MOBILIZATION OF SCIENCE

23 October 1951

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Dr. Oliver Ellsworth Buckley, Chairman of the Committee on Scientific Research in the Office of Defense Mobilization, was born in Sloan, Iowa, 8 August 1887. He received his B.A. degree from Grinnell College 1909; Ph.D. in 1914; and Sc.D. in 1936 from Cornell. In 1948 he also received a D.Eng. from Case and a Sc.D. from Columbia. From 1909-1914 he served as physics instructor at Cornell at which time he joined Western Electric Company where he served until 1925. He then joined Bell Telephone Laboratories and rose to the position of president in 1940, which position he held up to the time he accepted his present position with the Government. He is a member of many scientific organizations and is the author of many scientific papers.

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COLONEL DIEHL: General Vanaman and gentlemen: In the past week you have heard many distinguished men of science, men from industry, from the universities, from the scientific organizations and nonprofit organizations of our country, and men from the scientific departments of the Government, tell you of the problems of their agencies. Ordinarily in our course this would complete our schedule—but this is the year 1951. This is not an ordinary year. Our government today is facing problems in the field of science that it never faced before. It has to tie together those things that you have heard from other speakers. To bring you the picture of what the Government is doing in the mobilization of science, we have asked our speaker, Dr. Oliver E. Buckley, to address you.

Dr. Buckley is Chairman of the Science Advisory Committee of the Office of Defense Mobilization. It is a great pleasure, Dr. Buckley, to welcome you to the platform of the Industrial College of the Armed Forces.

DR. BUCKLEY: General Vanaman and gentlemen: I count it a great privilege to come before you, because I expect to learn fully as much from you in your questions and comments as you may have the opportunity of learning from me.

Let me say at the beginning that my talk is to be a very informal one. I have no written speech. It is an off-the-cuff talk.

I want first to tell you what my job is, because you may wonder what the Science Advisory Committee is. I really have two jobs here in Washington under the same title. I am chairman of a committee and I am a member of Mr. Charles E. Wilson's staff.

The committee of which I am chairman is one set up by the President with this directive:

> "To be available to the Defense Mobilization Director and to the President, (a) to provide independent advice on scientific matters, especially as regards the objectives and interrelations of the several Federal agencies engaged in research of defense significance, including relevant foreign relations and intelligence matters; (b) to advise on progress being made in dealing with current scientific research problems of defense significance and also concerning defense research matters which need greater attention or emphasis; (c) to advise concerning plans and methods for the implementation of scientific efforts for defense; and

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(d) for transmitting the views of the scientific communities of the country on research and development matters of national defense significance."

I have to call your attention to the first words of that—"to be available." To do all these things is more than we could do, but we are available to advise when requested on any of those points.

The committee consists of Dr. Detlev W. Bronk, President of the National Academy of Sciences; Dr. Walter G. Whitman, Chairman of the Research and Development Board; Dr. Alan Waterman, Director of the National Science Foundation; Dr. Hugh Dryden, Chairman of the Interdepartmental Committee on Scientific Research and Development, also Director of the National Advisory Committee on Aeronautics; Dr. James B. Conant, President of Harvard; Dr. Lee DuBoridge, President of California Institute of Technology; Dr. James R. Killian, President of MIT; Dr. Robert F. Loeb, of the College of Physicians and Surgeons; Dr. J. Robert Oppenheimer, Director of the Institute of Advanced Studies, Princeton; and Dr. Charles A. Thomas, President of the Monsanto Chemical Company. This is a very fine committee to work with, as you can imagine. But all of them are very busy executives.

My staff consists of an executive secretary, who is also a deputy in my relations with Mr. Wilson. He is Dr. Willis A. Gibbons and he is here today. We also have a private secretary, who serves us both. That is all our staff. It is all the staff we need since we are wholly an advisory and not an operating group.

In fact, before I took the job, I made a point of knowing how we would work. I laid out some rules or principles for this committee. I would like to read those to you, because I took them up with every member of the committee by personal contact before I accepted the position. I finally took them up also with the President and got his approval.

