

342-76-A-69 Box 21/26
St. Louis MO
Tsgt Reggie Williams

.OPY

This has been addressed to appropriate person

COPY

MBT 6-8 (HR2618)

JWS

Lieutenant General D. L. Putt
Deputy Chief of Staff for Development
Headquarters, USAF
Washington 25, D. C.

Dear General Putt:

This Command has completed its analysis of House Report #2618, "Organization and Administration of the Military Research and Development Programs." Comments are attached for your information and use.

The ARDC comments do not include an inquiry into the relations between our civilian and military personnel since it was understood that Mr. Gardner had retained Mr. Austin M. Fisher as a consultant for that purpose. Otherwise, I believe our comments are self-explanatory.

Sincerely,

Inclosure -
3 cys Riehlman
Rpt Comments by
ARDC

Enclosure

USAF # 467

ARDC STAFF SUMMARY SHEET

TO	ROUTE	DESIRED ACTION	INITIALS	DATE
RDTA	1	Information		
Gen Wood - RDT	2	Sig - S/S/S		
Gen Landon - BDS	3	Coordination		
Gen Sessums - RDGV	4	Sig - Letter		
				OFFICE OF PREPARATION
				RDTE
				RDTRG
				GRADE - SURNAME
				W. V. Hurley
				Maj Trakowski
				PHONE
				138
				132

SUBJECT

Comments on the Riehlman Report

SUMMARY

1. The ARDC comments on the Riehlman Report were developed through the medium of group discussion. A large working group was formed consisting of those whose names and signatures are found on the attachment to this Staff Summary. This group met five times for a total of 10 hours to review various segments of the work as it progressed. A small working group was abstracted from the large one and was composed of those whose names are marked by an asterisk. This group met ten times for a total of 15 hours. It discussed and formulated proposed positions on the less specific questions raised in the Riehlman Report. Specific questions which were amenable to treatment by an established organizational element of the Hq staff were assigned to representatives of such elements. Thus, the material on basic research was prepared by OSR, that on civilian and military personnel by the Personnel Directorate and that on procurement by the Procurement Directorate. The positions developed by individual staff representatives, and by the smaller working group, were reviewed by the large working group as they became available. In addition, the report and some of our proposed comments were reviewed at the Command Technical Conference of 14 September and during the SAB meeting at Omaha on 27 September. It was generally felt that the Riehlman Report deserved considerable attention for two significant reasons - (a) on principle, an alert organization should respond quickly and effectively to criticism of its basic operations, (b) it is believed that the report can be used as a tool to assist in obtaining for ARDC some increased understanding of its problems and support for their solution.

2. It became apparent during the course of discussion that most of those participating were aware that the problem areas brought out in the Riehlman Report were largely symptomatic and were not the most important factors hampering the effective prosecution of military research and development. The following list is an attempt to distill from these conversations those fundamental factors which it is believed severely hinder the ARDC in fulfillment of its mission:

a. There is lack of real recognition of the extreme strategic importance of military research and development on the part of top level governmental and military management, and on the part of the public at large.

b. There is lack of real understanding of the nature of military research and development on the part of those noted above, and also by many of those directly engaged in the work:

- (1) that it is largely ad hoc and flexible in character;
- (2) that it is constantly dealing in futures, in terms not only of its technical program, but of its facility, manpower budgetary and organizational requirements;

Subject: Comments on the Riehlman Report

- (3) that it grows in volume, complexity and diversity by the very laws of nature and should not be artificially stunted;
- (4) that much of it is speculative and experimental in nature and must be expected to produce a certain proportion of aborted projects.

c. Most of the policies and principles under which it operates as a part of the overall government establishment are, therefore, either oriented toward other ends, or in many cases are entirely lacking.

d. The resources allocated to the research and development activity thus come to be largely controlled and managed for purposes other than those of accomplishing the basic mission.

3. It is understood that these factors are fairly well known by most of those in the research and development business, but they were thought worthy of statement as a by-product of our work.

the Large Discussion
No. 2618

C
O
P
Y

/s/ D. Flickinger
Brigadier General D. Flickinger
RDTR (Research)

/s/ H. Huber
Mr. H. Huber
RDSKR (Procurement)

* Absent

Mr. W. W. Johnson
RDSPC (Civilian Personnel)

/s/ T. D. Mathis
Mr. T. D. Mathis
RDSOM (Manpower and Organization)

Absent, see following page.
Colonel F. W. Miller
RDTO (Operations)

* /s/ Paul C. Murphy
Lt. Colonel P. C. Murphy
RDTDD (Development)

/s/ Ernest G. Schwiebert
Dr. E. G. Schwiebert
RDEH (Historian)

/s/ S. A. Steere, Jr.
Colonel S. A. Steere, Jr.
RDEP (Plans and Policies)

Absent
Lt. Colonel J. D. Warthman
RDTRR (Research)

Handwritten notes:
27
Reference
10/21/54

Headquarters
AIR RESEARCH AND DEVELOPMENT COMMAND

Post Office Box 100
Baltimore 3, Maryland

18 November 1954

Comments
by the

AIR RESEARCH AND DEVELOPMENT COMMAND

on
House Report No. 2618, 83d Congress

"ORGANIZATION AND ADMINISTRATION OF
THE MILITARY RESEARCH AND
DEVELOPMENT PROGRAMS"

PREFACE

Throughout the course of the following discussion the 24th Intermediate Report of the House Committee on Government Operation, House Report #2618, will be referred to usually as the Riehlman Report. This report represents a thoughtful and sometimes incisive inquiry into the organization and administration of the military research and development programs. We have examined it from two divergent viewpoints: (a) as presenting the possibility of ultimate civilian control of military research and development (b) as an impartial and objective report on some of the difficulties which plague the prosecution of the military research and development program.

Section I of our comments is written from the first point of view, while Section II is written from the second. Section II also contains a discussion of the ARDC concurrence or non-concurrence with each of the pertinent recommendations made by the Riehlman Committee, as well as some additional ARDC recommendations. Section III comprises a group of appendices which present background data and more detailed discussion on selected issues.

Although by title and implication the Riehlman Report deals with the entire spectrum of research and development, the testimony and conclusions have been drawn predominantly from the scientific and highly technical end of the spectrum. Because of this narrow selection of evidence and opinion many important problem areas were overlooked or given scant attention. In addition many of the arguments put forth appear more conclusive than they would if presented against a more balanced background. This is not to say that the report should be discounted, but merely that the reviewer must maintain constant awareness that he is dealing predominantly with the opinions of a group of people with homogeneous interests and experience and that such data as have been presented have been selected by these interests and experience. The points at issue have, in the main, received much discussion both within and without the military services for many years. A number of related problems have been brought forth in previous investigations, discussions and studies, but to avoid undue length and complexity our comments will adhere to the issues raised in this report.

Section I

Civilian Vs. Military Control

If the military are to be held responsible for the effective defense of the nation, they must also be held responsible for the weapons with which to defend it. Relief from the latter responsibility renders the former empty and meaningless. The military research and development activity consists essentially of the process of shaping these weapons and the possibilities for future choices. Thus, the inclusion of a project, or an area of research, the military research and development program constitutes, at bottom, a military action though it needs to be done with great technical acumen. Conversely, the origination of a technique or device is essentially a technical action though it may be consummated with extreme military insight.

The question of civilian vs military control of this activity pervades the entire Riehlman Report. The principal argument brought forth in favor of civilian control of the R&D process is that the military have been largely unreceptive to new weapons and new techniques. This is alleged to result from certain characteristics of the so-called "military mind" developed by the process of selection and training. The military man is then held to be naturally conservative in such matters while the civilian is looked upon as the prosecutor of new ideas. Thus arises the dichotomy - "military vs civilian" - which is found again and again throughout the text in various connections.

While such reasoning appears attractive in its simplicity closer inspection reveals it as deceptive. In the first place new ideas and receptivity to them are at least as dependent on individual temperament and aptitude as on membership in a particular organization, or on prior training. One of the truly outstanding innovations of World War II was the turbo-jet, which, in the case of the Allies, was developed by an RAF officer, Flt. Lt. (now Air Commodore) Frank Whittle; who unsuccessfully sought support from the civilian dominated British Ministry of Supply at intervals over a period of about six years before he obtained private venture capital to proceed with its development.

Secondly, what is taken for purely military opposition to new devices or techniques is in reality but the outcropping of a basic problem common to all organizations (civilian and military) which have come to have a large operating component. Overall management frequently resists radical ideas, since acceptance usually means major changes in the personnel, equipment, and training programs of such operating components often at great initial cost. Within industries built on the basis of a few innovations the engineering department often later comes to be looked upon as a support service to the manufacturing organization, and additional major innovations are not encouraged since this would incur large changes in the manufacturing set-up (which will always substantially outweigh the engineering department in terms of budget, manpower, and investment). A number of industrial concerns have died rather than embrace a new product which was displacing the one of their traditional manufacture. Universities have not been notoriously receptive to radical educational theories or practices which might require extensive staff realignments or replacement of laboratory equipment. It is doubtful if the Corliss steam engine has yet disappeared completely from the laboratories of American engineering schools. The Air Force owes its entire existence to a relatively recent invention, and its structure, size, and relation to the other services have been largely derived from the advancing technology;

yet, research and development are looked upon in many quarters as simply a supporting service for the procurement and operating agencies - to furnish them with continually improved versions of the types of weapons already in use. This is thus a problem common to the industrial, academic, and military worlds and must be actively combatted wherever it exists if progress is to be made. It does not represent a basic difference between "civilian" and "military".

