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Carter, John Franklin - Proposal for Asst. Secretaries of War and Navy for Scientific Research

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REPORT ON PROPOSAL FOR ASSISTANT SECRETARIES FOR SCIENTIFIC RESEARCH.

The attached report represents the considered judgment of Henry Field and myself after nearly four years experience of the problems involved in corelating scientific developments with administrative procedures.

When it was taken up in War and Navy discussions, the civilian members objected to the idea of placing more civilians in positions of authority over service personnel but the service personnel themselves were in favor of this solution.

The C.S.R.D. has taken the position throughout that no organization should be enabled to foreclose free scientific experiment and development in or out of the government--a position which is entirely in tune with the traditional freedom of enterprise.

What we propose cannot be a solution to the problem but it might work more effectively than the past official set-ups which either ignored the question of official responsibility for technicological development or placed an unfair burden on service personnel who, by the nature of things, could not fully discharge the duties.

We believe that the device of making the suggested Assistant Secretaries of War and Navy for Scientific Research ex-officio members of the Research Board for National Security goes far to meet the objection that too much official control should not be imposed on the necessarily changing technological picture.

J.F.C.

March 6, 1945

PROPOSAL FOR ASSISTANT SECRETARIES OF WAR AND NAVY
FOR SCIENTIFIC RESEARCH

It is suggested that consideration be given to the proposal that an Assistant Secretary of War and Navy for Scientific Research be appointed.

The lack of coördination, the duplication of effort, the repetition of tests and in many cases the lack of any rapid decision have been expensive in delays and in lives lost.

Although the new Research Board for National Security should prove helpful in developing new weapons, there are many other correlated projects, such as jet-propulsion, which must be followed closely in the post-War years.

Each Assistant Secretary for Scientific Research should be a top-ranking and highly regard civilian scientist charged with keeping in touch with military and civilian research so that at all times the War and Navy Departments would be informed of all new developments, especially those not classified as "weapons."

It is believed that while each Division in the War Department and each Bureau in the Navy should remain autonomous, the Assistant Secretary would have cognizance of all major research in progress and have at his command adequate funds to initiate and promote correlated researches in university laboratories, research institutes and industrial plants.

The new Developments Division of the Army and the Office of Coordinator of Research and Development in the Navy would each become part of the proposed Secretariats.

These two Assistant Secretaries would be ex-officio members of the Research Board for National Security.

RESEARCH

Weapons For Future Wars

Many of our best known leaders are at work on numerous projects in university laboratories, research institutes and industrial plants.

➤ MANY of America's best known leaders in science are already at work on weapons that will be used by the United States in the event of another war emergency. They function collectively as the new Research Board for National Security.

Numerous projects are under way now in university laboratories, research institutes and industrial plants. To reveal nature and subjects of these experiments at this time might endanger national security.

Working to develop new weapons, without compensation except for expenses, are such men as Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, Dr. H. S. Gasser, director of the Rockefeller Institute for Medical Research; Rear Admiral J. A. Furer, coordinator of Research and Development in the Navy Department; Dr. E. O. Lawrence, professor of physics at the University of California; and Vice Admiral Ross T. McIntire, Chief of the Navy's Bureau of Medicine and Surgery.

As members of a 40-man committee of the National Academy of Sciences, created by Dr. Frank B. Jewett, president of the Academy, at the request of Henry L. Stimson, Secretary of War, and James Forrestal, Secretary of Navy, these men are formulating programs of scientific research and development to strengthen national security. Appointment of this committee results from a report of the Congressional Committee on Postwar Research and Development, headed by Charles E. Wilson, which advised the setting up of such an organization to continue and expand in peacetime scientific research on the mechanisms and devices of warfare carried on in wartime by the temporary emergency Office of Scientific Research and Development. The research board has already taken over several of the OSRD projects.

Conspicuous by his absence from the new committee is Dr. Vannevar Bush, of the Carnegie Institution of Washington, and now director of OSRD. Although he was invited to become a member of the new committee, Dr. Bush declined, stating that he did not want to appear to dominate the new organization.

Chairman of the Research Board for National Security is Dr. Karl T. Compton. Cooperating with him are four members of the executive committee: Dr. Roger Adams, head of the department of chemistry at the University of Illinois; Dr. A. R. Dochez, professor of experimental medicine and surgery at the College of Physicians and Surgeons, Columbia University; Brig. Gen. W. A. Borden of the War Department Special Staff; and Rear Admiral Furer. Board members include 17 civilians, selected by the National Academy of Sciences, nine representatives of the Army selected by the War Department, and nine representatives of the Navy, selected by the Navy Department. Placement of military members of the armed forces in reserve status after the war is not expected to affect their participation in the research program.

While the board is set up only on a temporary basis, it is believed by many informed observers in Washington that it will be permanently established by act of Congress. In the event that Congress establishes a new organization, the research activities now under way will be transferred to it. The Woodrum committee is now considering a permanent organization.