"The committee is to be advisory and not operating." We don't operate anything or take over anybody else's job. "To be constructive and not obstructive." I didn't want to get in the way of anybody else doing his regular job. "To work with and through existing committees." I didn't want it to be a committee on top of committees. "To have no budgetary responsibilities." I didn't want the Committee to spend its time on matters of budgeting. This does not mean that I would not give personal opinions on budgetary matters, but the committee as a committee would not endeavor to exercise any budgetary control. "To operate informally by personal contacts and with a minimum of formal reports." I thought we could be most effective in that way. "To avoid fanfare and minimize public appearance." And when the President came to that, he said he liked that one best of all. "Not to dominate

over or to dictate to other agencies. Not to assume the role of the cognizance of all science." I have to explain that one a bit. In one sense we do have cognizance of all science, but we don't profess to know all about all science in relation to defense.

That gives you an idea of how we work. Just what we shall do remains to be seen. We are gradually working out an understanding of the problems of science in relation to defense. If it takes a little time to do it, meanwhile we are not standing in the way of anybody else doing his job. We are available at anytime to give advice to the President, to Mr. Wilson, to the Secretaries, or to anyone else who requests it. But we don't wait for requests to come to us. We are actively studying the problems of the application of science and the best utilization of scientists in the defense effort.

However real our accomplishments are, they will never be very apparent. If this committee operates as I desire, its accomplishments will appear in what others do; and all that they do should be to their own credit. This committee does not seek credit for its own actions; you can't divide credit on things of this kind. The desire of the committee is to help other people to do their jobs rather than to take over part of their jobs for them.

The subject matter that I would principally like to cover in this discussion is our situation now compared to what it was at the beginning of World War II. I think we can learn something from a comparison of the two situations. Then, if there is time, I would like to point out some of the principal needs of the present situation as I see them.

The period between World Wars I and II was a period of growth of industrial research in this country. Industrial research was quite a new thing at the beginning of that period. It actually had its origin right about the beginning of the century, but by 1917 it had not grown to be very large. The growth was slow up to that time. Immediately after World War I its values began to be recognized in industry generally, and there was rapid growth all through the interwar period. By 1941 the expenditure in this country on industrial research had topped 500 million dollars a year. It has had an impact on every phase of American life--on life in communities, on transportation, on manufacturing of all sorts, and on health and everyday living.

One of the important concepts that developed in the interwar period, and became one of the great strengths of industrial research, was teamwork in research. The research that had been conducted in universities was very largely an individual affair. The individual scientist worked in his own laboratory. One of the things we did in industry was to group scientists together in teams to accomplish defined objectives. That concept later got into the universities, notably in some of the big cyclotron projects. It has spread widely since in academic research.

Of course, this same period was a period of great growth in academic research. By 1941, already feeling some of the impact of the war, it had grown to 80 million dollars. This, among other things, was an age of electronics, which got its actual beginnings about 1908. It hadn't grown very large even through the period of the First World War. Electronic devices were used in communications to some extent in the First World War, but the extent to which we used electronics was small. Immediately after the war there began our tremendous growth of electronics technology. It still has not had its full growth.

It was in this same period that the science of nuclear physics had its beginning. The possibilities of atomic energy were recognized close to the end of that period. The first fission of U-235 was in January of 1939.

This was also a period of military research and development. Of necessity the military research and development during that period had to be done in terms of concepts drawn from World War I. But not wholly so, because some new technologies got their start. Among them was radar, which got its start in the Naval Research Laboratory in the early thirties. Fortunately, it made considerable real progress before we got into World War II.

World War II had a tremendous impact on research and development. There was a great mobilization of effort of both academic and industrial laboratories, with a rather gradual build-up during the period of the war. That culminated in an almost all-out mobilization of industrial research, as well as academic research, at the height of the war.

The mobilization of academic science in this period was of particular interest. When the impact of the war in Europe was felt, it was recognized that there would be need to make use of all of our scientific talent and particularly our brilliant scientists in the universities. But there was no existing mechanism suitable for doing it. We had in the National Research Council of the National Academy of Sciences a mechanism for giving advice to government agencies on scientific question, but it was wholly advisory. We needed some way of getting an operating job done in research and development by the university people, so that their talents could be used, as industry was being used, directly by the service agencies.

