEARCH LABORATORIES	ABERDEEN PROV GR, MD.	38.689	24.215	38.358	23.884	66	826	8	89	61	417
BENET WEAPONS LABORATORY	WATERVLIET, N.Y.	15.664	13.288	10.706	8.330	7	390	0	43	2	190
COLD REGIONS R&E LABORATORIES	HANOVER, N.H.	8.190	6.719	4.769	3.876	41	242	1	28	36	84
COMBAT SURVEILLANCE & TGT ACQUISITION LABS	FT. MONMOUTH, N.J.	40.739	14.200	40.738	14.200	23	320	0	13	33	201
COMMUNICATIONS ADP LABORATORY	FT. MONMOUTH, N.J.	21.930	11.230	21.600	10.900	12	394	1	18	18	261
CONSTRUCTION ENGINEERING RESEARCH LABORATORY	URBANA, IL.	7.456	4.086	6.186	3.526	5	177	0	37	4	109
EDGEWOOD ARSENAL LABORATORIES	EDGEWOOD ARSENAL, MD.	39.439	37.302	31.497	29.350	219	1183	54	67	152	526
ELECTRONIC WARFARE LABORATORY	FT. MONMOUTH, N.J.	32.569	15.201	32.164	14.796	50	617	0	3	11	198
ELECTRONICS TECHNOLOGY AND DEVICES LAB	FT. MONMOUTH, N.J.	17.709	10.567	16.747	9.871	6	377	4	38	12	237
ENGINEER TOPOGRAPHIC LABORATORIES	FT. BELVOIR, VA.	10.216	6.384	9.998	6.167	20	310	2	22	15	181
ENGINEER WATERWAYS EXPERIMENT STATION	VICKSBURG, MISS.	28.305	24.509	14.506	12.153	58	1247	4	43	64	372
FRANKFORD ARSENAL LABORATORIES	PHILADELPHIA, PA.	32.442	25.606	27.181	20.347	34	1666	0	46	24	633
HARRY DIAMOND LABRATORIES	WASHINGTON, D.C.	68.257	27.021	43.041	23.190	9	1578	3	67	9	800
HUMAN ENGINEERING LABORATORY	ABERDEEN PROV GR, MD.	6.692	5.292	6.089	4.689	30	100	1	10	22	65
INSTITUTE OF DENTAL RESEARCH	WASHINGTON, D.C.	1.692	1.692	0.932	0.932	56	26	23	1	30	6
INSTITUTE OF SURGICAL RESEARCH	FT. SAM HOUSTON, TX.	3.146	3.146	1.635	1.635	134	80	23	3	141	19
LAND WARFARE LABORATORY	ABERDEEN PROV GR, MD.	7.508	4.778	7.227	4.507	16	110	0	5	11	51
LETTERMAN ARMY INSTITUTE OF RESEARCH	PRESIDIO, S.F., CAL.	13.214	1.509	0.629	0.629	91	22	22	5	54	12
MATERIALS AND MECHANICS RESEARCH CENTER	WATERTOWN, MASS.	25.502	14.861	18.999	11.277	9	597	7	64	13	217
MEDICAL BIOENGINEERING R&D LABORATORY	FORT DIETRICK, MD.	1.739	1.739	1.440	1.440	27	64	3	3	17	14
MEDICAL RESEARCH AND NUTRITION LAB, FGH	DENVER, CO.	3.774	3.774	2.652	2.652	110	90	24	9	65	33
MEDICAL RESEARCH INST OF INFECTIOUS DISEASES	FORT DETRICK,MD	9.837	9.837	6.556	6.556	358	229	57	23	62	43
MEDICAL RESEARCH LABORATORY	FT. KNOX, KY.	2.695	2.695	1.749	1.749	115	132	11	9	76	23
MEDICAL RESEARCH UNIT	KUALA LUMPUR MAYLASIA	0.359	0.359	0.274	0.274	8	0	5	0	7	0
MEDICAL RESEARCH UNIT	BALBOA HEIGHTS, C.Z.	0.249	0.249	0.140	0.140	10	11	2	0	5	0
MISSILE RES., DEV. AND ENGINEERING LAB	REDSTONE ARSENAL, AL.	103.309	44.521	91.595	33.469	40	1226	7	66	33	747
MOBILITY EQUIPMENT R&D CENTER	FT. BELVOIR, VA.	109.060	26.042	49.710	19.000	71	1494	4	22	79	501
NATICK LABORATORIES	NATICK, MASS.	35.532	28.072	22.836	15.632	126	1183	17	92	54	456
NIGHT VISION LABORATORY	FT. BELVOIR, VA.	38.199	16.007	38.199	16.007	51	396	0	30	28	195
PICATINNY ARSENAL LABORATORIES	DOVER, N.J.	110.400	59.400	80.300	42.300	71	2403	0	60	53	1075
RESEARCH INST FOR BEHAVIORAL & SOCIAL SCI	WASHINGTON, D.C.	5.742	2.805	5.742	2.805	28	144	2	48	23	88
RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE	NATICK, MASS.	3.716	3.716	2.948	2.948	84	102	17	19	59	46
ROCK ISLAND ARSENAL LABORATORIES	ROCK ISLAND, IL.	21.041	15.232	14.720	9.894	16	764	4	18	15	251
TANK-AUTOMOTIVE LABORATORIES	WARREN, MI.	58.979	26.409	34.066	14.903	35	922	1	7	22	443
WALTER REED ARMY INSTITUTE OF RESEARCH	WASHINGTON, D.C.	20.132	20.132	15.192	15.192	479	577	154	73	329	162
TOTALS		1017.702	553.116	763.357	422.408	3085	20954	477	1120	1752	9186