Other members of the research committee are: Dr. E. K. Bolton, E. I. du Pont de Nemours and Company; Dr. Oliver E. Buckley, Bell Telephone Laboratories; Bradley Dewey, Dewey and Almy Chemical Company; Dr. Lee A. Du Bridge, NDRC; Dr. H. S. Gasser, Rockefeller Institute for Medical Research; Dr. A. Baird Hastings, Harvard University; Dr. J. C. Hunsaker, NACA; Dr. W. S. Hunter, Applied Psychology Panel, NDRC; Zay Jeffries, General Electric Company; Dr. C. C. Lauritsen, California Institute of Technology; Dr. E. O. Lawrence, University of California; Dr. Linus Pauling, California Institute of Technology; H. W. Prentis, Jr., Armstrong Cork Company; Dr. I. I. Rabi, Columbia University; Dr. Elvin C. Stakman, University of Minnesota; Dr. Oswald Veblen, Institute for Advanced Study, Princeton; Dr. Lewis H. Weed, National Research Council; Dr. E. L. Bowles, expert consultant to the Secretary of War; Maj. Gen. Levin H. Campbell, Jr., Chief of Ordnance; Lt. Gen. B. M. Giles, Army Air Forces; Maj. Gen. John E. Hull, Chief of Operations Division; Maj. Gen. Harry C. Ingles, Chief Signal Officer; Maj. Gen. Norman T. Kirk, Surgeon General of the Army; Maj. Gen. William N. Porter, chief, Chemical Warfare Service; Maj. Gen. Wilhelm D. Styer, Chief of Staff, Army Service Forces; Maj. Gen. Albert W. Waldron, chief, Requirements Section, Army Ground Forces; Vice Admiral Frederick J. Horne, vice chief of naval operations; Vice Admiral Ross T. McIntire, chief, Bureau of Medicine and Surgery; Vice Admiral Ben Moreell, chief, Bureau of Yards and Docks; Rear Admiral H. G. Bowen, special assistant to the Secretary of the Navy; Rear Admiral W. J. Carter, assistant chief, Bureau of Supplies and Accounts; Rear Admiral E. L. Cochrane, chief, Bureau of Ships; Rear Admiral W. S. De Lany, assistant chief of staff, Readiness Division; Rear Admiral George F. Hussey, Jr., chief, Bureau of Ordnance; Rear Admiral DeWitt C. Ramsey, chief, Bureau of Aeronautics.

Chicago Daily News
February 23, 1945

War a Race Of Chemists --Patterson

War today is a race between laboratories, Robert P. Patterson, undersecretary of war, told the Executives' Club today at the Hotel Sherman.

"The race in research, development and design in weapons goes on," Patterson said. "It is a race that puts a premium on the ability to shift productive forces swiftly to meet new needs and to produce large quantities quickly. It is a race with the lives of men as stakes."

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THE IMPORTANT part played by science in the war, Patterson said, "is one more proof that success in this war calls for total national effort — in science, engineering, industrial resources and mobilization of manpower at home, as well as in well-trained, well-equipped, well-led military forces overseas."

"Germany and Japan wanted a total war," he concluded. "Let them have a total war!"

Bush Urges Co-ordinator To Develop New Weapons

By the Associated Press.

Dr. Vannevar Bush, director of the Office of Scientific Research and Development, yesterday urged appointment of a top military commander to co-ordinate the development and use of new weapons.

After the war, he said, Congress should set up a civilian agency to work on "the scientific aspect of military problems."

Dr. Bush, testifying before the House Committee on Postwar Military Policy, said the armed forces now are not geared to get immediate results in all branches from scientific development.

There is a need for technical planning at the top of the military organization, he said, for the development and use of new weapons in which more than one branch is directly interested."

Statement of Dr. Vannevar Bush, Director of the Office of Scientific Research and Development, before the Select Committee on Post War Military Policy on January 26, 1945.

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I am happy to be able to meet with you today, and I appreciate particularly the opportunity to express some of my views on a postwar policy for scientific research on military problems. As an American citizen, as well as by instinct, by training, and by the actual experience of nearly five years with the Office of Scientific Research and Development, I am deeply concerned about these matters. What I shall have to say has been submitted to the Bureau of the Budget but I have not been advised as to its relationship to the program of the President.

It is not necessary for me to expound at length on the importance of new weapons in modern warfare. That point has been made by many witnesses and is generally understood. Moreover, as knowledge of the events of this war grows, the essential role both of science and of new weapons will be seen with increasing clarity. Today it is evident to all thinking people that the evolution of new weapons may determine not only the outcome of battles, but even the total strategy of war. That has always been true to some extent, but today the rate of evolution of military weapons is much more rapid than it has ever been in the history of human conflict. Tomorrow the impact of new weapons may be even more decisive.