This need was recognized particularly by four very important scientists associated with the National Academy of Sciences, including the president of the National Academy of Sciences, who at that time was Dr. Frank Jewett, then president of Bell Telephone Laboratories. Dr. Jewett, Dr. Conant, Dr. Bush, and Dr. Compton put their heads together and proposed a new agency called the National Defense Research Committee. This provided a means of contracting with universities or other institutions to do

research. This committee drew together the military problems and the scientists and provided a practical means of implementing their efforts.

In this connection I would like to read a quotation from the book, entitled, "Organizing Scientific Research for War," by Dr. Irvin Stewart, who was the secretary of that group. Many of you are probably familiar with the book. There is stated in it the basis for the National Defense Research Committee, which later was merged into the Office of Scientific Research and Development. It reads:

> "What was needed was an organization which could make its own assessments of what the armed forces needed, and which could then, preferably with the assistance of the services, but over their opposition if necessary, go about the business of getting the necessary weapons developed. Previously our efforts to bring science into the program of weapon development were based on the theory that the services would know what they needed and would ask scientists to aid in its development. Modern science had progressed to the point where military people were not sufficiently acquainted with its possibilities to know what they might need with a reasonable expectation that it could be developed. The time called for a reversal of the situation, namely, letting men who knew the latest advances in science become more familiar with the needs of the military in order that they might tell the military what was possible in science, so that together they might assess what could be done."

These words are very interesting to read at the present time as showing the state of mind of the scientists at that time. You might not agree that such state of mind was fully justified; but I am sure that in some measure--and, I think, a large measure--it was well justified. It is rather interesting to contrast that with the present situation.

Let me say that from my observation the opposition of the services referred to was not encountered to any great degree. My own experience as chairman of one of the subcommittees was that we got the utmost cooperation from the military organization.

So from its start the National Defense Research Committee, in addition to giving a means for contracting for the use of academic researchers in their own laboratories, gave contact between research people and the military on the right level. It gave freedom for research to be effective, so that scientists could go after problems in their own way, rather than by being assigned little jobs on this or that. But it gave, more importantly than anything else, leadership of full-time outstanding scientists and scientific administrators in research with military objectives.

The NDRC was later merged with the Office of Scientific Research and Development under the directorship of Dr. Vannevar Bush, who was the first head of NDRC.

The success of this organization was so great that I don't need to dwell on it here. You are all very familiar with it. But I wouldn't wish to imply that it was the sole source of research and development during the war. Indeed, the development aspect of the job, as contrasted with the research aspect, was largely handled outside the OSRD. But from the work of OSRD came research and some development which played a very significant part in the war, and without which we should have been in a sad state indeed.

How different the situation was by the end of the war! We had developed a tremendous research and development activity. By 1945 the whole research and development effort of the country had grown to cost nearly 1.3 billion dollars on an annual basis. Of this industry was assuming a load of over 800 million dollars. Academic research and development had grown to 100 million dollars and was substantially all under government contracts. The industrial load of over 800 million dollars was about 50 percent under government contracts. But a great deal of that which was done by industry not under government contracts was nevertheless defense research and development that industry was supporting on its own.

Then in addition to that was the research work done by the Government itself in its own laboratories. That had grown to a load of about 450 million dollars.

Money, incidentally, is a poor measure of research and development effort. It just happens to be the one measure on which I have figures. You can spend a lot of money on research and development to no good purpose at all. It has to be wisely spent. A dollar wisely spent on research and development may be worth more than 10 dollars unwisely spent.

At the end of the war we had more than this great build-up. We had an established pattern for contracting for research and development. There had also been a tremendous growth of government laboratories. And, of course, we had an appreciation of new ways of utilizing science based on new experience by the military of what science could do for them. It was highlighted by radar and the accomplishments in the field of atomic energy; but we also had something on the other side of the book. We had a gap in the progress of fundamental research which called for the return of our top scientists from government work. It was essential at the end of the war to get out of this pattern that had been established for the emergency. It was recognized that the responsibility for their own research and development should reside in the military

services but that was need for coordinating the research for the three services and getting an organization of science better adapted to the situation we then faced.