TABLE 3A. NAVY R&D LABORATORIES. PROGRAM AND PERSONNEL DATA, FY 1973

INSTALLATION		FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
		TOTAL	TOTAL INHOUSE	TOTAL RDT&E	INHOUSE RDT&E	TOTAL MIL	TOTAL CIV	PHD MIL	PHD CIV	PROF MIL	PROF CIV
ENVIRONMENTAL PREDICTION RESEARCH FACILITY	MONTEREY, CA.	1.867	1.209	1.395	0.948	16	27	1	2	8	17
NAVAL AEROSPACE MEDICAL RESEARCH LABORATORY	PENSACOLA, FL.	3.750	3.750	3.317	3.317	31	124	12	14	22	47
NAVAL AIR DEVELOPMENT CENTER	JOHNSVILLE, PA.	136.607	56.519	87.536	42.426	387	2187	4	27	84	993
NAVAL AIR ENGINEERING CENTER	PHILADELPHIA, PA.	85.086	60.037	9.793	6.859	36	2188	0	5	13	404
NAVAL BLOOD RESEARCH LABORATORY	CHELSEA, MS.	0.547	0.547	0.390	0.390	13	10	4	0	6	1
NAVAL CIVIL ENGINEERING LABORATORY	PORT HUENEME, CA.	13.662	12.471	10.601	9.619	16	340	1	38	11	137
NAVAL CLOTHING AND TEXTILE RESEARCH UNIT	NATICK, MS.	1.463	1.463	0.771	0.771	1	60	0	0	0	22
NAVAL COASTAL SYSTEMS LABORATORY	PANAMA CITY FL	17.806	16.022	10.480	9.050	140	577	3	18	15	240
NAVAL DENTAL RESEARCH INSTITUTE, NTC	GREAT LAKES, IL	0.603	0.603	0.339	0.339	18	17	2	2	11	14
NAVAL ELECTRONICS LABORATORY CENTER	SAN DIEGO, CA.	56.534	39.837	32.067	22.465	90	1473	1	63	31	729
NAVAL MEDICAL FIELD RESEARCH LABORATORY	CAMP LEJEUNE, N.C.	1.434	1.434	0.798	0.798	34	42	4	2	5	6
NAVAL MEDICAL RESEARCH INSTITUTE	BETHESDA, MD.	7.522	7.521	5.057	5.056	203	210	55	34	77	59
NAVAL MEDICAL RESEARCH UNIT NO. 2	TAIPEI, TAIWAN	2.137	2.137	1.565	1.565	34	9	15	2	29	5
NAVAL MEDICAL RESEARCH UNIT NO. 3	CAIRO, EGYPT	1.847	1.847	0.856	0.856	31	260	8	4	12	4
NAVAL MEDICAL RESEARCH UNIT NO. 4	GREAT LAKES, IL	1.139	1.139	0.722	0.722	35	35	5	1	15	14
NAVAL ORDNANCE LABORATORY	WHITE OAK, MD.	98.794	61.082	73.594	41.623	49	2700	0	153	20	1117
NAVAL RESEARCH LABORATORY	WASHINGTON, D.C.	187.343	180.655	158.918	153.629	117	4026	1	601	41	1788
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER	WASHINGTON, D.C.	119.638	60.377	96.703	44.947	62	2895	0	107	25	1250
NAVAL SUBMARINE MEDICAL RESEARCH LABORATORY	GROTON CT	1.874	1.874	1.426	1.426	37	66	8	12	14	33
NAVAL UNDERSEA CENTER	SAN DIEGO CA	77.858	49.154	50.317	33.238	285	1645	0	98	14	682
NAVAL UNDERWATER SYSTEMS CENTER	NEWPORT, R.I.	109.114	87.648	67.684	40.356	178	3325	2	89	41	1450
NAVAL UNIT, FORT DETRICK	FREDERICK, MD.	0.224	0.224	0.091	0.091	16	1	2	0	6	0
NAVAL WEAPONS CENTER	CHINA LAKE, CA.	180.672	114.528	101.700	63.349	677	4412	8	137	75	1708
NAVAL WEAPONS LABORATORY	DAHLGREN, VA.	96.456	77.453	37.870	30.570	84	2916	2	77	41	1135
NAVY MEDICAL NEUROPSYCHIATRIC RESEARCH UNIT	SAN DIEGO, CA	1.762	1.677	1.347	1.347	20	58	1	9	14	28
NAVY PERSONNEL RESEARCH & DEVELOPMENT CENTER	SAN DIEGO,CA	9.393	8.647	6.200	5.687	33	289	0	45	34	151
NAVY TOXICOLOGY UNIT, NNMC	BETHESDA, MD.	0.579	0.579	0.415	0.415	16	7	1	0	7	2
TOTALS		1215.721	850.434	741.942	521.848	2659	29899	150	1540	671	12036

TABLE 5A. AIR FORCE R&D LABORATORIES, PROGRAM AND PERSONNEL DATA, FY 1973

INSTALLATION		FUNDING DATA (MILLIONS $)				PERSONNEL DATA					
		TOTAL	TOTAL INHOUSE	TOTAL RDT&E	INHOUSE RDT&E	TOTAL MIL	TOTAL CIV	PHD MIL	PHD CIV	PROF MIL	PROF CIV
AEROPROPULSION LABORATORY	WPAFB, OH.	55.468	9.454	54.539	8.525	49	355	10	14	42	180
AEROSPACE RESEARCH LABORATORIES	WPAFB, OH	12.540	7.675	11.370	6.505	69	174	19	43	59	82
AVIONICS LABORATORY	WPAFB, OH.	105.936	14.174	103.636	11.974	195	905	18	32	133	339
CAMBRIDGE RESEARCH LABORATORY	L.G. HANSCOM FLD, MS.	56.975	35.563	54.350	33.504	155	978	11	166	60	588
FLIGHT DYNAMICS LABORATORY	WPAFB, OH.	58.400	26.508	51.474	24.117	210	967	21	39	126	517
FRANK J. SEILER RESEARCH LABORATORY	USAF ACADEMY, CO.	1.457	1.457	0.525	0.525	22	9	12	1	24	3
HUMAN RESOURCES LABORATORY	BROOKS AFB, TX.	16.073	6.139	13.824	4.450	127	254	8	34	94	122
MATERIALS LABORATORY	WPAFB, OH.	48.095	11.305	35.397	10.210	56	341	22	45	60	234
ROCKET PROPULSION LABORATORY	EDWARDS AFB, CA.	27.265	12.642	24.317	9.980	178	299	10	7	64	106
ROME AIR DEVELOPMENT CENTER	GRIFFISS AFB, N.Y.	142.640	27.644	95.505	22.196	299	1133	5	11	85	513
WEAPONS LABORATORY	KIRTLAND AFB, N.M.	90.957	40.132	79.347	29.247	790	394	93	28	484	195
6570 AEROSPACE MEDICAL RESEARCH LABORATORY	WPAFB, OH	14.851	7.502	13.118	5.769	134	170	28	25	75	97
TOTALS		630.658	200.195	537.402	166.902	2284	5979	257	441	1306	2976