The great change in pace which science and technology have introduced into warfare underlines the vital importance of continuing an effective research on military problems in times of peace. In the past, the pace of war has been sufficiently slow so that this nation has

never had to pay the full price of defeat for its lack of preparedness. Twice we have just gotten by because we were given time to prepare while others fought. This time the margin was narrower than in 1914. The next time--and we must keep that eventuality in mind--we are not likely to be so fortunate.

The speed and surprise with which great damage could be done to our fleet at Pearl Harbor is only a mild warning of what might happen in the future. The new German flying bombs and rocket bombs, our own B-29 and the many electronic devices now in use which were unknown five years ago, are merely the forerunners of weapons which might possess overwhelming power, the ability to strike suddenly, without warning, and without any adequate means of protection or retaliation. I do not mean that some methods of protection or retaliation could not be developed. I only mean that we might not be given sufficient time within which to develop those means, once hostilities had begun, before disaster overtook us.

It is imperative, therefore, that after this war we begin at once to prepare intelligently for the type of modern war which may confront us with great suddenness some time in the future. We all hope that no such event will occur. We all hope that means will be found to secure peace among nations, and we are anxious to do our full part in bringing about in due time an international organization and understanding that will truly preserve peace, but in the meantime we need to keep our powder dry. More specifically, we need to be effectively organized.

I think it is clear that we must not go back to either the organization or the philosophy which prevailed with regard to scientific research on military matters in the years between 1918 and 1939. Let me

make myself fully clear. Many admirable things were done by both the Services and civilian groups in those twenty-one years. Both the Army and the Navy, for example, can be proud of some real technical advances during that period. But that is not the whole story. To get a full picture we must remember also the neglect and the mistakes. Of these there was a full quota.

Yet, in my judgment, it is truly remarkable that the Services were able to accomplish as much as they did in the face of the tremendous obstacles which beset them on every hand in the peacetime years. The fundamental difficulty, of course, lay in the attitude of the American people toward preparedness for war. The American people were not prepared to build soundly for war during times of peace. We cannot, therefore, expect the Services to have accomplished what the people, by their attitude, made it impossible to do. I might say, at this point, that to the best of my own recollection, the Congress in those years regularly voted the research appropriations requested by the Services.

In addition to the attitude of the American people, however, there were at least two fundamental obstacles to a truly successful program for military research inherent within the Services themselves. First, and most important, was the internal organization of the Services. That organization gave insufficient recognition to science, its requirements or potentialities as a phase of warfare. Second, in addition to the organizational difficulties, service personnel, by training and tradition, did not, by and large, appreciate either the position which scientific research must occupy or the contribution it could make to any successful program for the national defense.

The essential fact is that we failed during peace to do as much as we most assuredly should. Certain of the reasons for that failure are obvious. They should be cured with all the vigor at our command. And it will require both vigor and courage for the roots of the trouble are deep.

Since someone is certain to suggest that the answer lies in extending our wartime organization into the peace, let me meet that argument now. The argument has deceptive plausibility. It is deceptive for two reasons. In the first place, no temporary expedients, effective as they may be, can outlast the emergency pressures which gave them being and vitality. War-improvisations should be recognized for what they are. Their real usefulness will be over once the war is concluded. In the second place, no temporary improvisation, excellent as it may be, can be completely effective if the fundamental organization upon which it is superimposed is either weak or unsound.

Under the pressures of war, our temporary expedients have worked well. It is not necessary for me to describe in detail these temporary expedients. The Office of Scientific Research and Development is one. It brought civilian scientists of the very highest calibre into active participation on matters of military research. It gave a civilian body, reporting directly to the President, authority and funds both to support and to initiate research on matters essential to the national defense. Within the Services there have been similar expedients. They have been explained to you already by their responsible officers. The New Developments Division in the Army, under General Borden, and the Office of the Coordinator of Research and Development in the Navy, under Admiral Furer, are notable. Within the structure of the military

itself, moreover, and reporting directly to the Joint Chiefs of Staff is the Joint Committee on New Weapons and Equipment, over which it has been my privilege to preside. This is the senior staff body within the military organization itself on new weapons and equipment.

When a new emergency arises it may well be necessary to create new emergency organizations for temporary action. There is a great advantage in new organizations created for explicit emergency purposes. They have not accumulated the rigidity and formalism toward which all organizations are likely to trend with the passing of time and when not under pressure. They are cut from whole cloth, and the vigor of youth applies to organizations as well as to individuals.

Yet the continuation of an emergency organization after the emergency has passed is likely to be as great an error as the failure to create it when needed. We should not mistake emergency remedies for a permanent cure.