It was for this purpose that the Research and Development Board was established. I understand that this class has had, or will have, a lecture on the functions of the Research and Development Board, but I might just review those functions for you--reading from the official statement:

> "Under the direction of the Secretary of Defense, the Research and Development Board is responsible for preparing a complete and integrated program of research and development for military purposes,,advising with regard to trends in scientific research relating to national security, and measures necessary to insure an increase of progress; recommending measures for coordinating the research and development among the military departments, and allocating among them responsibility for specific programs of joint interest; formulating policies for the Department of Defense in connection with research and development matters, including agencies outside the department; and controlling the interaction of research and development and strategy and advising the Joint Chiefs of Staff in connection therewith."

Experience with the Research and Development Board has taught us something of the need for further development of our scientific potential in relation to military needs. We still have a good way to go, in my opinion, to make of the Research and Development Board all that might be made. But very constructive steps are being taken in that connection.

Meanwhile I can say that the values of that Board and of its activities are, in my opinion, far greater than has been generally realized. By its very existence the services are compelled to get together more effectively than they otherwise would on research and development matters. But they still leave something to be accomplished in this regard.

Let us examine how we stand at present. In the field of industrial research we have grown from 520 million in 1941 to a total of 1,630 million dollars, estimated, for 1952. Of this, 30 percent is government and 70 percent is work of the industrial laboratories on their own behalf. But not all of that is selfishly on their own behalf. Much of it is very important for defense purposes. I have no way of measuring how much of this private research is of defense significance but I believe that a large fraction of it is. However we still have not reached the full proportion of industrial research that might be directed toward military problems. We got to about 50 percent in 1945. We are at about 30 percent now.

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Academic research represents about 10 percent, roughly, in money costs of all the research and development of the country. Of course, the university people are principally concerned with the research side. The development of the products of research runs to much bigger money than does the research itself.

Academic research has grown from 80 million to 260 million dollars, of which about 46 percent is supported by the Government. Of the amount supported by the Government, the Department of Defense is paying about half, the Atomic Energy Commission about a quarter, and other agencies the other quarter.

Research and development in government institutions has grown from 200 million in 1941 to 430 million in 1945; for 1951 it is estimated at 700 million dollars, of which the Department of Defense is responsible for 64 percent, the Atomic Energy Commission 14 percent, and other agencies 22 percent. These are just money figures. You have to look at the value of the dollar in relation to them; and the dollar, even as it is, is not necessarily worth as much in one place as it is in another. But I think it is worth while to have an over-all dollar picture.

More important than dollar figures is our situation in technology. We have a host of new materials. We have a tremendous expansion in electronic technology, which is due for a complete change and additional expansion with the invention of the transitor. This device will open a new era in electronic technology as the vacuum tube opened a new era before. We have atomic energy, which was merely a laboratory concept at the beginning of World War II, and which is now one of the largest activities in the country with all of its implications, with which you are familiar.

I look on the atomic energy situation for this period as being somewhat analogous to the electronics situation at the beginning of World War II. We can expect atomic energy to have an impact on military thinking and military action even greater than that of electronics.

Our technical manpower has also grown. Our engineers and scientists are up 64 percent over 1941. But even at that we seem to be faced with a tremendous shortage; and this in spite of the fact that the capacity of engineers and scientists has been tremendously increased by new tools that they can work with and new ways of working; so that an engineer or a scientist can do more than he could do before.

What, then, is the reason for this great shortage of which we hear so much? Well, in part it is the tremendous growth of technology. In part it is a greater appreciation of what the scientists and engineers can do. But in part also it is a kind of inflationary demand. Industry finds it very profitable to push its own research and development right on top of military demands for research and development. All of this makes the demand much greater than the supply.

There is not a falling off of the total technical manpower, as some people have indicated. Actually the number of men coming in from the colleges is more than the number going out from old age. But it is not enough more to supply all the prospective demands. We can't do much about that for the next few years other than make the best use of the men we have.