It appears from the foregoing that the military vs civilian dichotomy developed in the Riehlman Report constitutes a substantial distortion which can generate far-reaching and harmful effects if accepted. Under modern conditions military doctrine, strategy, and tactics are very intimately entwined with science and technology. It is extremely difficult in many cases to distinguish boundaries among them. Any artificial division of responsibility and authority in these areas simply cannot be countenanced. There are areas of effort within the ARDC where the military content is very high and technical content very low. An example of this occurs in some of the test phases where a partially developed military weapon is being evaluated for its military effectiveness. Conversely, there are areas of effort where the technical content is high and the military content very low, as in some of the "pure" research projects. Rarely is either the technical or the military element totally missing. In the great bulk of our effort military thinking and technical thinking are, and must be, completely integrated. It is both gratifying and inevitable that some of the best technical thinking comes from technically competent military officers and that some of the best military thinking stems from civilian scientists and engineers of considerable military wisdom. In the interest of national survival we must not be denied the benefit of this effective combination - for the sum total of our effort may not be equal to the task at hand.

The issue of military versus civilian control as brought out in the Riehlman Report should be a matter of the gravest concern to the entire military organization since it ultimately threatens to place that organization in the untenable position of being responsible for the national defense without responsibility or authority for the weapons to conduct that defense. Accordingly, this Command earnestly solicits the interest of the Air Council in these matters and suggests that every effort be made to bring about the defeat of all attempts to wrest control of the military research and development program from the military departments. Any apathy toward this question on the part of top military leaders will serve only to reinforce the opinion expressed on page 46 of the report -- "However, the subcommittee feels very strongly that unless the military departments, and our military leaders in particular, choose to correct these problems caused largely by military administrative characteristics, the forces of logic and civilian scientific dissatisfaction could well dictate that research and development be rightly considered incompatible with military organization."

Section II

A. Introduction

The military research and development program is the vital keystone upon which national survival ultimately rests. Over a period of years advancing technology has played an increasing role in shaping the art of warfare and the policies of nations, until we have reached a point, unprecedented over the whole span of history, where every significant global decision is made within a context of such products of the scientist and the engineer as the thermo-nuclear weapon and the long range bomber.

Against such a background we have reviewed the report of the Riehlman Committee with two essential guiding principles in mind:

a. The military research and development task is so staggering in its urgency and importance and in the magnitude and complexity of its content that every available resource must be mustered in its behalf. We can ill afford less than the total integrated results of the best technical and military thinking which can be brought to bear on its problems.

b. A cardinal requirement of research and development is that of maximum flexibility in the control and management of the human and material resources which are employed. This requirement springs directly from the inherent dynamic nature of the research and development process. The entire activity is effective only insofar as it produces new devices and new techniques. It is thus, by its very purpose, founded on change and is fundamentally unsuited to static and inflexible control.

In general, where we have found the recommendations of the Riehlman Committee to contravene these principles we are opposed to such recommendations. Where we have found recommendations in consonance with these principles we are in agreement with the Committee.

In addition to its specific recommendations, the Riehlman Report calls into question the current effectiveness of the Military Departments in carrying out research and development programs, with particular reference to:

- a. The timely and effective prosecution of novel devices and techniques.
- b. The maximum utilization of scientific and engineering manpower.

We are in complete accord with the Committee on its appraisal of the importance of these issues but find ourselves in disagreement with many of the proposed solutions and with much of the reasoning put forward. These matters are touched upon in the remaining portions of this section and taken up more fully in Section III.

B. Discussion on the Riehlman Report Recommendations

"The subcommittee therefore recommends to the Secretary of Defense the advisability of initiating and supporting a systematic program of basic research directly through the Office of the Secretary of Defense with funds authorized for expenditure by the Assistant Secretary of Defense for Research and Development."

The ARDC agrees that in some instances where basic research has common interest among all the military services, direct support by the OSD would have advantages. However, the ARDC strongly opposes centralization of basic research in the OSD which would supplant, rather than supplement, basic research carried on by the separate military services.

The subject of centralizing basic research into a single Department of Defense agency has been exhaustively treated by the RDB Ad Hoc Committee on Basic Research in 1953. The ARDC strongly concurs in the Ad Hoc Committee's conclusion that consolidation would not be to the best interests of the military services because:

a. A centralized agency would be severely limited in determining the nature or strength of a research program necessary for the support of advancement of specific interests of the separate military services.

b. A single unified program would be inherently weak in providing research results usable by the separate military services, and the reward of direct contact between the using military service and the producing scientists would be lost.

c. A sincere interest in seeking out and exploiting radical devices and new techniques must include the realization that having several places where support may be obtained will decrease the chances of failure to recognize worthy techniques and devices at the earliest stage.

A detailed commentary on this recommendation is found in Appendix C hereon.

"The subcommittee recommends that the Secretary of the Air Force modify existing Air Force procurement regulations to take into account the coexisting Air Force policy with respect to materiel support for research as expressed in AFR 80-4, paragraph 4d (4)."

This Command strongly concurs with this recommendation and urges that it be acted upon with minimum delay. Recognition must be given this problem and appropriate action taken to augment the scientific and technical effort available to the Air Force through liberalized contractual provisions and flexible procurement procedures.

"The subcommittee therefore recommends that the Department of the Air Force give serious consideration to the advisability of organizing the top-level civilian scientists and technicians employed by the Air Force both at staff levels and at operational research and development field activities into an advisory committee which would participate with the Air Force's highest planning councils in considering problems concerning the research and development program."

The recommendation appears very elastic, and the intent is not clear as concerns participation or functions.

The ARDC agrees to the principle of this recommendation. In regard to its application to ARDC, two predominantly civilian groups are already in action within ARDC which may partially fulfill the intent of this recommendation. They are:

- a. The Technical Conference which meets in association with the ARDC Commander's Conference
- b. The ARDC Research Committee.

Inasmuch as the "Air Force's highest planning councils" must exist at Headquarters USAF, interpretation of this recommendation rightly belongs to that agency. The ARDC would be pleased to assist in the fulfillment of this recommendation to whatever extent Headquarters USAF desires.

"The subcommittee recommends that the Secretary of Defense strengthen the Joint Strategic Survey Committee."

The ARDC does not consider it appropriate to comment on this recommendation. However, insofar as this recommendation is understood, the ARDC concurs. The ARDC believes some mechanism is required at the highest military level to objectively examine new concepts of warfare related to technological advancement, and to press for their early acceptance.

"The subcommittee recommends that the Assistant Secretary of Defense for Research and Development take immediate steps to direct that formulation of a uniform policy, applicable to all military departments, designed to prescribe the conditions necessary for the most effective administration of military research and development programs in order to assure maximum attraction and utilization of our national scientific and technical personnel resources and maximum utilization of our national scientific facilities. The subcommittee further recommends that the Secretary of Defense direct the Secretaries of the Army, the Navy, and the Air Force to implement vigorously such a policy."

The research and development process is so varied in nature, and subject to such rapid change, that the key requirement for its successful administration is flexibility, not uniformity. A specific uniform policy for administration of research and development, depending upon its detail, might hamper the conduct of work more than aid it. A broad policy statement along the lines of AFR 80-4 would do much toward stabilizing management of military science and technology and providing it with its administrative needs. It is suggested that AFR 80-4 be offered to the Assistant Secretary of Defense for Research and Development as a model in connection with this recommendation.

"the subcommittee recommends that the Assistant Secretary of Defense for Research and Development formulate a uniform policy in the organization of military research and development activities to provide that the civilian technical directors be assigned specific authority and responsibility for technical direction. The relationship between the technical director and the commanding officer should be unequivocally clear."

With reference to the first part of this recommendation, this Command cannot concur with any action which removes the quality of flexibility from R&D management. The ARDC is necessarily a highly heterogeneous mixture of scientific, technical, and military activity. Each ARDC Center is different in the basic nature of its mission, in the composition of its working force, and in its facilities. Management at each Center must be arranged as the circumstances dictate, and there must exist the freedom to fill management needs as the demand occurs. The availability of both military and civilian technical managers is so limited that their use and their relations with respect to each other must not be bound by prescribed uniformity.

Concerning the second part of this recommendation, wherever technical directors are used in ARDC, their authority, responsibility, and relationship to their military superiors have been made as clear as possible.

"The subcommittee recommends that the Assistant Secretary of Defense for Research and Development consider the advisability of physically separating military support activities from military research activities."

The ARDC does not wholly concur in this recommendation for the same reasons brought forth on the preceding two recommendations. However, the ARDC has recognized the need to separate base support from R&D activities, and has done it in every instance where advantage has been evident. The support needs of each ARDC Center, and even the needs of separate work within a single Center, must be considered in terms of the individual character of each activity. A uniform, mandatory type of organization for support cannot be expected to properly provide for the many different circumstances existing in ARDC at present, or which may exist in the future.

"The subcommittee feels that the organization of research and development programs at the military installation levels, largely administered by civilian-led units free from the dominating characteristics of large military supporting activities, is a practicable resolution at the present time."

The ARDC does not exclude this type of operation, and it is used in ARDC in some instances. However, because of the restrictions imposed by the attendant inflexibilities, the ARDC does not concur in this recommendation as a uniform method of operation.