APPENDIX I

TECHNOLOGY BASE MANAGEMENT MANPOWER

CXR WORKLOAD

OXR	PROF. PERS.	CONTRACT FUNDS: $M*	RATIO: $K/PROF.
ARO	21	16.6	614
ONR	216	126	583
OSR	53	42.5	801
NAVSYSCOM			
AIR	79	76	962
ELEX	26	25	962
SEA	118	113	958

$$\frac{\text{NAVSYSCOM RATIO}}{\text{ONR RATIO}} = \frac{960}{583} = 1.65$$

*FY 74

TECHNOLOGY BASE MANAGEMENT STAFFING

	PROFESSIONAL			SUPPORT			GRAND
	MIL	CIV	TOTAL	MIL	CIV	TOTAL	TOTAL
ARMY							
• STAFFS	59	118	177	3	80	83	260
• BMD-ATC	7	74	81	0	26	26	107
• ARO	1	20	21	0	16	16	37
TOTALS	67	212	279	3	123	125	404
NAVY							
• STAFFS	59	223	282	8	81	89	371
• ONR*	45	171	216	0	112	112	328
TOTALS	104	394	498	8	193	201	699
AIR FORCE							
• STAFFS	100	22	122	8	45	53	175
• OSR	23	30	53	27	71	98*	151
TOTALS	123	52	175	35	116	151	326

*DOES NOT INCLUDE OFFICES OF PATENTS, FINANCIAL MGMT AND CONTRACTS

*OSR SUPPORT INCLUDES PROCUREMENT STAFF

I-3

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

30 SEP 1974

MEMORANDUM FOR: DEPUTY DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING (RESEARCH AND ADVANCED TECHNOLOGY)

SUBJECT: Technology Base Management Manpower

Reference DDR&E, DD(R&AT) memo, subject as above, 13 Sep 74.

The attached data has been compiled. The totals for the Army are:

Professional			Support		
Mil	Civ	Total	Mil	Civ	Total
67	212(-)	279(-)	3	123(-)	126(-)
		Grand Total	404		

This data is calculated in terms of equivalent full time man years. The seemingly low totals are the result of transferring detailed management responsibility downward from staff and command levels to the laboratory level, which is not included in this survey.

It is AMC's opinion that the Army Research Office (ARO) should not be included in this total since it is the equivalent of a laboratory. The same is true for BMD-ATC.

K. C. Emerson

1 Incl
Chart

K. C. Emerson
Acting Deputy Assistant Secretary of the Army
(Research and Development)

TECHNOLOGY BASE MANAGEMENT STAFFING

Military Department: Army — As of: 20 Sep 74

Organizational Entity	Professional			Support			Grand Total
	Mil	Civ	Total	Mil	Civ	Total	
OASA(R&D)	0	1(-)	1(-)	0	1(-)	1(-)	1
OCRDA	30	15	45	0	12	12	57
Corps of Engrs	1	3	4	0	1	1	5
The Surgeon General	8	0	8	0	7	7	15
ODCSPER	1	1	2	0	1	1	3
Army Security Agency	1	2	3	1	2	3	6
BMD-PO	3	6	9	0	9	9	18
BMD-ATC	7	74	81	0	26	26	107
AMC-HQ	3	25	28	0	9	9	37
ARMCOM	3	22	25	0	7	7	32
AVSCOM	4	22	26	1	3	4	30
ECOM	1	6	7	1	4	5	12
MICOM	0	5	5	0	3	3	8
TACOM	3	6	9	0	12	12	21
TROSCOM	1	4	5	0	10	10	15
ARO	1	20	21	0	16	16	37
TOTALS	67	212	279(-)	3	123	126(-)	404

(Equivalent full time)

I-5

DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
(RESEARCH AND DEVELOPMENT)
WASHINGTON, D.C. 20350

11 OCT 1974

MEMORANDUM FOR DEPUTY DIRECTOR (RESEARCH & ADVANCED TECHNOLOGY), ODDR&E

Subj: Technology Base Management Manpower

Ref: (a) ODDR&E Memo DCN 256498 of 13 Sep 1974
(b) ASN(R&D) Memo of 30 May 1974
(c) ODDR&E Memo of 28 August 1973

Encl: (1) Technology Base Management Staffing

Enclosure (1) is submitted as requested by reference (a).

The following assumptions were used in collecting the requested data:

a. The technology base includes all of Categories 6.1 and 6.2 and those elements identified as Category 6.3A in reference (c).

b. Technology Base management Manpower includes professional and support personnel involved directly with Technology Base Management. For example, in the Office of Naval Research it includes the entire staff of the Assistant Chief for Research (Code 400); the Office of the Chief of Naval Research, Deputy and Assistant Chief; Deputy and Chief Scientist; and the Ocean Science Staff. It specifically excludes the offices of patents, financial management, and contracts. The data on these offices was provided in reference (b).

c. Within the Office of the Chief of Naval Material and the Systems Commands, we included all of the 03 organizations and any equivalent man-years in other organizations involved with the management of the technology base.

Copy to:
CNO (OP-980C)
CNM (MAT 03)
NAVMEDRSCHDEVCOM
BUPERS

Donald W. Rehorst

Donald W. Rehorst
Special Assistant (Financial Management)

Technology Base Management Staffing

Military Department: Navy As of: 30 September 1974

Organizational Entity	Professional			Support			Grand Total
	Mil	Civ	Total	Mil	Civ	Total	
ASN(R&D)	-	1	1	-	1	1	2
CNO	2	1	3	1	2	3	6
NAVMAT	15	12	27	2	10	12	39
NAVAIR	10	69	79	-	23	23	102
NAVSEA	15	103	118	-	24	24	142
NAVELEX	3	23	26	4	9	13	39
NAVMEDRSCHDEVCOM	13	2	15	1	7	8	23
NAVFAC	1	6	7	0	3	3	10
NAVSUP	-	6	6	-	2	2	8
ONR	45	171	216	-	112	112	328
TOTALS	104	394	498	8	193	201	699

Notes: * Does not include personnel assigned to the laboratories.
* Support includes only non-professionals.