Nor does the solution to the problem lie simply in the establishment of an agency through which the assistance of civilian non-Governmental scientists can be made available to the Army and Navy. The participation of civilian scientists in the scientific aspect of military problems is only one small portion of the total problem. The very heart of the problem of an adequate postwar organization for the conduct of research and development lies in the organization of the War and Navy Departments themselves. Unless this major problem is resolutely faced and affirmatively resolved, the solution of the peripheral problems (such as the form of organization for civilian participation in military research) will not enable us to prepare ourselves adequately for the wars which may come.

The previous testimony before this Committee with regard to a policy for military research has dealt largely with the problem of organizing for the participation of civilian scientists. I trust that, before your hearings are concluded, there will be greater emphasis upon the research organization of the military services themselves, for that seems to me to be the primary question. In fact, it may well be maintained that if the Army and the Navy are properly organized, and if they approach the problem of science and scientific research in the postwar era in a sound and thorough fashion, the enthusiastic cooperation of civilians will more readily follow. Even more important, a sound military organization, which is receptive to the role of science and of civilian scientists, will enable an auxiliary civilian organization to operate to maximum advantage. The converse is equally true. No mere addition of an auxiliary civilian body designed to aid the military effort will insure adequate development of weapons in time of peace if the military organization itself is unsound or unreceptive.

This question of postwar organization for military research and development is an integral part of the major question of the overall peacetime military organization of this country. And on this major issue I feel that the material presented to this Committee has been disappointing. I have read all of the testimony that was presented to this Committee during its hearings and, although there were some very interesting discussions, it seemed to me that exceedingly important matters were hardly touched upon and that the surface of the problem of adequate or effective organization for the defense of this country has only been scratched.

Since the over-all postwar military framework has not yet been fixed, it is difficult for me to discuss the problem of organization for military research and development in any explicit way. Yet certain fundamental principles seem clear. In the hope that it may be helpful to this Committee and the Congress, I would like to summarize four of the important principles which, to my mind, should be observed in any postwar organization for military research.

FIRST: There must be adequate planning at the top both for the evolution of weapons and for the strategic use of new weapons.

At the outset, I should make it clear that in this discussion, which will involve some criticism of the military system, I differentiate between the system and the officers who operate under it. There is no intention on my part to criticize any of the officers in whom this country has placed its confidence and who are among the most able military leaders this country has ever produced. These officers and men have performed most effectively under a system which is not calculated to make the most of science and technology in modern war.

I also want it clear beyond all possibility of misunderstanding or misconstruction that, in my judgment, the military and civilians, working together, are now fighting the technical aspect of this war in an effective partnership. On the scientific front, on research and new weapons, things in general are now going well--remarkably so when we consider the great organizational handicaps under which we started this war, and which to some extent still persist.

Military tradition, for example, has in the past, called for planning in terms only of existing weapons. Such planning is done in view of all the complexities of logistics, training, intelligence, and personnel to fit into an over-all strategic program. The failure to have at the top levels of the military organization trained scientists and military leaders who plan in terms of future weapons or weapons in process of evolution may be costly in terms of lives and battles. Of course, planning for immediate campaigns must always be done in terms of existing weapons. The long range planning of a whole war, however, must go further. It must be done in the terms of the evolution of weapons and strategy. In the future, the presence or absence of this type of planning at a high level may determine the entire course of war.

Traditionally, the advanced military thinking on the improvement of weapons and on new methods of combat has been left to the lower echelons. The theory has been that any matter of sufficient importance will force itself up from below upon its own merits, and demand the attention it deserves. There is, of course, a basis for this argument. Yet, the course of modern war is so largely determined by the evolution of new techniques that it is absolutely essential that first-class thinking be

done which combines military considerations with the possibilities opened by technical progress. This thinking can only be done at the top. To proceed without it in a modern war is simply not good enough. Progress in complex technical matters is slow enough in the face of inertia, limited vision, obstinacy, vested position, tradition, and all the other ills that flesh is heir to without superimposing the organizational handicap of making new thinking fight its way to the attention of the top level commanders who ought to be giving it affirmative consideration.

Lest it be thought that this is merely a matter of generalities, examples can best be drawn from the first World War. The three great technical innovations of that war were tanks, poison gas, and aircraft. All three produced effects on the course of the war, yet these were essentially temporary and local. If sufficient grasp and vision had been present to see

possibilities at the outset and prepare for full-scale surprise use thoroughly followed up, there is little doubt that the war could have been shortened, one way or the other. In particular, tanks, in their then crude form, but in the absence of air opposition or anti-tank weapons, could undoubtedly have turned immobile trench warfare into a war of movement at that time as well as later, had they been exploited to the full instead of tentatively and on a shoestring. To have brought this about would have required the combined vision of military men with those who understood the potential possibilities of tracked vehicles. The procedure whereby enthusiasts, with a novel method, convinced the High Command sufficiently to overcome skepticism and obtain a trial, could bring only small results; which it did.

There is need for technical planning at the top not only to give affirmative direction and drive to new developments and their use; there is an almost equal need for such planning at the top in order to coordinate the work of the several branches of the Services, both in the development and in the use of the new weapons in which more than one branch is directly interested.