"Although the subcommittee would not attempt to determine the appropriate percentages of total military research and development work which should be allocated to outside facilities through service contracts or to Government laboratories, the subcommittee recommends that no governmental "in-house" research be conducted solely for the purpose of training and familiarizing military officers or other Government employed technicians with research and development procedure in order to build up capability within the Government for the qualitative control and assessment of contracted research."

The ARDC agrees with this recommendation. There is no laboratory of ARDC which is operated solely for maintaining technical competence of government employees. However, the ARDC believes that the maintenance of competency is an invaluable by-product of the "in-house" research which it conducts for other reasons

A high level of competency is essential to those who are responsible for supervising and evaluating involved and high cost contract work. It is also essential for the provision of sound judgment in the application of the results of research to critical Air Force operating problems. Neither of these functions can be satisfactorily performed by persons who have no timely experience on the matters in which they are dealing.

A full discussion of this matter is found in Appendix D hereon.

C. Recommendations by AFDC on Problems Discussed in the Riehlman Report

In regard to the establishment of R&D management policy, this Command strongly recommends that all action necessary for full implementation of AFR 80-4 be initiated without delay.

The Riehlman Report recommendation, and attendant discussion, concerning the establishment of a program of basic research directly through the OSD implies that research of potential value is not now being supported by the military departments. In one sense this is true, but only because of severe funds restrictions imposed by the Bureau of the Budget on the basic research programs of the DOD. The Bureau of the Budget has erroneously assumed that the National Science Foundation would adequately support certain basic research of military interest. It is recommended that vigorous and persistent action be initiated to lift the existing budget ceiling for basic research in the Department of the Air Force.

Both the military and civilian personnel systems are strongly oriented toward goals which are not aligned with the pressing need for imaginative and sustained intellectual effort which exists in today's R&D war. Numerous studies have been made at various times pointing up the deficiencies in the civilian and military personnel systems and many recommendations have resulted. However, too often there have been no positive implementing actions taken as a result of these recommendations. It is recommended that these studies and their recommendations be reviewed by a group of military and civilian experts under Department of Defense auspices. Legal and administrative obstacles which impede the establishment and implementation of sound basic policies in R&D personnel matters should be clearly defined and vigorously attacked at that level. Where necessary the Congress should be asked for legislative help.

A survey of relative salary levels for scientists and engineers, between private industry and government, showed that as far back as 1951 industry paid 7% to 30% more than the government for corresponding levels of experience and at the same time offered fringe benefits at least equal to those of the government.

a. It is recommended that Federal salaries for engineers and scientists be increased by an amount which will remove the disparity between government and competitive employment.

b. To maintain a reasonable relationship between Federal salaries and those of competitive organizations, it is essential that a flexible system for the administrative establishment of pay rates be authorized by legislation.

The material compensations of the military officers corps have traditionally been commensurate with the demands of the professional level of the Service. In recent years, however, the rapid advance of technology in importance to the nation, coupled with the general shortage of technological personnel, have caused an ever-widening difference between the material benefits received by the qualified technical officer and the benefits he could obtain if free to exploit his talents in an open labor market. This condition is especially pronounced among the younger officers up to the middle field grades. The steady reduction or curtailment by legislative action of fringe benefits such as buying privileges, early retirement, and dependents medical care, have greatly diminished the advantages of military service in consideration of the larger salaries to be obtained in industry. Many of the Service's most promising young technical officers frequently receive tempting offers from industry which keeps them constantly aware of the salary differential.

The ARDC strongly indorses all action directed toward increasing military officer pay and material benefits to a level consistent with comparable industrial compensation.

Since civilian and military personnel are, in practice, closely and interchangeably associated in all aspects of conducting military R&D, it is necessary that a method be devised to be the basis of uniform treatment in the matter of personal privileges. It is recommended that for purposes of granting personal privileges an official USAF system of equivalent military rank be established for civilian employees.

A liberalized policy with respect to government scientists and engineers attendance at professional society meetings is essential. Only by at least equalling the policies of industry or universities in this regard can the government hope to acceptably provide for this basic need in creating the environment required for science and technology. It is recommended that relief be provided from monetary and approval limitations, other than those normally placed on travel funds, for travel to non-Federally sponsored meetings.

Since the end of World War II, the lack of immediate and apparent danger to the U. S. has been reason for a general public let-down in national security consciousness. Most scientists and engineers have taken advantage of the apparent lull to achieve personal satisfaction. It is generally not appreciated that national survival depends upon today's R&D war. Since the government does not now offer attractions equal to industrial or academic work (although every effort must be made to do so), a higher order motivation is required to call to service those individuals whose talents are essential to military preparedness. It is recommended that the President issue a statement of urgency to the nation's scientists and engineers to let it be known that the nation is in a state of technological emergency and requires their most concentrated effort.

Air Force supply procedures as set down in the Air Force Supply Manual, AFM 67-1, are directed toward objectives which do not consider the special supply needs for research and development. A major deterrent to the progress of R&D work is an inability to support that work with its material needs by the rapid acquisition of a wide variety of odd items in small quantities. It is recommended that specific cognizance be taken of the flexible supply requirements for research and development work; that these needs be translated into a special R&D supply procedure external to that of AFM 67-1; that compliance with AFM 67-1 be waived for R&D applications.

Although there has been a notable effort in recent years to improve the quality of ARDC working facilities, a great portion of the ARDC laboratory and administrative facilities are inadequate and below industrial or academic standards. This is especially true of the facilities for ARDC research. Buildings in use are often crowded, incapable of being kept clean or orderly, poorly ventilated and lighted, without proper heat control, and are in some cases fire hazards. It is recommended that all possible support be placed behind the rapid acquisition of improved ARDC facilities; toward the objective of obtaining facilities which are at least the equivalent of modern industrial or institutional organizations.

Although the establishment of the ARDC separated R&D from the supply and logistics functions of the USAF, autonomy of procurement for R&D activities has not been achieved. This is evidenced by the fact that R&D procurement and contracting authority is redelegated to the Commander, ARDC by the Director of Procurement and Production, Hq Air Materiel Command, in a memorandum dated 11 March, 1953, which imposes many limitations.

The Armed Services Procurement Regulations recognize the necessity for separate treatment of problems of R&D procurement by provision of (1) contract cost principles for research contracts with non-profit institutions, and (2) a manual for control of government property in possession of non-profit R&D contractors. However, implementation by the Air Materiel Command of these regulations for Air Force application continues to reflect the influence of production procurement philosophy and policy.

It is recommended that ARDC be granted a direct delegation of procurement authority by Hq USAF, and that ARDC be permitted direct implementation of basic procurement laws and regulations to meet the special needs and required flexibility for R&D contracting.

Appendix A

Urgency

The tremendous urgency of the R&D program is too little understood, particularly by our top governmental, industrial, and scientific leaders. The technical war just really got under way at the close of World War II. Damage can now be inflicted at such a high rate that the quality and quantity of the force-in-being at the initiation of a future conflict is decisive. There is not the time we have had in past wars to set our R&D and production machines in motion to eventually overwhelm the enemy. The maximum yearly tonnage of conventional bomb drops achieved in World War II was 1.5 megatons per year. The maximum tonnage of conventional bombs dropped in a single raid was .006 megatons. Comparison of these figures with the capability now in hand should illustrate this point clearly to anyone. It is thus evident that any contribution which research and development can make to Western survival is being made now.

The continually accelerating rate of technological advance has brought us to the point where time is being compressed to a degree hardly realized even by those of us causing the compression. In the millions of years before 1825 no man had traveled faster than 34 mph. The next 100 years brought us up to 270 mph, and in the last 25 years we have increased this to 1600 mph. During the last year the world's speed record increased by about 300 mph in the short space of three weeks. The history of explosives is even more startling. TNT appeared in military use in 1902 and yielded about twice the energy release of gunpowder, first used some six centuries earlier. By 1945 conventional explosives had increased to about three times the energy of gunpowder. The atomic bomb dropped in that year released the energy of several thousand tons of TNT and the thermonuclear device exploded seven years later released the energy of about a thousand such atomic bombs. It is seen from these examples that time has acquired, since World War II, a significance many orders of magnitude greater than it previously had. A technical lead of even a few months by a potential enemy can spell future catastrophe. During the few months which elapsed between Operation Ivy and the Russian megaton class explosion we enjoyed the technical advantage of a factor of 1000 in the energy release of bombs. We have now to preserve this small lead in timing.

The extremely rapid change in capability brought about by advancing technology is often misunderstood because it appears that no sooner has one country achieved something than it is almost immediately achieved in another. This leads to the feeling that we are all advancing together and that it is almost impossible to attain a real lead. The important thing, however, is that a small lead in time now means a big lead in capability which will not persist for very long and must be continually renewed.

With these factors in mind the conclusion that we are now in an era of technological emergency seems inescapable. Uncompromising recognition of that fact must be secured at all government, industrial, and scientific levels.

Appendix B

The Prosecution of Innovations

An interesting result of the selective viewpoint embodied in the Riehlman Report is that two definite impressions are conveyed:

a. The military cannot effectively prosecute novel devices and techniques and this must be done by civilians.

b. Radical weapons and concepts originate in the laboratories of universities and research institutions and are brought forth largely by scientists.

As noted in Section I, the first of these does not withstand critical inspection. It should be added here that the Germans developed the V-1, the V-2, and jet propulsion under direct military control. The U. S. guided missile effort is currently proceeding this way.