Enclosure (1)

I-7

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE SECRETARY

SEP 27 1974

MEMORANDUM FOR DEPUTY DIRECTOR (RESEARCH & ADVANCED TECHNOLOGY), ODDR&E

SUBJECT: Technology Base Management Manpower

The attached table of Technology Base Management Manpower is provided in response to your memorandum of September 13, 1974. The table includes personnel of headquarters and staff elements at levels above the laboratories who are principally associated with laboratory programs. The personnel of AFOSR have been included as you requested; however, the Air Force views AFOSR as a laboratory and not as part of the management staff. Another qualification is that personnel of the Air Staff have other responsibilities as well as monitoring laboratory programs. Therefore, the Air Staff and SAF/RD figures should be interpreted as man-years associated with laboratory programs rather than numbers of Program Element Monitors.

Franklin J. Ross

for WALTER B. LaBERGE
Assistant Secretary
(Research and Development)

1 Attachment
Table of Manpower

TECHNOLOGY BASE MANAGEMENT STAFFING

Military Department: Air Force — as of 31 Aug 1974

Organizational Entity	Professional Mil	Professional Civ	Professional Total	Support Mil	Support Civ	Support Total	Grand Total
SAF/RD		1	1		1	1	2
AF/RDPS	8	3	11		5	5	16
AF/RDGA		1	1		1	1	2
AF/RDPA		1	1				1
AF/RDPE	1		1				1
AF/RDPN	2	1	3				3
HQ AFSC/DL	64	10	74	4	29	33	107
HQ AFSC/SG	3	1	4		1	1	5
HQ AMD	22	4	26	4	8	12	38
AFOSR	23	30	53	27	71	98*	151

*AFOSR Support includes their procurement staff.

APPENDIX J

IN-HOUSE LABORATORY/TECHNICAL CENTER MANAGEMENT

ON THE MANAGEMENT OF IN-HOUSE LABORATORIES/ TECHNICAL CENTERS

Preface

During the course of the Laboratory Utilization Study, the study personnel had the opportunity to become familiar with the differing structures and methods of management of the three Services' laboratory complexes and related facilities as well as with those of some laboratories outside DoD and outside the government. From this effort it was seen that no one laboratory system is clearly superior in all regards. Rather, it was apparent that a better system could be evolved from an intermingling of the best features of all the systems examined, tailored to the particular environment of DoD and each Service.

The two extreme styles of management can be classified as (1) that in which the laboratories serve as closely directed performers of explicitly directed, tightly formulated tasks largely under the control of external customers and (2) those in which the laboratory is given a broad responsibility with only minimal detailed guidance but with a careful attention to results. Neither of these extremes are, in their entirety, well-matched to DoD needs across the entire spectrum of RDT&E. The latter style has generally been most productive in producing innovative new ideas and new technology. The former recognizes that as a mission oriented agency, there are some specific jobs in RDT&E that need to be done in response to headquarters direction.

We have considered all these factors and derived a set of management principles for DoD hardware system-oriented laboratory/technical centers that we believe to be consistent with DoD needs, and reasonably free of internal inconsistencies. The principles reflect what we believe to be the best features of the variety of systems examined.

What is described herein is a system that combines both styles of operation, placing the burden of responsibilities on the laboratories for the more innovative phases of technology, but making them dependent upon and responsive to headquarters directions in support of the development of new systems and the support of existing materiel.

The underlying theme of the management system put forth here is based upon the results of previous studies of technology oriented operations that generally conclude that the keys to an outstanding laboratory system are threefold: (1) the assignment to each component of an important job to do; (2) the attraction and retention of good leadership; and (3) the

provision of sufficient flexibility in the system to allow the leadership to most effectively use its talents to accomplish the job assigned.

I. THE OBJECTIVES OF THE IN-HOUSE LABORATORIES/TECHNICAL CENTERS

The reasons for the existence of the in-house laboratory/technical center (IHL) complex and, indeed, for all the DoD RDT&E effort, are those of (1) increasing the effectiveness and (2) decreasing the cost of the U. S. military forces. In the case of laboratories whose principal activities are related to hardware systems, as opposed to medical and personnel labs, these objectives specialize into that of improving the design, facilitating the acquisition and assisting with the operational usefulness of military systems including weapons, vehicles and supporting materiel.

Two principles following from these objectives are (1) the success of a lab should ultimately be judged on the basis of its contribution to this process and (2) its overall level of funding should be predicated upon its previous success therein and the Services' forecast needs for such contributions.

II. JUSTIFICATION FOR THE EXISTENCE OF IN-HOUSE LABS

The primary justifications for having in-house labs are (1) their potential for participation in the Services' decision making process, (2) their capability to perform as an interface between technology and their Service's needs, and (3) their ability to provide technology bases in those defense-unique areas where industrial capability is low and/or where there is reluctance by industry to meet defense needs.

Many of the other functions performed by the IHLs are also available from industry and/or the universities; however IHLs are unique in the spectrum of available resources in that they complement their technical expertise with (1) an extensive familiarity and experience with Service problems, (2) a degree of access to proprietary, intelligence, planning and test and evaluation data usually denied those outside the DoD, and (3) the lack of a profit motive. They are therefore uniquely qualified to relate problems of their particular Service to the on-going flow of technology and, most importantly, to provide inputs on these considerations into the Services' decision making process. Indeed, if the lab expertise is not used in the Services' planning, the most important reason for the existence of IHLs is largely negated.

III. FUNCTIONS OF IHLs

In pursuing their basic objectives, the labs should perform several explicit functions that are implicit in the foregoing. Among these are:

(a) provide the technical knowledge to assist in the planning, analysis, development and acquisition of new weapons and support systems and to originate new system concepts.