Our present military and naval organizations were built for much more static armament than we have today. In the days of wooden ships and iron men it was not only sufficient, it was highly desirable, to place the full responsibility upon one officer to see to it that those ships were soundly built, and upon another to see that their guns were the best that could be constructed. We have come a long way from that situation, both in techniques and in organization; but our techniques have outrun our organization for handling them.

It is still true and it will always remain true, that for the effective performance of any organization, especially a military organization,

responsibility must be definitely assigned and responsibility and authority must go together. This sound principle should never be departed from. In the case of military research, however, this sound principle has been departed from by the Services themselves. Whenever a new research program or development appears which is not directly and entirely within the cognizance of a particular branch, there has been no body with responsibility and authority to direct and coordinate the work of the several branches. It is essential that there be such a person with power both affirmatively to direct new programs and to integrate existing programs when they involve more than one Bureau or Service branch.

Modern weapons call for complex programs involving many skills. So much so that an item as humble as a flashlight if designed for special operational use may find itself the victim of overlapping jurisdictions and competing demands for control over both its development and procurement. Today, a single complex unit of offense or defense, such as a radar controlled anti-aircraft installation, may cut across many of the traditional branches of the military service. A complex weapon on the order of the German V-bombs might, for example, involve Chemical Warfare if it were an incendiary, Air Forces if it were borne by wings, Signal Corps if it involved control devices, Engineers if it needed emplacements for launching, and Ordnance. Similarly, a new type of incendiary bomb would involve both Chemical Warfare and the Air Forces. Each has a responsibility and each must be satisfied as to its own specifications, standards of safety and performance. No one branch sees the whole picture. No one branch can give over-all direction.

The requirements of modern war have outrun the erstwhile satisfactory formal organization. Bureaus and Services can have responsibility for

parts of a complex development, instituted and ordered from the top, but often no one Bureau or Service can do the whole job itself. Nor in fact, can it be done from the top unless some of the men in positions of great authority grasp the trends of science and its implications. This they can do only if science and its applications have bulked large in their professional careers.

The problem, therefore, is to provide some means by which scientific and technical thinking of the highest calibre may fuse with military thinking at the top level of command. A number of things can and should be done to bring this about. The precise steps which must be taken will, of course, to a large extent depend upon the ultimate framework of the military organization. The full solution will, naturally, come slowly, particularly since the art of using scientific and technical thinking as a part of top level planning will not ensue merely by providing for its presence. There must be a conviction within the Services that individuals must be so placed. Moreover, such individuals must be of the intellectual fibre and background to enable them to synthesize the two types of thought, military and scientific, into an integrated whole.

SECOND: The position of the technical man in uniform must be improved.

It is not enough merely that technical and scientific planning be done at the level of high command. The position of the technical man should be improved throughout the length and breadth of both the Services. Men in responsible positions should have better technical training. Conversely, soundly trained technical men should be eligible for high command. Lastly, broad or complex programs of research and development should have a status

at a staff level.

Under conditions of modern war a grasp of broad technical trends would seem to be as fine a qualification, when combined with indoctrination in the art of command, as an officer of the top rank could possibly have. Yet, the practice of the two American Services seems to have been based on the assumption that technical specialization is incompatible with high command. It is hard to see how this tradition ever arose; yet it has certainly existed for a long period of time. It is reflected in many ways: In the limited courses on science given at West Point and Annapolis, in the failure of the regulations on promotion and selection for high command to give due credit to advanced scientific and technical accomplishment - in effect, the road to high command lies through field command alone. As an example, the Construction Corps of the Navy, although it certainly produced outstanding combat ships and although it attracted, while it existed, some of the finest minds in the Navy, nevertheless did not furnish a corresponding quota of officers to positions of high command. The difficulty under which the scientist labors is also reflected in the fact that research unsuccessfully conducted places a permanent blot on a military career. It should be recognized, however, that in research which is forward looking and advanced in nature, many failures are the price of one success.

Men in uniform should receive better and more fundamental scientific training. Provision should be made for advanced scientific training of large numbers of officers either at special service schools or through a fuller utilization of existing colleges and universities. The War College idea is a sound one. It should be extended to include an advanced military college devoted to the evolution of weapons and its relation to strategy. It

should bring together for training officers of land, sea, and air. Its courses and problems should be tough so as to test and exert the best brain power. Successful completion of the course should give an officer definite credit toward promotion in the line that leads to great responsibility and high command.

The Service Schools themselves will want to bring new methods of teaching and new subjects to their curricula. They will want to follow the modern trend and give more attention to expanding the horizons and broadening the mental grasp of the officers-to-be.