The second of these impressions is also misleading. Although true in a number of cases it is far from universally so. Very often the radically new weapon or concept is essentially an "engineering development" rather than a "scientific innovation." The airplane, rocket propulsion, the gas turbine, are but a few which fall in the former category. Of the handful of radical weapons and concepts currently supported by this Command but one or two can be called laboratory innovations. The others are simply bold engineering extensions or syntheses of known techniques and principles. In any event, there is a great need for worthwhile new ideas throughout the entire R&D spectrum and they must be vigorously sought out and exploited in all fields and from all types of individuals and organizations. The search cannot be profitably confined to civilian scientists.

The generation and the bringing to practical fruition of novel devices and techniques involves a number of steps and requirements. These may be roughly set forth as -

- a. A creative and imaginative mind
- b. Furnishing that mind with appropriate mental tools and techniques (education and training)
- c. An environment conducive to intellectual exercise and creative activity
- d. Selection of those ideas created which are worthy of exploitation
- e. Recognition and acceptance of those ideas selected by those in control of the human and material resources which can be applied.
- f. Organization of the human and material resources allocated and their use in the effective development of the device, technique, or theory.
- g. Acceptance by those who will use the new device, technique or theory.

The first two of these are often not adequately considered in discussions of this type. They are, of course, very fundamental requirements. In our preliminary investigation of this overall problem it has been disconcerting to note the preponderance of novel devices of great military significance which have been imported to the United States or which have been developed within the United States by the foreign born and foreign trained. Examples of the former are the turbojet, the ballistic missile, and the swept wing. An outstanding example of the latter is the nuclear weapons which were initiated by a group of recent Italian and Hungarian immigrants centered around Fermi and Szilard. Teller, of thermo-nuclear fame, is also a European import.

The ARDC Brussels Office is a tacit recognition of this situation and more detailed study might indicate that it should be strengthened and expanded. The factors underlying the high production of militarily significant innovations by the foreign and foreign trained deserve very serious and detailed study and may ultimately call for basic revisions in our system of technical education.

The third of the steps listed will receive more complete study so that important factors can be more adequately defined. It is recognized that many of the ARDC operating establishments do not properly provide such an environment.

The Analysis and Evaluation Office recently established in this Headquarters under the Deputy Commander for Technical Operations has been charged, from its inception, with fostering steps d, e, and g of those listed. It is intended that this agency use the regularly established staff offices as the operating channel for its activities in this regard. A budget line item, entitled Exploratory Studies, has been set aside for its use. This office has established liaison with the Deputy for Evaluation at the Air University (who is charged with conducting "studies as required on: the impact of new weapons on air warfare; the development of new concepts for the command and employment of air power") and will work with them to obtain operational studies of novel weapons at an early stage to ascertain possible modes of strategic or tactical employment. This should result in providing additional justification and direction for such weapons during their formative years as well as gaining earlier operational acceptance. In addition it is planned to conduct an ARDC symposium on novel devices and techniques with participation by the Air University group, the using commands, the Assistant for Development Planning to the DCS/D, and other interested agencies.

The Assistant for Development Planning, DCS/D, also promotes the acceptance of innovations through their continuing study of the interaction of technology and air warfare.

In addition to possible lack of operational acceptance, another factor often deters the rapid exploitation of new devices. This is the factor of adverse expert opinion and is frequently harder to cope with since the expert is generally well equipped with critical apparatus. Advisory groups which meet briefly to consider complex problems have an inherent tendency to deliver conservative judgments because there is not time for complete consideration of possible methods of overcoming obvious obstacles. This is another major facet of the overall problem which must receive further study to develop an optimum policy for the use of advisory groups and consultants.

The general problem of effective prosecution of radical devices and techniques is thus a complicated one beset by budgetary problems, divided expert opinion, managerial reluctance, and a host of other difficulties. The most often suggested solution for such problems is that of organizational separation. This must be approached with considerable caution. Too great a separation results in a considerable loss of time during the transition from research to development to production to use. From an overall standpoint it is felt that the current organizational separation of research and development from production and use carried through the Assistant Secretary level is appropriately balanced between the two extremes. The desirability of isolating the "exploratory" research and development within this complex deserves further study. Balanced against some of the obvious advantages is the need for additional high calibre personnel which would be generated and the inefficiency resulting from partially paralleling the main organization, with the attendant overlapping of functions and interests. In any event, it is believed that this work should be properly maintained under military control for the reasons set forth in Section I.

The ARDC will continue its present study of the problem of effective prosecution of novel devices and techniques, and will explore in particular the desirability of organizational separation of this activity within ARDC or within the Air Force. Appropriate recommendations will be made to Hq USAF if necessary.

Appendix

Conduct of Military Basic Research by a Central Agency

The following discussion is relevant to Section II, paragraph 1 of this paper concerning the recommendation to establish within the Office of the Secretary of Defense an agency to centrally support a program of basic research.

This recommendation proposes to make the Office of the Assistant Secretary of Defense for Research and Development an operating agency with its own budget and with the mission of initiating a program in basic research in the physical sciences. This program would supplement the work of the National Science Foundation and as the report states "might involve support of projects not particularly applicable to any immediately known military needs." This implies that research of potential value is not being supported now by the military departments. This is true. The implication that it is because of lack of foresight is not true. The fact is that the Bureau of the Budget has imposed limitations on the amount of funds allocated to the Office of Scientific Research, ARDC, as well as on the funds allocated to other basic research programs in the Department of Defense. (Attachment 1 to Appendix 3)

The reason given for this limitation is based on a curious semantic interpretation. It is stipulated that money withdrawn from the services will be allocated to the National Science Foundation so that the total support of basic research will remain constant. This interpretation appears to be faulty from two points of view. First, the Congress failed to appropriate the funds requested for the Science Foundation and yet no restitution was made to the military budget, so that the total funding for basic research was substantially reduced during this fiscal year. Second, and most important, the assumption that the two programs are interchangeable is completely without foundation.

The military programs are

- a. in areas of relevance to the military mission (in the case of the Air Force this program was entirely in the physical and engineering sciences).
- b. restricted to the best scientists and laboratories in each field with the emphasis on yield of results of value to the military programs.

On the other hand, by virtue of its responsibilities for the overall scientific development of the nation the program of the National Science Foundation

- a. is spread over the entire range of scientific interest including many areas not remotely of interest to the military.
- b. must support the growth of small universities, develop scientific interest and competence on a geographical basis, and generally concern itself with many matters other than the production of results.

Thus, even if all the funds deleted from the Defense program were appropriated to the National Science Foundation for basic research, it is estimated that only about 20% would yield comparable results of value to the military.

This action ignored all aspects of the problem except the straightforward financial support of research. It did not take into account the most important reasons for the support of basic research by the military services in terms of contact with the scientific community as powerfully expressed in the report of the RDB Ad Hoc Committee on Basic Research. This Committee was convened in 1953 specifically to consider the advisability of consolidation of basic research into one DOD agency, and was under the Chairmanship of Warren Weaver. It concluded unanimously that not only would such consideration adversely affect the individual programs of the three services, but that it would not be in the best interests of science and the universities. A copy of this report is attached. (Attachment 2 to Appendix C)

Research and Development

FY 1955 BASIC RESEARCH BUDGETING

Information regarding the current status of basic research programs of interest to the Policy Council obtained from the Bureau of the Budget as of 1 December 1953 are indicated below:

The Bureau of the Budget has given a tentative allowance of a \$15-million appropriation to the National Science Foundation. The \$15-million is broken down as follows: \$4-million to carry forward contractual research already initiated; \$2-million for a general increase in research sponsored by NSF; \$4-million for fellowships and administrative expenses of the agency; and \$4-million as a tentative estimate of research that may be transferred from the Department of Defense to the National Science Foundation. This amount is specifically subject to adjustment up or down depending on the outcome of current discussions among the Department of Defense, the Bureau of the Budget and the National Science Foundation.

It is also understood that in determining the actual reduction in the DOD FY 1955 budget, the BOB will propose to subtract the transferred total from the current DOD level of basic research and not from the current FY 1955 budget estimates.

The current level, according to the BOB, is \$21.6-million (\$4-million Army; \$12.1-million Navy; and \$5.5-million Air Force). The FY 1955 budget estimates total \$19.5-million. If \$5-million turns out to be the transferred total, the reduction in the FY 1955 estimates would be \$2.9-million.

It is hoped that a paper on basic research, now being prepared by the BOB, containing more information on their plans will be available for distribution at the 7 December Policy Council meeting.

E. L. KLEIN

RD-CGS 106/1
R&D PC Mtg
7 Dec 53

RESEARCH AND DEVELOPMENT BOARD
WASHINGTON 25, D. C.

BR 202/1 (Final)

BRG Memo No. 1

3 June 1953

MEMORANDUM FOR CHAIRMAN, RESEARCH AND DEVELOPMENT BOARD

SUBJECT: Centralization of Support of Basic Research in the Department of Defense

1. This memorandum refers to the possibility and/or desirability of changing the present situation by setting up one single agency in the Department of Defense responsible for the support of basic research.

2. It must be emphasized that the Basic Research Group of the Research and Development Board has only two meetings before the present one. It is an unfortunate but as we understand it inescapable fact that we are asked to give advice on a most fundamental issue before we have had really adequate opportunity for study. Thus this memorandum must be understood to represent the best we can do at the present time on a necessarily partial and tentative basis.