(b) provide the technical expertise to make the Services "smart buyers."

(c) participate in test and evaluation of new systems and procedures.

(d) provide engineering support to fielded systems.

(e) provide a corporate memory in systems development and in aspects of the environment related to weapons.

(f) assure that the state-of-the-art in areas of importance to systems development is advancing.

(g) provide technical experience for military personnel.

(h) provide knowledgeable personnel to assess intelligence information on potential enemies' systems.

(i) provide a "quick reaction capability."

IV. THE ROLE OF INDUSTRY & THE ACADEMIC COMMUNITY

Although the list of the functions of the in-house laboratories is long, reflecting the fact that their role in the Defense RDT&E process is a key one, the differences between the in-house laboratories, commercial industry, and the academic community lead to differences in their capabilities that must be recognized and exploited for a maximally effective RDT&E process.

The industrial community with its large number and variety of available talents, provides a source of new ideas coupled with the competence to turn these ideas into hardware more effectively than the IHLs in most technology areas. The fact that we generally depend on industry for most design and production of weapons systems also makes it advantageous as a means of stimulating transfer of new technology to such systems to do much of our development of new techniques and

and devices in industry. Furthermore, since the industrial contract arrangement usually carries no implication of continued support, it is usually easier to start work in new areas and to discontinue work in fields of diminishing importance than is the case with the IHLs, with their relatively stable manning and resulting viscosity in reacting to the evolution of technology. Consequently, in most technologies, a more vigorous and dynamic hardware research and development program can be run with a substantial dependence on industry. In these areas most of the work should be placed with industry and the hardware development role of the laboratories restricted. Of course, some work in hardware development, even in these areas, should continue in the laboratories to keep them competent and current, but the amount of such work in the IHLs should be limited so that they maintain their objectivity in judging the work of industry and so that they can concentrate most of their resources on those technology areas where adequate industrial capability is lacking.

The roles of the academic community (excepting large university related full time research laboratories) lies largely in (1) doing research via contracts and grants, (2) producing specialists with the training needed by the Services, and (3) providing scientific advice. The potential advantages of the use of the academic community for research over doing the work in-house are again those of diversity of available talent and ideas, access to eminent scientists and engineers and the flexibility of the contractual arrangement. The major disadvantages are the (1) inability or reluctance of much of academia to marshall and maintain for an extended period a team effort involving diverse skills, (2) a pace of results keyed largely to the thesis research time scale, (3) lack of some large scale expensive test facilities, and (4) a reluctance on the part of some researchers to be involved with DoD.

The potential advantages of the use of academia and industrial sources are often frustrated when large scale and long term commitments are made to a few researchers. Such arrangements are not necessarily bad, but should be given special scrutiny to insure the potential benefits of the particular arrangement justify its existence.

V. MANAGEMENT PRINCIPLES

A. Mission Responsibility and Competition

Studies of DoD laboratories have shown a strong correlation between those laboratories held in high esteem by knowledgeable observers and the assignment of an important mission or product responsibility to

that laboratory (in support of Program Managers (PMs) and others charged with materiel support in that mission or product area). The absence of meaningful responsibilities is not only demoralizing to a laboratory but raises serious questions about the need for the facility. Thus the need for such assignment of responsibility is clear. A major problem arises in the determination of the degree of overlap of responsibilities that should be permitted to encourage competition.

There exists, in principle, an optimum degree of competition among IHLs. If there is too little competition, the laboratories tend to lose competence and their effectiveness is decreased. Too much competition is costly in duplication of facilities and supporting effort.

In considering the amount of competition that is necessary, it should be borne in mind that industry does, in fact, compete directly with the IHLs for much of their work and represents an alternate or additional source of support to PMs. It is in their unique role as privileged advisors to the Services and OSD that competition is limited to other IHLs and to some degree, FCRCs. Alternate in-house or FCRC sources of advice must be provided, either within the same Service or by use of other Services' laboratories.

Continual performance comparisons with industry and other laboratories engaged in similar work should be used as an incentive to the IHLs to excel.

B. Laboratory Funding

Laboratories should be encouraged to aggressively solicit business in direct support of the materiel acquisition process (i.e., that work not classified as Technology Base support as defined below) within the constraints of their assigned mission and subject to an overall control on the level of in-house work to be permitted (see "D" below). The resulting work should be industrially funded (i.e., customer funded on a task basis including overhead burden) to encourage the laboratories to be responsive and render quality service and to encourage the customer to assure that he received services in proportion to the true costs of the support. The IHLs would consequently be funded for such work in a manner quite similar to the funding of an industrial contractor. The peculiar problems of the IHLs in responding to rapid funding changes should be recognized and taken into account whenever possible, however, and funding transients smoothed as much as possible.

The IHLs must also have adequate support for providing the necessary Technology Base work (normally that in budget categories 6.1,

6.2 and some 6.3) required to keep up their competence and to conduct an appropriate level of both in-house and contract activities as required to technically support their mission. To help prevent a fragmented program of many poorly funded efforts and substantial voids in the program, and to allow some margin of freedom within the laboratories to pursue efforts they believe important on their own initiative, 6.1 and 6.2 base programs should be sustained by block funding of the laboratory effort controlled as described below, perferably by Single Program Element (SPEF) in 6.2 and by single blocks in 6.1. Base-line institutional funding should also cover:

(1) specialized facilities required to accomplish the mission (i.e., research and exploratory development required for underwater combat system development);

(2) a fund to provide for assistance to the Fleet in support of exploration of new tactical or technical concepts; and

(3) a fund to support program development, analysis and consultation.

(Some of this institutional funding probably should be provided from 6.5.) Work in category 6.3 that is of a Technology Base nature (e.g., Advanced Technology Demonstration projects) should be funded on a project basis. Since such programs are in response to perceived technological opportunities rather than formal requirements, the management and the source of funding should be those responsible for the Technology Base program, not those responsible for material acquisition.