Until technical men in uniform are given better training and until they find a readier route to positions of command, it is certain that the top levels of our military command will not grasp the full implications of military innovations and will not be organized to handle them to optimum advantage in some possible future highly technical war. We have, of course, today some officers at high levels with a technical background and appreciation. The rapid technical advance of air warfare, and the constant peacetime association in the Navy with technical matters, inevitably has produced such individuals. My point, however, is that we must have many more such individuals and they must have a broader scientific preparation for their responsibilities.

The position of the technical men in the Services suffers not only from the failure to give a position of importance and responsibility to skilled scientists and technicians, but also from the failure to give an independent and important status to research and technology itself. In the Services, research is subordinated as incidental to the work of branches whose primary interests and responsibilities are in other directions.

The Services have not yet learned - as industry was forced to learn

a long time ago - that it is fatal to place a research organization under the production department. In the Services, it is still the procurement divisions who maintain the research organizations. The evils of this arrangement are many. Basically, research and procurement are incompatible. New developments are upsetting to procurement standards and procurement schedules. A procurement group is under the constant urge to regularize and standardize, particularly when funds are limited. Its primary function is to produce a sufficient supply of standard weapons for field use. Procurement units are judged, therefore, by production standards. Research, however, is the exploration of the unknown. It is speculative, uncertain. It cannot be standardized. It succeeds, moreover, in virtually direct proportion to its freedom from performance controls, production pressures, and traditional approaches.

In the case of research, a scientist agrees to use his best efforts in the solution of a particular problem and he is paid for the effort and talent which he devotes to the job. Since research is speculative, a research scientist must be paid - or promoted - whether or not he succeeds in solving the assigned problem. In the case of procurement, on the other hand, one must furnish a particular product to meet stated specifications and one is, therefore, only paid - or promoted - for a product which satisfies those specifications.

Moreover, a procurement unit is under constant pressure to produce sufficient quantities of material for use on the far-flung battlefronts and can make no adequate or special provision for the prompt supply in small quantities of important new devices. To be effective, new devices must be the responsibility of a group of enthusiasts whose attentions are undiluted by other and conflicting responsibilities. As it is now, with

nearly the entire procurement scheme geared to the mass production of great quantities of standardized equipment, the small special job becomes an orphan.

The union in the Services of the research and procurement functions has one other unfortunate consequence. A procurement unit which also is responsible for research is not anxious either to use or to recognize the merit of developments made by those outside the unit. Human nature being what it is, and it is certainly no different inside military organizations than outside, the result is to slow down the adoption of devices which first appear or are first suggested outside of the procurement unit. This may be particularly serious when we remember that modern weapons may either draw their components from or be, at least in part, the responsibility of several competing procurement units - each of which is in a position to retard or advance the progress of the other.

What is required is a separate organization within the Services for research, for development, and for rapid procurement, in experimental production, of small lots of new equipment to be used for field testing, and in critical situations for actual use against the enemy. Such an organization must be in the hands of trained enthusiasts and, although linked at all levels with all branches of the Services, it should report directly to an officer on the very top level of command who has the training, vision, and competence to direct the broad formulation of new weapons and to devise the techniques by which they should be employed. This will make it a main staff function to coordinate research, procurement and requirements - a job which can be done only by men who thoroughly understand all three.

THIRD: There should be a genuine scientific interlinkage between the two Services.

In these days, when technical liaison between the two Services is so complete and functioning so effectively, it is hard to realize that there was a time not so long ago when the two Services were completely insulated from each other in certain technical areas. The failure of the two Services to have technical cooperation at all levels was not only wasteful and short-sighted from the point of view of technical progress, but harmful to adequate preparation for the defense of the country.

This problem of technical interlinkage between the Services is, of course, only incidental to the important, broader problem of adequate interrelation between the Services on all subjects. That problem is one which this Committee will wish to explore very thoroughly. In whatever way adequate linkage between the Services may be brought about, whether by a permanent Chiefs of Staff organization or otherwise, it is evident that such interrelation must be extended to technical matters.

On this question of mechanics, however, it is my personal view that, in peacetime, the device of linking the two Services with joint boards which report only to the two Services will be ineffective. Such Boards would have no one in a position of authority to resolve the inevitable differences. The Boards could operate only by unanimous consent. In wartime, however, such an arrangement does manage to work. The reason, of course, lies in the fact that, under the exigencies of war, men will agree. In peace, there is no comparable stimulus to agreement. Moreover, operating on a basis of agreement through joint boards, is contrary to the fundamental and ever valid military principle that some one person must have the responsibility, and the power, to resolve all differences.

The technical problems of the two Services are, of course, not the same. Yet, there are broad areas on which they overlap. The fact that the problems and points of view of the Services differ to some extent would be a distinct advantage in any interchange of ideas. This cross-fertilization of ideas between two groups, each with its own particular set of problems, has long been established as an essential prerequisite to successful research. Scientific achievement on one set of problems can often furnish the key to progress on a broad front,

Adequate interlinkage will also avoid unnecessary duplication of facilities and effort, particularly when it comes to building large numbers of expensive devices. This does not mean, however, that there should not be parallel programs within the two Services, In the early stages of research and development on any problem, parallel programs are essential, not only to insure that all avenues of attack are covered, but because a parallel approach affords the necessary stimulus of competition. It keeps research scientists on their toes. Parallel effort is often highly economical in a long-range sense.