3. Before one can effectively decide how to do anything, he must think through what it is he is trying to do. Thus the organizational question posed requires prior consideration of the two questions:

A. What is the purpose and value, to the Department of Defense, of a program or programs of support of basic research? And even more fundamentally,

B. What is basic research?

4. It is advantageous to consider first the question, what is basic research. For present purposes it is essential to recognize that there are two aspects of basic research, depending upon who is viewing it.

From the point of view of the research worker himself basic research is research motivated by curiosity and interest, carried out because it promises to add to knowledge, and without any necessary interest in or concern for the practical applicability of any results that may be obtained.

Nevertheless it is most strikingly and emphatically true that basic research is not impractical research. The whole history of science constitutes a most impressive proof of this statement. And a research administrator, informed as to the history of research and aware of the interrelationships between various fields of science and various fields of

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Attachment 2 to Appendix C

application, can, concerning a given body of basic research activity, reasonably make judgments concerning probably practicality, these being judgments which may be quite foreign if not meaningless to the individuals actually doing the research.

Thus it is quite obvious if one is interested in, say, the development of new materials which will maintain strength at high temperatures, that there are certain areas of pure research which have probable relevance to such problems, and other areas which are clearly unlikely to yield results useful for this purpose.

Thus, without in any way abandoning or contradicting the concept of basic research as viewed by the researcher, the research administrator can discriminate between various areas of basic research, and can sensibly judge that certain of these general areas have a high probability of producing results useful for given purposes, while others have a very low probability. In other words, having a field of application in mind, it is meaningful and sensible for a research administrator, without in any way influencing the creative atmosphere within which the research himself operates, to judge that certain areas of basic research have, with high probability, relevance to his practical interests.

5. Having established these points concerning two legitimate and non-contradictory aspects of basic research, let us ask what is the purpose and value of supporting basic research within the Department of Defense.

This question surely does not have one simple and categorical answer. There are several interrelated purposes. The primary reasons appear to be:

A. To assure a continuing flow of fundamental knowledge of the sort which the Armed Services need, now and in the future, in connection with their practical problems.

B. To maintain effective contact between the Armed Services and the scientific fraternity of the country, so that the scientists be legitimately encouraged to be interested in fields which are of potential importance with respect to the national defense, so that the entire scientific strength of the country could be brought to bear promptly and effectively in case of a severe emergency, so that the Services are continuously and growingly aware of scientific developments and of the value to them of scientific activity, and so that the scientists and the research administrators can contribute an important element of intellectual leadership within the Armed Services.

As a by-product of great importance, this support of science tends to assure to the Armed Services a more adequate supply of suitably trained scientists who may later find employment within the Services.

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6. In view of the above analysis of the two different aspects of basic research, it should be clear that there is no inconsistency or contradiction in the demand, in purpose A, that the research be on the one hand basic, and on the other hand, that it be located in scientific areas which promise results relevant to the practical problems of the Armed Services.

7. It is worth noting, in passing, that the two stated primary purposes of basic research activity in the Armed Services imply that such an activity should not accept major responsibility for meeting certain other national needs. Thus the program would only incidentally serve such other purposes as:

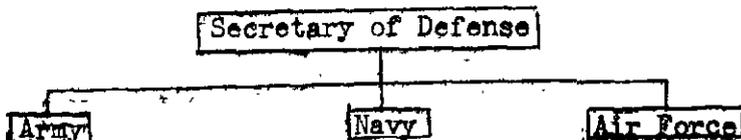
- The over-all advancement of knowledge.
- The development of the general research strength of the country.
- The general national problem of recruitment and training of research personnel.

These are purposes which cannot best be served through military channels.

It should further be understood that the present memorandum relates to the basic research supported in universities, colleges, and other research institutions through contracts. Each of the Services conducts a certain amount of research which might be designated as basic and which occurs within the service laboratories. The situation concerning these in-service research activities differs materially from Service to Service. Such research as well as the research supported at universities, colleges, and other research institutions is of obvious value to the Services. The Basic Research Group intends later to survey such activities so as to obtain a broader understanding of the over-all picture of research in the Department of Defense. At the present moment we can only say that we are not discussing these intramural activities in this memorandum.

8. Having now indicated the character and purpose of basic research in the Armed Services, let us consider the problem of the desirable organizational and administrative setting for such activities.

The uppermost section of the organization chart of the Department of Defense consists, in essence, of one top box (representing the Secretary's Office and associated agencies such as the Joint Chiefs of Staff and the Research and Development Board) below which is an array of three boxes, representing the three branches of the Armed Services.



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We would argue first that the basic research activity in the Department of Defense should be located symmetrically with respect to the three services. In view of the purposes to be served, it would be a serious retrograde step to adopt a new organizational pattern which assumes or implies that any one Service has an interest in or a capacity to profit by basic research which is not shared by the other two Services.

There are two significant ways of locating an activity symmetrically with respect to the above organizational array, this is by:

- A. Locating the activity in each of the three Services.
- B. Locating the activity in the top box.

There are some tempting arguments in favor of attaching, to this top box, certain activities which manifestly serve common interests of all three Services, and whose concentration into a central symmetrical agency might contribute notably to the actual fact of unification.

The Basic Research Group, however, does not recommend the centralization of the three existing Service programs of contract support of basic research. We do not favor this centralization because we are convinced that the two purposes A and B of Section 5 cannot be served as effectively unless the basic research activity is intimately immersed within the structure of each of the three Services.

We therefore submit, in summary, the following recommendations and comments:

I. We recommend that no present moves be made to unify into one agency the existing activities of the three Services in the contract support of basic research in universities, colleges, and other research institutions.

II. It is our opinion that the total support for basic research from Federal funds should not be dominated by one large Department of Defense agency such as would result if the existing programs of the three Services were unified and combined. Although the existence of three programs in Army, Navy, and Air Force may seem unnecessarily complicated from some points of view, it should be remembered that the mere fact of this division serves two purposes: from the point of view of the DOD, it assures emphasis upon the support of those phases of basic research which are concerned with the individual interests and responsibilities of each of the three Services; from a broader point of view, the three programs help to provide a desirable dispersal of interest and support within the general field of basic research.

III. In our judgment, the combination of these three Service programs into a single unified program would not be as effective

in producing research usable by the Services (Purpose A of Section 5), nor would it give them to the same degree the rich advantages (Purpose B of Section 5) that now result from the direct association between the individual Military Services and scientists.

With each service maintaining its own program, it is of obvious importance that these three programs be coordinated, one with another, and that each program be informed with respect to similar and relevant activities outside the DOD. Our group is of the opinion that satisfactory procedures, largely informal and for that reason the more effective, now exist for coordinating the programs activity of the three Services. We call attention to the importance of assigning within the DOD continuing responsibility for establishment and review of policy matters related to basic research conducted or supported by the three Services.

It may be argued that the combination of these three Service programs into a unified program would produce more basic research for less money. Even if this be the case, it seems probable that there would nevertheless be an actual over-all increase in cost if one attempted to set up liaison and other mechanisms to try to bridge the gap between a single unified agency and the internal problems of each of the services.

IV. We suggest the desirability that the Basic Research Group study in much further detail the research activities and programs of the three Services, including both in-service and contract work. Following such a study, the Basic Research Group may wish to make recommendations as to changes in emphasis or levels of support.

V. It is clear that such a study will help to delineate the scientific areas of relevance to the interests of each Service. A Service cannot wisely agree to discontinue any field of special relevance to its interests unless and until it has received assurance of adequate and stable interest, in this field, on the part of some other agency.

VI. As the National Science Foundation acquires funds which will permit it to activate policies and procedures which will assure stable support, within a proper scientific environment, it is our opinion that we should then move toward a situation in which the broad national support of basic research, with due allowance being made for areas of special relevance to one or more of the Services, should, so far as the Federal government is concerned, be more heavily concentrated in the National Science Foundation than in any other one Federal Agency.

BASIC RESEARCH GROUP

By /s/
WARREN WEAVER, Chairman

BR 202/1

APPENDIX

"IN-HOUSE" RESEARCH

With reference to paragraph - Section II of this discussion of the Riehlman Report, there follows a commentary on ARDC "in-house" and contractual R&D.

In consideration of this problem it must be borne in mind that many types of R&D are involved. Principal among these that are not discussed in the Riehlman Report are the following two types of work:

a. Hardware development, which is universally done by contract. There is no attempt, in this case, to do this work in-house.

b. Work which should properly be done "in-house" but is not because of lack of means to acquire either the proper numbers or kinds of personnel. It has become usual to contract for work in connection with

- (1) Management problems,
- (2) Exploratory and feasibility studies, and
- (3) Operation of facilities.

Although these kinds of work are done by contract, this method of accomplishment is inherently unsatisfactory since their proper disposition demands day-to-day operating knowledge and background which can come only from intimate and continuing connection with the responsible organization.