C. Control of the Customer-Supplier Relationship

To insure the effective discharge of the most important function of the IHLs, the rendering of objective technical advice, the in-house laboratories must maintain a significant level of independence from their direct sponsors. In order to insure this independence while remaining responsive to their customers, the relationship of the laboratories and their customers must be a reciprocal one. To promote this reciprocity, the laboratories must have a degree of access to, and the attention of, top level managers in their Service and in OSD similar to that given the System Command(s) and Commodity Command. The opinion of the responsible laboratory with regard to the technical merits of courses of action proposed by customers should be routinely and formally solicited by those in the decision making process up to and including the DSARC principals. Service RDT&E management should act to insure that each laboratory maintains a multiplicity of customers (e.g., Program Managers) for its activities.

D. Controls on Laboratories

In order to effectively use all available resources, it is necessary that a program balance be maintained between the in-house laboratories, industrial contractors and other participants. Decisions on the proper distribution of effort must be made separately for each technology area reflecting the considerations of where the best capability resides, the volatility of the technology vis-a-vis the inflexibility of in-house manning, and any other relevant factors.

Since the RDT&E process is fundamentally dollar limited, that portion of all RDT&E funding supporting the IHLs must be ultimately controlled to preserve this balance in the face of budget trends and salary changes. Redundant controls such as the dual control of funding and manpower should be avoided. Judgment as to the type, level and discipline of personnel to be applied to a problem should be left to those responsible for solving the problem. A modified form of REFLEX (management by fiscal constraints alone) should be used but with controls over the maximum of internal operating expenses allowed.

Controls should therefore be exercised on:

- o total block funding to that laboratory
- o that fraction of the block funding that may be expended in the IHLs
- o the maximum dollar level of total in-house effort allowable to each laboratory (the sum of the block funded money that may be expended in-house and the maximum in-house industrially funded business that will be allowed)

These levels should be based upon a continuing appraisal of each IHLs performance and Service needs in its area of competence. Levels should be arrived at as part of the annual budget cycle and approved by the same approval chain. The levels and ratios would be expected to vary from year to year in response to technical and administrative changes. Consideration should be given to smoothing short term fluctuations in in-house funding, but such funding must be responsive to long term trends.

E. Overall Planning, Approval and Execution

That portion of the IHLs work in support of the materiel acquisition process should be negotiated on a task-by-task basis with

individual customers. The responsibility for structuring this work and guiding it to a satisfactory conclusion ultimately rests with the Program Manager, with the continuation of the relationship dependent upon the user's satisfaction with the laboratory's performance. Thus, work in the materiel acquisition process should be essentially self-regulating through a "customer-supplier" relationship, except for the need for a limit on the amount of such involvement allowable, as described in Section D.

Work that is block funded, however, will have the benefit of considerably less of a customer-supplier relationship, requiring more explicit attention to its planning, approval, execution and appraisal. These subjects are addressed in the following sections.

F. Technology Base Program Planning & Execution Responsibility

It is vital that the Technology Base program be an integrated aggressive program, based upon a detailed understanding of both Service problems and contemporary technology. The best combination of these understandings, vested in enough people to carry out such extensive and detailed initial planning in any Service, is usually found in the IHLs. Consequently, the first stages of the Technology Base program planning should normally be done within the IHLs. Technology area responsibilities should be assigned to each laboratory paralleling its mission or product responsibilities ("lead laboratory" assignments). Since the Technology Base is coordinated on a tri-Service basis and benefits by a degree of open literature information exchange, the technical areas of responsibility can in most areas be assigned within each Service on a substantially non-overlapping basis with interservice competition providing the stimulus for excellence. Special care must be taken in those areas of single Service interest however.

A Service's Technology Base program within each area, including work to be done in other laboratories and on contract to industry and other sources, should be initially formulated by the responsible lead laboratory, with advice and consultation of interested parties including other conceptual laboratories and present and potential customers. In order to provide an adequate level of 6.1 funding devoted to research of a more speculative nature than that normally conducted by or for IHLs whose attention is focused on solving recognized problems, it is advisable to conduct part of the research program outside the direct control of the laboratories through a Research Office unattached to any specific laboratory, but staffed with people of comparable technical competence and operational familiarity. Such a program should be coordinated with

people of comparable technical competence and operational familiarity. Such a program should be coordinated with relevant laboratories and their advice and consultation sought and considered in the program planning and evaluation. Management principles for the Research Offices should follow those described herein for IHLs, excepting those directed at in-house work.

The laboratory assigned responsibility for a technical area should be held directly responsible for the execution of the Technology Base program in its area of assigned responsibility and the quality of work of all performers.

G. Approval and Appraisal Responsibility for the Technology Base Programs.

In order to assure quality control of the planning and execution of the Technology Base programs, higher level approval of the program plan and assessment of the responsible laboratory's performance is necessary.

To maximize the quality of the Technology Base, personnel in headquarters approval positions should be selected from among those combining the highest technical competence, with sufficient operational knowledge to assess the operational consequences of new technology. Extensive use should be made of the advisory process so that all potential customers of the technology can participate in the planning and evaluation. The enlightened use of advisory groups from outside DoD is also encouraged. However, to preclude stifling of new ideas by too many people who can say "no," the actual formal approval and appraisal chain should be kept short and competently staffed.

H. Lab Expertise and Staffing

The unique feature of the IHLs within their Service is their technical capability; therefore, the IHLs must put first emphasis on technological expertise. Operational <u>expertise</u> is neither expected nor appropriately placed in a laboratory; the uniqueness of in-house labs can be satisfactorily fulfilled by operational <u>awareness</u>.

The appropriate lab atmosphere is consequently most effectively and efficiently achieved by providing <u>operational</u> exposure to <u>technically</u> trained personnel rather than the converse. The recruitment stress should therefore be on technical training and competence. The use of technically trained military personnel in laboratories can greatly facilitate this process. However, the assignment of military personnel without adequate technical credentials is disruptive to a lab if they are arbitrarily placed in positions of technical management responsibility.