Whatever interlinkage of the Services is ultimately provided, it should not be allowed to inhibit the esprit de corps and the pride in organization which is at the heart of much of our military strength. We owe too much to the aggressive fighting spirit of our Navy, of our Marines, of our Air Forces, and of our indomitable Infantry to take any steps which would reduce the justifiable pride of belonging to unique, aggressive, skilled, fighting organizations. The significance of the uniform should not be diluted in the name of economy. Rivalry between Services and branches, extending even as it sometimes does to absurdities, nevertheless is a real source of military strength.

FOURTH: There should be some form of parternship between civilian scientists and the military.

An improved form of civilian collaboration with the military on matters of military research should be worked out. This may be done within the Services themselves or outside of the Services, by means of a civilian scientific body with both the power and the funds to initiate research. Both of these alternatives are worth a brief examination.

(a) Civilian Collaboration Within the Services.

The problem of working out within the Services a status for civilian scientists and technical men is particularly acute. American practice has

been to insert such civilians at various levels. As a result, civilians have had to report directly to the uniformed personnel at the level to which they were attached. In spite of notable individual exceptions, this practice does not attract into the Services scientific and technical men of the highest calibre.

American practice has also been to keep the civilian organizations attached to the Secretaries small. They operate primarily to keep the Secretaries informed and especially in connection with procurement, to implement the policies of the Secretary in connection with the business affairs of the department. The philosophy, and it is a sound one, is that the Secretary will determine internal policies and conduct external relations with other agencies of the Government, but will not interfere with the detailed performance of essentially military matters. Thus, in this country we do not find civilians operating important branches within the department and reporting to the Secretary.

British practice has been somewhat different. In the Admiralty, for example, there has long been a civilian structure, on matters of finance and business, reporting to the permanent Secretary of the Admiralty. Separate ministries for procurement divide the business from the military affairs of Army and Air Force up to the level of the Cabinet. Under these circumstances, and under the pressure of war, there has been a decided trend toward the organization of research and developmental matters in

such a way that civilian research workers report through civilian organizations to the top.

In this country during the present war the OSRD, as an emergency measure, has produced some of the same result. It is linked to the uniformed services at all levels, but reports directly to the President. The OSRD also maintains sufficient independence and initiative to insure vigorous action, and to hold its civilian workers under civilian control, which they understand and under which they work best.

One solution to the problem thus lies in the great expansion of the offices of the Secretaries in time of peace, with a civilian branch devoted to research and development. This has its distinct advantages. It can be carried to the point where there is a full structure, on basic research, on far-reaching developments, in civilian hands, within the control of the department itself, but in parallel with the current improvement of existing weapons by the Bureaus and Services. The experience of the British, and their further development of this scheme after the war, will be worthy of serious study. The scheme is, however, contrary to what has long been pre-war American practice.

Another approach lies in revised organization within the existing branches of the Services so as to achieve more effective use of their civilian employees. The emphasis should be on an essential professional partnership between scientists and military men. The conditions of civilian

employment should approach, in opportunity for recognition, freedom of action, and group esprit de corps, those of the better university and industrial organizations, if scientific men of the highest calibre are to be attracted.

A third approach lies in expanding and improving the Services' system of contracting with private laboratories for research tasks. It is important that contractors be given a free hand to carry out their assigned tasks in accordance with their own conception of what should be done. In the last analysis, it is the effort and the particular talent of the skilled civilian scientists that should be sought. That effort and that talent will only suffer if the Services seek to substitute their own ideas and instructions or the ideas and instructions of their lower echelons for that of the skilled technical men in the contractor's employ. The research scientist is, after all, exploring the unknown. He can not be subjected to strict controls, nor can he be given detailed instructions as to the solution of the problems which he is retained to solve.

Which of these or other approaches should be adopted by itself, or in combination with others, must depend in the last analysis on what our postwar military structure may turn out to be, on whether the position of the scientist within the Services is improved, and on whether the overall organization for research and development within the Services is adequate.

(b) Civilian Collaboration Independent of the Services

Regardless of what the internal organization of the Services may be, it is desirable to have outside of the Services themselves a civilian body with authority, and funds, to conduct research on matters which have military significance. In this I agree with the recommendations of the Wilson Committee that it is an excellent idea to have some sort of an independent agency eventually established by the Congress for the purpose of enlisting the aid of top civilian scientists on the scientific aspect of military problems.