The Riehlman Report has also noted the problem of attracting and retaining qualified scientific personnel. In order to attract, hold, and develop competent scientists, it is essential that they be given opportunity to perform creative research. It is only by having and holding competent scientists that the (1) classified in-house projects, (2) the urgent requirements, (3) the operational tasks, and (4) the continuity of attack on continuing projects can be efficiently and effectively accomplished. The reasons for conducting in-house scientific work are:

a. Classification

In many cases it is difficult or impossible to hire a contractor with the necessary security clearances. In addition, many universities and scientists refuse to take on classified work. For example, two scientists at a large university's research foundation refused to take on a classified project and the work had to be split into a classified "in-house" project and an unclassified study at the university. Some capable contract scientists are considered poor security risks and cannot be cleared for such work.

b. Urgency

The urgency of many requirements precludes the delay in finding a suitable contractor and negotiating a contract. An example of such a case was a requirement initiated by SAC when it appeared that the B-36 radars were failing during flight near the tropopause. A team of scientists from the AFCRC was able to provide a solution to the problem in less time than it would have taken to negotiate a study contract. It should be noted here that it was only through the existence of continuing in-house activity on atmospheric conductivity and ionization that there were experts within the Air Force who were able to solve this problem so rapidly.

c. Operational Nature of the Project

Many possible contractors refuse to take on tasks in applied research, preferring more stimulating but less practical basic studies. The analysis of the "Moby Dick" balloon flight trajectory data is one instance where every university, which was approached to work up the significant climatological data, which was a result of this project, refused. The study, therefore, had to be performed in-house.

d. Continuity of Attack

An example here is the work of Dr. Haskell of the Geophysics Research Directorate of AFCRC who has worked over a period of several years in the determination of peak overpressures from nuclear reactions - work which is now foremost in the field. The know-how acquired in the analysis of "Greenhouse" data has been developed and put to use on every subsequent atomic weapon test series. The Air Force has thus insured a continuous program of analysis which is now providing the answers required for determination of the lethal envelope for aircraft. If data from each of these tests had been analyzed under contract, and a change of contractors had been forced by circumstances, the program would not have had its successful outcome.

e. Field Program Required

Many contractors are unwilling to take on an extensive field program. Absence from campus for extended periods and in remote regions is not compatible with a teaching program. Where a university does take on field work, support from in-house work must often be furnished in addition.

f. Non-availability of a Competent Contractor

Although proposals for research are frequently received from universities, too often these are for work in areas which already are being adequately investigated or which are outside of the areas which guidance from higher authority has indicated for added emphasis. A letter requesting proposals was dispatched last year to all likely universities and observatories which might have been able to pursue certain specialized studies in atmospheric albedo, and not a single proposal was received.

g. Integration of Contractual Effort

The integration of the research results from a number of contracts which are working toward complementary goals must be performed in-house.

h. Feasibility Studies

Where research and evaluation is to be conducted on the operational use of techniques or devices by the Air Force, such work must be done in-house. The Air Force responsibility in this regard cannot be delegated.

i. Maintenance of Competency

In order to monitor research contracts adequately, a project scientist must be allowed to carry on laboratory investigations in his general field of science. Monitorship cannot be performed by "desk-scientists" if the Air Force is going to maintain a sound and integrated contractual research program.

Appendix E

Civilian Personnel Problems

The administration, use, and retention of civilian research and development personnel in the government, is a matter of considerable concern in the Riehlman Report. A discussion follows on the principal components of this general problem.

A. The Civil Service System Versus the Needs of Research and Development

The Civil Service classification system is founded upon the thesis "equal pay for equal work". Under this thesis it is assumed that jobs are comparable by absolute standards and that the job exists independent of the man who fills it. In opposition to this precept research and development work is essentially non-uniform. Scientific creativity is characterized by its uncommonness and by its being the output of individuals. Wherever found those talented individuals who have demonstrated their capability must be obtained, supported and used as a nucleus of working groups to solve the defense problems of the country. Therefore, it must be made easier to attract and retain those individuals whose talents are unique and who cannot be considered as interchangeable under the accepted job concept. Present classification and qualification standards make no provision for individual capability. In many research and development positions the job, as such, does not exist until the man develops it around his own unique abilities. The preceding comments are generally applicable to all government research and development work. However, in the Department of Defense these deficiencies become extremely critical because of the extreme urgency which characterizes most of the work being done. In a discussion of these problems the Subcommittee on Scientific Personnel of the Interdepartmental Committee on Scientific Research and Development recently suggested that separate classification series could be established which would make use of "scientific specialists" or "science fellow" positions at the upper grade levels. By definition these series would include the technical expert whose value lies in his personal research activities rather than a position in the organization. It was also suggested that allocating and qualifying factors be revised to include amount and quality of work as evaluated against specially developed standards for scientists and engineers. Another alternative would be to provide authority to apply "incumbency allocations" to classification act positions much as is now done for the small number of P.L. 313 positions.

B. Inequities of Compensation

The ARDC agrees that the difference in the salary scale for technical personnel in research and development between those employed by industry and those employed by the Federal Government is a problem of major importance in obtaining and retaining qualified personnel. The Riehlman Report alleges that:

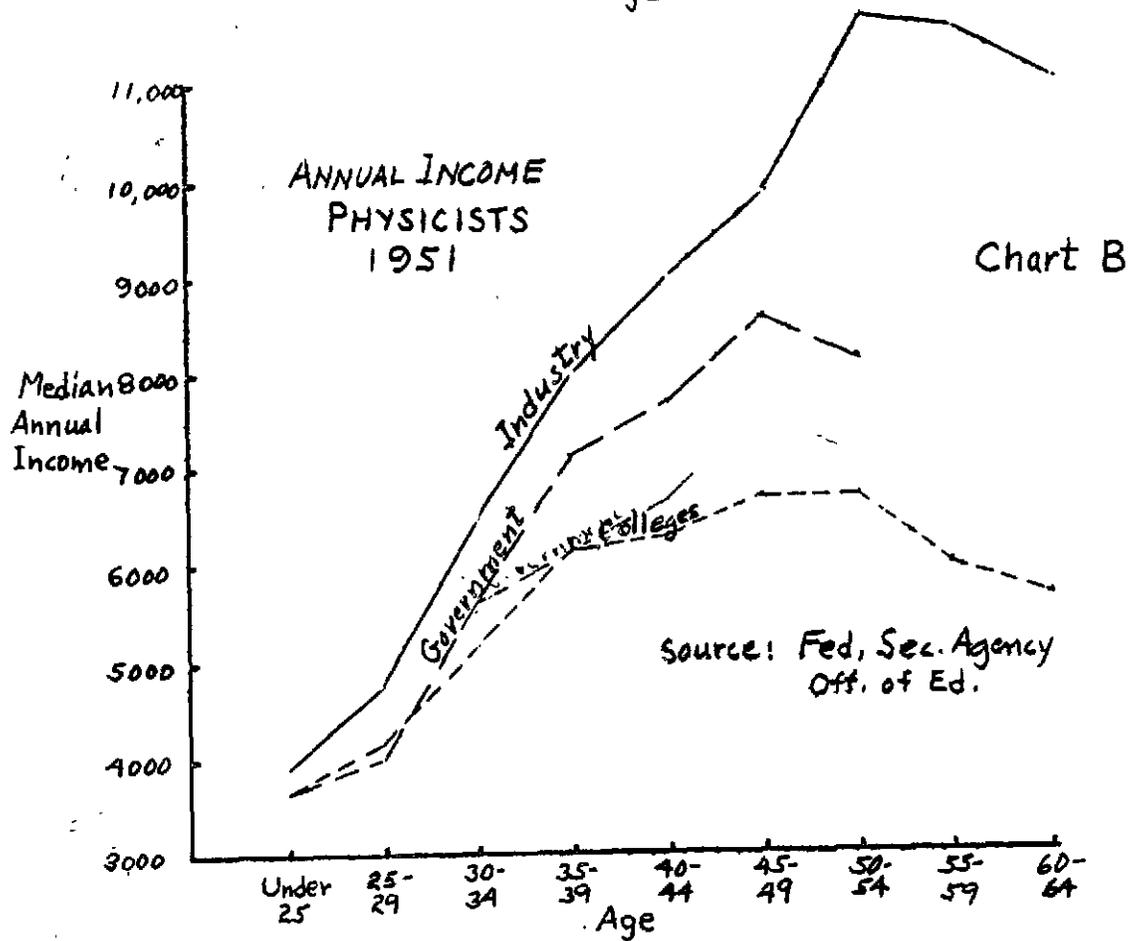
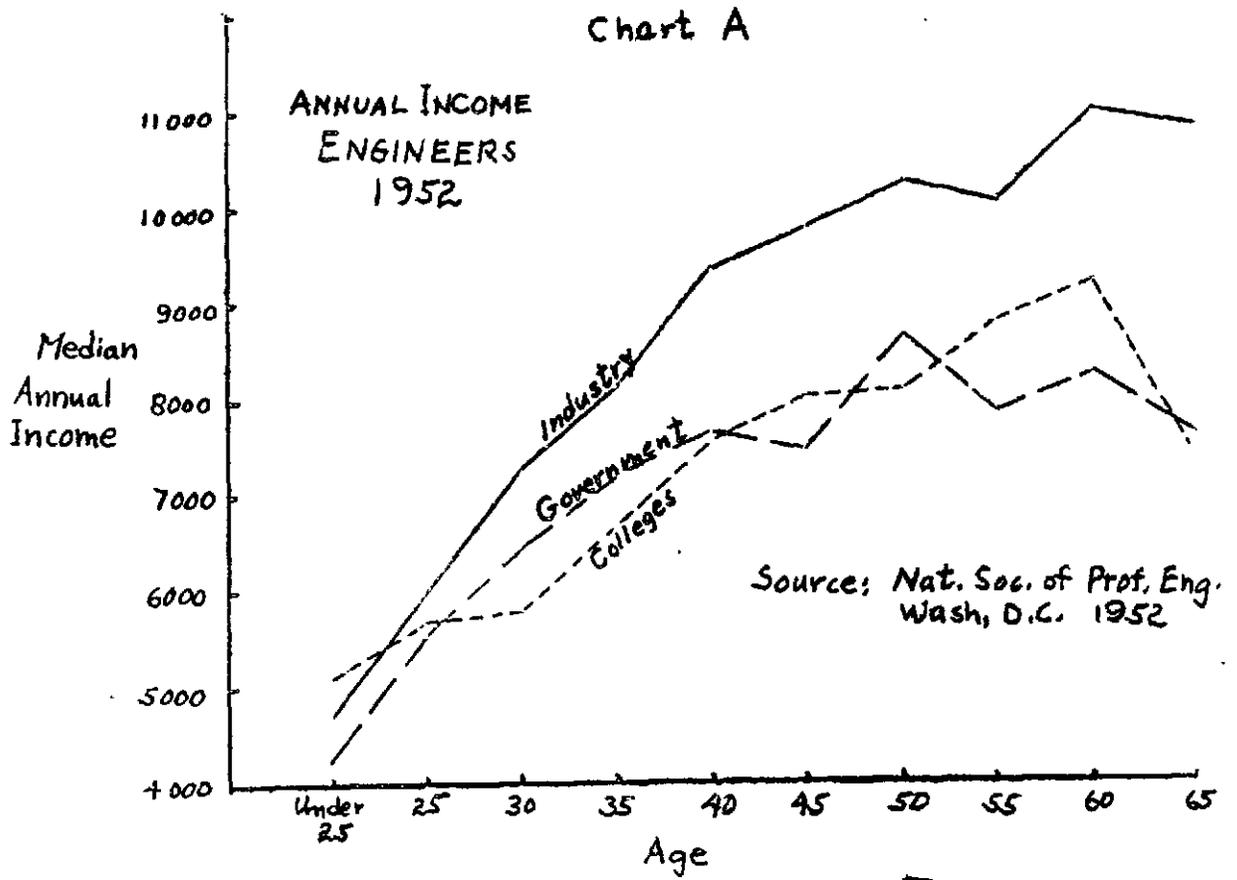
- a. Private industry can pay twice the salary paid by the Federal Government.
- b. Salary increases of 50% are required to attract scientific and technical personnel away from government jobs.
- c. Inflexibility of "Position Classification" does not permit salary increases for a job well done, while industry, because of freedom of action can entice government employees away.