These observations suggest the following staffing principles:

- Laboratory staffs should be a mixture of civilian and military personnel
- The same quality of technical background should be required of both civilian and military personnel for the same position
- Supervisors should be selected on the basis of best qualifications for the job, irrespective of military or civilian status
- Personnel without adequate prior laboratory experience (either IHL or elsewhere) should be placed in technical supervisory positions in laboratories only under extraordinary circumstances

Laboratory personnel, both civilian and military, should be encouraged to serve tours in appropriate positions elsewhere in the Services, most notably in RDT&E staffs, the systems/commodity commands, on staffs of Project Managers and as technical advisors to commanders of operational forces to enhance their own backgrounds and to facilitate the diffusion of technical expertise through the Services.

I. Laboratory Management Responsibilities and Accountability

The overall quality of a laboratory is strongly dependent upon the quality of the leadership of the laboratory. It is therefore vital that all possible steps be taken to attract the best possible people to senior laboratory positions. Once attracted, these people should be allowed to make maximum use of their competence with minimum constraints. Service and OSD imposed restrictions on resource management (notably personnel and procurement restrictions beyond those required by law) should be minimized. In addition, easing of statutory regulations should be sought in recognition of the distinction between professional technical organizations and the more typical government organization. In recognition of the dependence of the RDT&E process on rapid response, laboratories should be allowed to have resident Personnel, Procurement and other support operations if the laboratory feels such activities sufficiently vital to its performance so that the laboratory is willing to support such activities out of their (controlled) in-house funding.

Consistent with giving Laboratory Directors maximum authority, they must be held fully responsible for the laboratory's performance. If after a reasonable amount of time, Laboratory Directors and top management personnel are found lacking in the qualities necessary to manage first rate laboratories, they should be replaced.

J. Maintenance of Technical Skills

The constantly changing nature of technology and the continual evolution of the techniques and tools thereof make it vital that laboratories have a continual infusion of new people and a continual upgrading of their existing staffs.

Formal programs for the continual technical upgrading of the existing staff are a necessary and legitimate expense of laboratory operation. The success of these programs should be measured periodically. Personnel should be philosophically and financially encouraged to undertake additional formal education relevant to their laboratory's mission periodically throughout their careers.

A more serious problem is that of retraining to enable those personnel whose area of expertise is being phased downward to acquire a new expertise to retain their capability to make significant contributions to technology and to maintain and enhance their value to the laboratory. With the mean life expectancy of many R&D disciplines now shorter than the average career, this problem has become a critical one throughout the entire R&D community. For self-preservation, DoD should devote resources to, and the laboratories should support intensive investigation into, the psychological aspects of this problem before the laboratories become saturated with people with obsolete expertise.

APPENDIX K

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Mr. Peter R. Murray
Tech. Consultant

Colonel R. Sigethy
Secretariat

*Now with industry

APPENDIX L

FY 74 LABORATORY PERSONNEL END STRENGTHS

ARMY R&D LABORATORIES INCLUDED IN LUS FY 1974 END STRENGTH

	Military	Civilian
Air Mobility R&D Laboratory	40	598
Atmospheric Sciences Laboratory	440	281
Avionics Laboratory	13	248
Ballistics Research Laboratories	66	817
Benet Weapons Laboratory	7	390
Civil Engineering Research Laboratory	5	303
Cold Region Research and Engineering Laboratory	42	244
Combat Surveillance and Target Acquisition Laboratories	23	320
Communications ADP Laboratory	12	394
Edgewood Arsenal Laboratories	173	898
Electronic Warfare Laboratory	50	417
Electronics Technology and Devices Laboratory	5	368
Engineer Topographic Laboratory	20	310
Frankford Arsenal Laboratories	28	1648
Harry Diamond Laboratories	9	1578
Materials and Mechanics Research Center	9	597
Missile Research, Development and Engineering Laboratory	40	1219
Mobility Equipment R&D Center	68	1578
Natick Laboratories	126	1183
Night Vision Laboratory	51	396
Picatinny Arsenal Laboratories	54	2865
Rock Island Arsenal Laboratories	16	764
Tank-Automotive Laboratories	34	905
	1331	18,321

NAVY R&D LABORATORIES INCLUDED IN LUS
FY 1974 END STRENGTH

	Military	Civilian
Environmental Prediction Research Facility	15	34
Naval Air Development Center	339	2489
Naval Civil Engineering Laboratory	16	301
Naval Coastal Systems Laboratory	102	618
Naval Electronics Laboratory Center	90	1492
Naval Ordnance Laboratory	40	2791
Naval Research Laboratory	119	4008
Naval Ship Research and Development Center	68	2905
Naval Undersea Center	264	1656
Naval Underwater Systems Center	148	3238
Naval Weapons Center	588	4655
Naval Weapons Laboratory	89	2802
	1878	26989

AIR FORCE R&D LABORATORIES INCLUDED IN LUS FY 1974 END STRENGTH

	Military	Civilian
Aeropropulsion Laboratory	49	350
Aerospace Research Laboratories	69	174
Armaments Technology Laboratory	233	543
Avionics Laboratory	195	880
Cambridge Research Laboratory	157	904
Flight Dynamics Laboratory	207	995
Frank J. Seiler Research Laboratory	22	9
Materials Laboratory	56	333
Rocket Propulsion Laboratory	178	267
Rome Air Development Center	308	1155
Weapons Laboratory	735	403
	2209	6013

	Military	Civilian
Army	1331	18321
Navy	1878	26989
Air Force	2209	6013
Grand Totals	5418	51323

Total 56741

APPENDIX M

PROPOSED OSD ACTIONS FOR RDT&E MANAGEMENT

PROPOSED OSD ACTIONS FOR RDT&E MANAGEMENT

Since a key role of the laboratories is to serve as a corporate technology reservoir for their Services, a particularly appropriate use of the laboratories would be stimulated by requiring their input to the DCP/DSARC process (or the program memorandum (PM)) process for smaller programs). To this end, we propose altering the requirements of the systems acquisition process as expressed in DoD Instruction 5000.2 (Ref. 23) to require that DCPs and PMs for new programs contain a Technical Assessment Annex (TAA). The purpose of the TAA would be to identify any areas of technological risk remaining in the program to describe plans for addressing these risks. The TAA would be prepared by the most appropriate laboratory for the particular system in question (with the provision for possible additional inputs as explained below) and appended to the DCP without editing by the Program Manager.