I should also say that I agree with the Wilson Committee recommendation that, in the meantime, there should be a Research Board for National Security under the National Academy of Sciences, to bridge the gap between the termination of the OSRD and the eventual creation of an independent agency under mandate from the Congress. The OSRD is a temporary war agency. It was established for a war purpose and as such was properly organized on a basis of highly centralized authority. As presently set up, it should go out of existence at the end of the war. Any new organization, either interim or permanent, should be organized on a more representative basis and definitely for its peacetime purposes.

The problem is one of timing. If we could tell with any certainty now what the postwar military structure of the United States is to be, if we knew how and whether the two Services are to be linked with each other, if we knew where the Air Forces were to fit in, whether the Joint Chiefs were to continue, whether there is to be an organization comparable to the British War Cabinet, if we knew these things and more, it might be possible to eliminate the interim step and move directly to the establishment of a

permanent independent agency. Since none of these things is now clear, some interim organization is necessary.

An independent civilian body having both authority and funds would ably supplement the efforts of the Services with the freshness of approach and independence of mind which is invaluable to successful research. For nearly thirty years the National Advisory Committee for Aeronautics has been such a body. That Committee, of which it was my privilege to be Chairman for several years, supervises and directs the scientific study of the problems of flight in the closest of cooperation with both the Army and the Navy. If it had not been for this Committee, our country would not have been in the strong position in which it found itself in aeronautical matters at the beginning of this war.

We must face up to the fact that although research on military problems and military weapons is largely a military matter, it is not entirely so. The job is primarily one for the trained professional scientist and engineer. It is a mistake to believe that since science has military importance, scientific research should be run exclusively by military men.

The two Services exist to fight. That is their primary reason in being. In order to fight a modern war, the military must draw upon industry, agriculture, science, and all the other facets of our economy. Because industry, agriculture, and science have vital military uses does not mean, however, that they should be made the exclusive responsibility of the military.

It is true that the Services have been charged with the defense of our country. It does not follow from that premise, however, that all aspects of the civilian economy which have vital military significance should be the exclusive function of the military. Not only would that be illogical,

it would be a great practical mistake. The military cannot be expected to be experts in all the complicated fields which make it possible for a great nation to fight successfully a total war. The job of fundamental research can succeed best if given to those best trained to handle it.

Civilian science must clearly do the job, which by specialized training, it is equipped to do. Civilian science cannot make its true contribution, however, if its efforts are subject to the complete direction of the military or if it has no independent funds. The real answer to the problem, of course, is a partnership between the military and civilian scientists. But a true and effective partnership can only come about if both are equals in a common endeavor. They must be equals and independent in authority, prestige, and in funds.

Whether or not a civilian body for military research should also be responsible for research on non-military matters involves a problem of formal organization which need not be gone into at this time. It is a matter, however, to which I am giving careful thought in connection with the reply I am planning to make shortly to an inquiry from the President.

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Although it is premature to draw any blueprints of postwar organization, and although for reasons of military security we cannot yet publicly discuss the detailed experience of this war as a basis for future planning, a full appreciation of the four principles which I have mentioned this morning will, I hope, aid in the construction of a sound postwar military organization. I think it important that these principles be recognized and implemented. The particular mechanics by which they are carried out is of lesser importance. On the other hand, regardless of the machinery

which may be constructed, if there is no conviction or enthusiasm for the role which scientists and technicians must play in modern war, we can expect no greater degree of achievement in the next period of peace than in the two decades preceding the present war.

I am so sure that the evolution of weapons is exceedingly important in the conduct of modern war, so anxious to impress this importance that we may be fully prepared for what may lie ahead of us in the future, that I should add a word to be sure I am not misunderstood. The weapon is an adjunct and a tool only. It should be better than the tool in the hands of the enemy. But wars are fought by men. The fighting strength of this country rests on many factors, and we will be strong only as each element is strong. It rests on the skill of military leaders, their ability to command, their readiness to accept appalling responsibility which would crush men of weaker fibre, their knowledge of their complex profession. It rests on business men, on their patriotic willingness to take chances in a common cause, on their ability to organize and manage complex affairs. It rests upon every laborer at the bench or in the field, upon their technical skills and their determination to support their sons in combat by supplying them fully. It rests upon the women of the country, as they endure the stress of war, and as they encourage and support their men folk, and carry on men's work. It rests especially upon the men in the ranks, upon their ruggedness of body and mind, upon their fighting spirit, upon their belief in their cause as they come to define it.

The scientists in war are merely one more group in a country which fights. They have special skills and training, which can be especially useful when intelligently applied, and which should not be squandered.

They are doing their full part in this present war. They are in no sense a privileged class, they are just one more group in a democratic society, ready and willing to put forth their best efforts in whatever way will best serve the common cause. They are exceedingly proud to be full partners in the present dangerous effort, and they will stand ready to serve their country in times of peace by adding their bit to the national effort to maintain this country strong, under whatever scheme of organization may emerge.