Of the three (3) allegations, only the last is borne out by the facts, available statistics are contrary to the other two statements.

While it may be true that in individual cases private industry is able to pay twice the salary paid Federal scientists and engineers, the available statistics indicate that this is not generally done. Studies made of 1951 and 1952 data show that the medium salaries of industry are 7% to 30% more than those paid by the Federal Government. Comparative charts A and B attached, indicate the relationships of salaries of industry, colleges, and the Federal Government at corresponding experience levels. In industry, complete freedom is enjoyed in making offers to candidates for employment. As a result of new legislation government, too, will be able to increase beginning salaries in hard to find specialties.

There are no known studies to prove or disprove the contention that a salary increase of 50% is required to attract scientific or engineering employees away from the federal payroll. This lack of information is primarily because the source of the information must be employees themselves who are either preparing to leave for a new job, or who have already left. Because of the delicacy of the situation regarding the movement of people from one job to another it is virtually impossible to obtain by questionnaire or interview the true reasons for leaving, or the salary offered. A study of the comparative value of industrial positions with government positions, other than salary, reveals that in many cases the fringe benefits of government service are less than those of industry. Most industries today offer vacation and sick leave, insurance plans, disability compensation, and even retirement plans that compare favorably with those of the Federal Government. In fact, the combination of Social Security and industrial retirement systems provide in many cases more benefits with less cost to the employee. Consequently, it does not seem reasonable to assume that employees must be paid 50% more in order to induce them to leave the employment of the Federal Government. It is the general experience of ARDC that employees may leave to take jobs in industry for small increases in salary - certainly less than 50%.

It is true that the inflexibility of the Civil Service Classification Act does not permit salary increases as a reward to excellent employees. However, there are other ways of rewarding these deserving employees, such as promotions to other jobs, superior accomplishment pay increases, and other incentive awards. This inflexibility likewise prevents inequities in pay which might result in continued bargaining with employees every time an offer from industry was received.



C. Losses of Top-Level Civilian Scientific Personnel.

The turnover rate of key civilians in super-grades and Public Law 313 positions was mentioned as a serious matter in the Report. Further, the Report deplored "the apparent self-satisfaction among officials in the Defense Department that the turnover rate of top-level civilian scientific and technical personnel in the military research and development programs is not any higher than that found among similar employees in private industry."

The Report indicates concern only with personnel as referenced in its Appendix I, consequently this discussion will be limited to the super-grade and Public Law 313 positions.

It is to be noted that the P.L. 313 and super-grade positions of the Air Force only total 19; of these 16 are assigned in ARDC. In 1954, these were lost by resignation. The numbers involved are so small that the results of statistical treatment cannot be considered significant. The loss of these three individuals out of 16 does not constitute a "rate." They can properly be considered only as three individual events.

The ARDC does not compare its turnover rate of upper level personnel with that of private industry. However, a study is made of each loss to determine if and where special attention should be directed to relieve situations or conditions that may result in loss of desirable employees.

Considering the three individuals in ARDC who resigned, one left because of an opportunity to become more closely and uniquely associated with his scientific specialty (a specialty in which the ARDC had very limited responsibilities) and so that he might achieve the satisfaction of more research accomplishment without the attendant burden of administration. The other two left because of basic differences of opinion on vital management principles and the ARDC does not regard these two losses as harmful to the ultimate accomplishment of its functions.

D. Waste of Time on Job Descriptions and Surveys.

In paragraph 3 of page 32 of the Report, under Military-Civilian Problems, a witness was reported as saying he was annoyed by the great amount of time wasted as a result of Civil Service and Military regulations. Objections were voiced particularly to the requirement of writing job descriptions and the periodic job surveys.

A large proportion of the Civil Service and Air Force regulations are implementations of Congressional legislation. For example, virtually all of the regulations relating to the employment of veterans result from the Veterans Preference Act of 1944. Similarly, the requirement for annual position classification coverage is imposed by Section 1310(d) of Public Law 253, 82nd Congress.

It is necessary that the supervisor of government research and development work have a general knowledge of how to operate under these regulations in the same manner as the supervisor in private industry must be familiar with the pertinent policies of his company.

Inasmuch as the only specific complaint made was in regard to annual classification coverage, detailed comment will be confined to that area.

It is ARDC policy for the position classifier to write all position descriptions. Occasionally, operating officials prefer to write an initial draft in order to assure himself that all important factors of his job are included. Once a position has been established, most changes in duties are not of such scope that a new description must be written. For the most part, the survey consists of a review of position descriptions and pen-and-ink changes by the classifier. Complete rewrites usually result from reorganizations and are normally initiated by the operating official. A study by this Command extending over six months experience showed that time spent on surveys of technical and scientific positions is substantially less than eight hours per position. This includes interviewing the employee and supervisor and making necessary changes in the position descriptions. This constitutes only a small portion of the 2080 hours in a workyear. Since supervisors are required to review and discuss with classifiers, all positions under their immediate cognizance, their time devoted to this responsibility is somewhat greater.

Both in industry and government it is necessary that a supervisor devote substantially more time to administrative and policy matters than ever required of him when he was employed simply as a working scientist. It is quite possible that this fact is not recognized by scientists who have taken supervisory positions.

As long as a legal requirement exists, it will be necessary to review all positions annually. Since staffing standards compel classifiers to maintain a high production rate, we can be sure that they will not unnecessarily use the time of scientists or any other type of employee. This command will continue its policy of requiring the position classifier to prepare the position descriptions.

The time spent by scientific and engineering personnel on job classification and analysis in ARDC has been significantly reduced by having position classification technicians prepare the job descriptions based on information obtained at the time of the desk audit to the greatest extent possible. This practice will continue and as the organizations are stabilized, the time spent on desk audits will be reduced considerably.

E. Working Hours

Use of authorized procedures to flexibly administer the statutory 40-hour work week is encouraged throughout the ARDC for professional people whose productivity is said to be handicapped by strict working hours. However, periodic spot checks have indicated that this does not pose a major problem in ARDC. Full use of provisions for allowing compensatory time off enables the introduction of a limited amount of latitude in working hours. The Air Force policy in this area is more restrictive than required by the Civil Service Commission. A study will be made to determine whether the problem is greater than heretofore realized and if so, relief will be sought through liberalization of Air Force policies.

Except for one Center, the use of time-clocks in ARDC has been abolished. At the excepted Center (WADC) time-clocks are only used by personnel under GS-12. Use of time-clocks has been retained only to prevent the formation of undesirable morale tensions because of the universal use of time-clocks by intermixed AMC personnel.

F. Personal Privileges

The Rishlman Report includes considerable discussion concerning disparities between military and civilian personnel as concerns personal privileges (clubs, housing, commissary, etc.).

There have undoubtedly been unfortunate incidents where civilians have considered themselves improperly treated concerning their use of military personnel facilities. These incidents are usually traceable to misunderstanding among the individuals involved of the views and intentions of each other.