The selection of the "Cognizant Lab" would be made in advance of the DCP/PM regulation by the appropriate Assistant Secretary for R&D with the Program Manager informed of the selection at the outset of program planning. Ideally, the Program Manager and the Cognizant Laboratory Director and their staffs would then work together throughout the program formulation, resolving differences of opinion and initiating needed supporting R&D in the laboratories or via contract, as most appropriate. In most such cases, the TAA would be essentially an assertion by the Cognizant Laboratory Director that either the required technology was at hand to prudently proceed or that the gaps had been confidently identified and were being addressed in a timely manner. In the event of irreconcilable disagreement between Program Manager and the Cognizant Laboratory Director, the Cognizant laboratory opinion would still become a matter of record. The Program Manager would have the option to solicit and append other laboratory opinions to supplement that of the Cognizant Laboratory.

The DSARC would weigh the Cognizant Laboratory opinion and any additional inputs to the TAA supplied by the Program Manager in reaching its decision.

The quality of all laboratories' contributions would, of course, be noted by those concerned in the Services and in OSD and be an important contribution to the assessment of the quality of that laboratory and its capability to discharge its mission.

We would thus hope by this alteration of the acquisition process to (1) stimulate better usage of the in-house laboratories by the Services and to upgrade their quality through more extensive and intensive involvement between the laboratories and Program Managers, and (2) provide a means

for monitoring the technical expertise of each of the laboratories and the quality of the participation in the systems planning and acquisition process.

Experience with Project REFLEX (Resources Flexibility) has indicated the possibility of substantial benefit to the laboratory management by removal of redundant and uncorrelated controls on funding and manpower ceilings. It was the conclusion by all the Service studies and endorsed by ODDR&E that a means should be found to operate the laboratories by specifying only their maximum allowable level of in-house funding as indicated in Table 4-1 and leaving the decisions on the control of the mix and number of personnel to the Laboratory Director. Implementing such a scheme in a Department which must itself operate under a manpower ceiling may appear difficult. However, we feel that the advantages to efficient laboratory operation would be sufficient to justify an experiment with a modified form of REFLEX; that is removal of manpower ceilings on the laboratory but the imposition of tight fiscal controls on their in-house expenditures (the latter was not a feature of the original REFLEX experiment). The Government Accounting Office in its recent report (reference 25) also endorsed this form of management and recommended its widespread use in the Government. We believe that the tight control of in-house expenditures would itself control the total manpower of the laboratories to within a few percent. Thus, if we could not convince OMB and the Civil Service Commission to accept or share the risk of slight overage in the ceiling, we could assure conformance with a DoD ceiling by holding a few percent in reserve until we accumulate some experience. It should be noted that this is the form of control that has been used on all DoD FCRCs for years.

APPENDIX N

CONSIDERATION OF A SINGLE TRI-SERVICE CONTRACT RESEARCH PROGRAM

CONSIDERATION OF A SINGLE TRI-SERVICE CONTRACT RESEARCH PROGRAM

A specific aspect of possible tri-Service consolidation that is worthy of special attention here is that of a single tri-Service 6.1 Contract Research Program (CRP) in place of the three separate ones now operated by the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR).

The major arguments for the proposition are:

(1) By consolidating the management, fewer total people might be required.

(2) Unnecessary technical duplication of programs could be more easily avoided;

The principal arguments against the proposition are:

(1) There is no existing organization in the Office of the Secretary of Defense properly organized and staffed to operate such a program, i.e., one would have to be created.

(2) It is the nature of research that extremely high payoffs are achieved from a small fraction of undertakings. It is extraordinarily difficult to perceive the most effective path to success. Duplication in research programs, therefore, is not bad, and in fact should be encouraged in areas having potentially high payoff;

(3) Preservation of individual Service affiliation with the three Contract Research Programs permits closer ties to Service needs.

(4) In further recognition of the peculiar nature of research, it is of utmost importance that all new ideas receive a thorough and careful consideration for potential funding. The existence of multiple sources of funding providing more insurance against a revolutionary idea being frustrated by the inevitable occasional misjudgments of a single organization.

With regard to the arguments for consolidation, the total contract research program management of the three Services now involves a total of about 500 people (about 290 professionals) who manage approximately $180M of contract research (See Appendix I for details). These

people are directly involved in the day-to-day contract supervision and monitoring function and, if truly needed now, would be required to operate the program irrespective of whether it were consolidated on a tri-Service basis or not. (The variance in dollars managed for now with the Navy ratio well below that of the other Services is a subject of separate concern.) The expense of setting up a new organization or addition to an existing one to manage a single program would offset any consolidation savings for many years.

The second point potentially favoring tri-Service consolidation is effectively countered by the second point against the proposition.

In the case of the research programs, argument (3) against the proposition is not as compelling as it would be in the case of development programs. The very nature of research is such that it has broad applicability and less specific coupling to particular Services. There are exceptions to this statement in which very specific needs for research grow out of specific Service activities but such research can, and usually is, handled through or in the laboratories rather than the Contract Research Programs.

The basis for the decision thus appears to hinge primarily on the validity of argument (4) against the proposition. Here again, careful distinction must be drawn between research and development programs. In the latter case, the costs of undertaking parallel efforts are higher and the likelihood of an unforeseen high payoff substantially less than is the case in research programs, especially the more fundamental research programs of the Contract Research Programs. Thus, we conclude that in the long run the existence of more than one Contract Research Program is desirable to provide alternate sources of research funding. Consequently, we have directed that the Contract Research Programs of the Army and Air Force be increased to a level closer to that of the Navy so that the alternative sources are truly viable.

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This study of the utilization of DoD in-house laboratories was initiated in April 1974 by a memorandum to the Assistant Secretaries of the Military Departments (R&D) in response to a management objective of the Secretary of Defense. The charge for the study was (1) to determine the requirements for DoD laboratories, (2) assess the capability of the laboratories to meet these requirements, (3) identify excess capacity, overlapping capabilities, shortfalls or instances where R&D could be contracted to industry at a savings, and (4) define a program to upgrade the quality of the laboratories.

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