An extreme military view is that the civilian is a free agent who accepts employment with the understanding that his pay is full compensation to meet his needs. With his freedom of choice of work and pay goes the responsibility to secure his needs. On the other hand, the contract of the military man includes the fringe benefits as part of the pay provided to meet his needs. The military "privileges" are intended to cover the exigencies attendant to the forced irregularities of military life. They are not privileges as popularly believed, but are in fact real compensations in lieu of monetary consideration and are established and controlled by legislation. Civilian participation in these so-called privileges on a level equal to the military might be interpreted as a competition with the military where there are limited facilities. This, in turn, implies a threat to the military man of deprivation of part of his earned pay while the civilian obtains a benefit for which he has already been paid and should have provided to himself.

However, in accepting military service employment many civilians have given up fringe benefits at their places of former employment which were at least equal to those military personnel receive. Large industries provide opportunities for exclusive club memberships and buying privileges, and allow far more liberal compensations and services for job transfer and household moving than does the Government. It is not unreasonable that the civilian should expect similar treatment when he enters Government service.

The ARDC view in regard to personal privileges is founded upon the belief that a spirit of unity among all participants, both military and civilian, is essential for successful prosecution of the R&D mission. The accomplishment of R&D is intellectual activity which is no respecter of age, seniority, social groupings or organizational hierarchy. Any action which might tend to recognize exclusive groups is destructive to the individual and collective feeling of "belonging" which is vital if the people involved are to operate as a smooth running team. It is necessary that the people treat each other as equals and that no administrative partitioning be allowed to occur that would tend to break down mutual respect and understanding.

Within the limits of legislative authority, ARDC has endeavored to grant personal privileges to civilian employees equal to those of military personnel, and especially at bases where civilian living is dependent upon military personnel facilities. Effort will be continued to eliminate all inequities where they constitute personnel problems. Where legislation impedes this objective, appropriate recommendations will be submitted.

Appendix F

Technical Military Personnel

Part II, Section III of the Riehlman Report gives much attention to the adverse effects of military personnel policies on the use of technical military personnel. In broad terms it is alleged that rotation, as practiced, prevents continuity of attention by qualified officers to long-term R&D efforts, and injects inert management into R&D by placing unqualified officers in vital positions for shorts periods of time. Secondly, it is alleged that even though there is a great shortage of qualified technical officers, they are not promoted as rapidly as the operational officers and thus are denied the material rewards of their profession that are attainable elsewhere in the Service.

A. Rotation

Frequent rotation makes it difficult to administer any effective program whether it be an R&D program or the program of combat operations. It should be recognized that the causes of rotation are often complex and that many of the causes, although simple in themselves, are in the aggregate very complex. It should also be recognized that these causes (likewise their cures) are not bred or nurtured solely within the Department of Defense, the Air Force, or ARDC, but that many come from outside the National Military Establishment; for example, the President and the Congress. (Presidential - the decision to send U. S. military forces to fight in Korea. Congressional - the large variances in military appropriations which cause expansion or contraction of the military force, or changes in emphasis or abolishment of certain programs, thereby causing the requirement to release many qualified technical officers from active duty and to move others.)

The major cause of rotation within ARDC in the past, at the present and in the future is changing requirements. For example, when ARDC was established in 1950 it had five centers under its command. Now there are ten centers and one development division assigned. Thus, the rapid growth of technology, which is commented on in Appendix A is reflected not only in the establishment of ARDC but also its subsequent growth. This rapid growth is basic to the ARDC problem of rotation for it was necessary to move many of our qualified technical officers to these new centers where they became the nuclei of teams of civilian and military engineers and scientists. The movement of these officers was rotation; however, their movement created another problem of rotation, for, as the new centers were being formed, the older ones were given additional tasks, thereby generating requirements for replacing officers who had been lost to newly formed centers and in most cases requiring additional personnel at the original centers.

An example of rotation caused by technological advancement, which is the mission of ARDC, is the Matador missile. The assignment of units equipped with this missile to overseas areas resulted in a number of

qualified technical officers moving with the organization. The number was small but it added to the total number of officers being rotated. Numerous other examples of rotation caused by changing requirements could be shown. In general, if one is to retain correct perspective, it should be remembered that a new technical development invariably results in the requirement to move people.

The Air Force, and especially ARDC, is developing a program which will insure that personnel stability is given more consideration than it has been given in the past, especially during the early stages of technical program development. A three-year tour of duty has been determined as the desirable minimum. Air Force Regulation 36-65, issued on 15 September 1954, establishes duty tours of technical officers as three to five years.

It is notable that at the present time there are many Air Force officers now in the middle-to-upper rank levels who have served for a long time (more than ten years) within the R&D field. There are also several Air Force general officers who have spent virtually their entire careers within the area of R&D.

B. Promotion

ARDC considers the term "qualified technical officer" to mean one who possesses a research and development specialty code, and who is assigned to ARDC and performing duty in an R&D Air Force Specialty Code.

For temporary promotion of officers up to the rank of colonel, the Air Force system proportionately allots each major command a quota of promotions by rank based upon the command's officer population by rank. ARDC receives a promotion quota proportionately equal to that of any operating command; ARDC suffers no discrimination in receiving promotion allotments.

Examination of the past three temporary promotion cycles shows that the technically qualified officers in ARDC have received in each case at least their proportionate share of all available promotions. It can be concluded that advancement opportunities for the technically qualified officer are at least equal to those of the average Air Force officer.

Statistics are not available to ARDC which would fully show promotion opportunities for technical officers to general officer grade. However, the general officer temporary promotion list of the Air Force released 28 October 1954 shows that ARDC received five promotions out of the 52 for the entire Air Force (9.6%). even though the ARDC has only about 3.6% of the Air Force's officer population.

C. Technical Personnel Shortage and Training

It is true that the shortage of qualified technical officers is one of the most significant and perplexing problems facing the Air Force. However, it must be realized that this problem is not unique to the

Air Force. Its effects are equally, if not more, serious to industries and scientific institutions. This shortage is accentuated by many individuals who possess advanced training in engineering or physical science, but do not desire to exercise their training. There are also individuals who have the required training but are unsuitable for R&D work because they lack imagination or creative talents.

Deficiencies in the availability to the Air Force of technical officers can only be overcome by training, and acceptance of the normal probability that among those trained a number will be suitable for R&D work. The Air Force has established a special training program to meet the need. The USAF Institute of Technology offers undergraduate and graduate work both in residence courses and courses in the nation's highest quality academic institutions, in all fields of engineering and science required by the Air Force. Between Fiscal Years 1950 and 1955, the Air Force Institute of Technology has placed in training 1673 officers in engineering; 404 officers in sciences; and 141 officers in engineering administration and R&D management. ARDC receives approximately 90% of the USAFIT graduates in engineering, 85% of the science graduates, and all of the R&D management graduates.

Conclusion:

The Air Force is acutely aware of its need for qualified technical officers, it is also aware of the need for adequate promotion opportunities for such officers. Although promotion policies do not single out any Air Force specialty for promotion preference, there can be little doubt that qualified technical officers assigned to ARDC receive consideration for promotion consistent with Air Force need for their qualifications.

Appendix C

Security Classification of Documents

Fulfilling a realistic need for military security in connection with the results of scientific and engineering effort is at once in opposition to the need for liberally distributing this same information for purposes of application and cross-stimulation to the solution of other problems. Here the Air Force (as well as all the military services) is caught on the horns of a dilemma. Even general security clearances for the purpose of receiving classified information, or publication media intended for the distribution of general classified information, are in conflict with one of the fundamental points of military security - that even to the cleared individual, classified information is released only on a basis of "a need to know." By strictly observing security a scientist or engineer can't have what he needs until he can ask specifically for it and demonstrate its connection with his work, yet if he isn't given free access to classified technical information, he cannot find out just what it is that he needs to know.

By far the largest step toward solving this perplexing problem has been taken in the establishment of the Armed Services Technical Information Agency. Briefs of all classified information submitted to ASTIA are available to anyone with an adequate general security clearance, and the complete documents are available for the asking. The ASTIA catalog service is so widely available, there is little excuse for anyone not to exploit it fully.

Within ARDC, there is no significant technical information which is classified "Top Secret," and so the problem of exchange of technical information of "Top Secret" classification does not exist. That classification is principally reserved for operational planning information.

The security classification placed on technical reports is to prevent hostile nations from becoming aware of our military state of readiness and our plans for insuring national security. It is necessary and it poses administrative difficulties as unpalatable to military organizations as to scientists and engineers. Even the scientists agree that it is necessary. It is also true that evidence is available which shows that at times some military security officials have been overly zealous in regard to security procedures.

Within the Air Force, specific steps have been taken to encourage wide dissemination of technical information. These include:

- a. The supply of copies of all Air Force scientific and technical reports to the Armed Services Technical Information Agency for servicing of information requests from contractors, military research activities and other government agencies engaged in research having military value.

b. The assignment of the lowest security classification commensurate with the national security to scientific and technical reports resulting from the military research and development program.

c. The regular supply of copies of unclassified and declassified Air Force technical reports to the Department of Commerce for public dissemination as provided for in Public Law 776 - 81st Congress.

d. The encouragement of Air Force scientists and engineers to publish the results of their official work in professional journals and the acceptance of such publication in lieu of formal reports.

e. The combination of technical information and intelligence activities in one organizational framework under civilian direction in ARDC to insure continuity and full exploitation of both foreign and domestic research and development results.

f. Participation in scientific symposia and meetings on both national and international levels for discussion of technical subjects and exchange of technical information.