And now, as I turn to the matter of what needs doing, I think one of the most important things that we have to do is to use effectively the technical manpower that we have. This means using technically trained people on technical jobs. It means giving them the right tools to work with and giving them specialized assistance.

I have had some experience with this problem. I found in the Bell Laboratories during the war that we could tremendously increase the output of our development people by giving them enough hands. I got hold of a bunch of telephone installers whose work had been falling off. I put those telephone installers in the laboratory and let them work with the scientists and engineers as helpers. This increased the output of the scientists. We need more of this kind of planning and more use of mechanical and other help to increase the capacity of the research and development engineers that we have. It can be tremendously increased in this way.

Military organizations should not use trained scientists and engineers in nontechnical work. They can get other people for that work. Industry itself can do something in this regard.

Another clearly indicated need is better coordination of military research and development programs to insure elimination of duplication where it exists and the discontinuance of outdated projects. In this I could point my finger at all three of the military services, because I am sure there is room for improvement in this regard.

One of our failings is that we never stop anything. Everything that ever gets started is carried on. It is awfully hard to stop research and development work. It goes on and on. The people in charge never want to stop it. This takes some control. You have to go and say to some people "You have to drop this" even on some good jobs. Then you have to see that they stop them. Some of the ones that should be stopped may look pretty important to those doing the work. But you will find out soon enough if the jobs are really important or not if you stop them. That releases people for other work. There simply isn't a sufficient supply of technical manpower to get all the projects done that people would like to carry on.

We also need greater efficiency in government research. It needs to be better rather than larger. The growth of research in government institutions, let me say here, is more rapid percentagewise at the

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present time than the growth in academic or industrial research. Whether that is right or not I don't know, but it needs careful scrutiny. I suspect that internal government research is growing relatively a bit too rapidly. It makes me suspicious that not enough attention is given to stopping jobs.

Obviously, what we want is better quality, and that means higher-grade people. It means that the situations have to be made attractive to higher-grade people. There must be a favorable atmosphere for doing research. That means giving the research man a fair degree of freedom. It does not mean having a military man looking over his shoulder while he works, which has happened in some cases. The military may define the technical problem, but that doesn't mean necessarily the problem in the sense of a specifically assigned job. It should be, rather the ultimate objective to be achieved.

In fact one of the most valid criticisms, I believe, which is made of the military laboratories is that they are given "jobs" to do rather than "a job" to do, if you can get the distinction between those two objectives. It has been my good fortune to spend most of my active career in the Bell Telephone Laboratories, where one of the first things that I learned as director of research was that one thing a director of research should not do is to direct research. You must leave it to the fellow on the job to direct the research. You can point out to him general objectives for the area in which he is assigned.

We in Bell Telephone Laboratories work to achieve "the best possible telephone service at the lowest possible cost." The technical means for doing that is our responsibility. That is our only directive. That is all we need. We have done an outstanding job, partly because we had that simple directive. We had "a job" to do. We aren't assigned a lot of little jobs to do—this or that or the other thing, that the operating companies may need. We hear of their needs and get their advice. We go out and investigate their needs. But we determine how those little jobs fit into our over-all job. I think there is something here to be learned by some of the military laboratories and some of the other government laboratories.

But the laboratories aren't the only places for scientists. More attention should be given by the scientists to the application of scientific help to the operation and use of new weapons. One of the faults of research and development during the war was that too many gadgets were developed. There is a tendency even at the present time to develop too many gadgets, without enough attention to the problems of use and operation, which also call for scientific help. We are going to have, if we don't look out, more complicated tools than we know how to use properly.

But of all our scientific needs the one that stands out to me most importantly is the need for scientific leadership. We need more full-time, outstanding civilian scientists in all military research and development, in both the laboratories and staff positions. This I am impressed with more than anything else. How to achieve the desired result, I don't know; that is a problem that has to be worked on.

The question has been often raised as to whether we shall need another thing like the Office of Scientific Research and Development. I hope it will not be necessary, because I like to see the services responsible for their own research and development. This is a subject deserving of more study. But, however the problem is solved, there is no question as to the need for outstanding scientific leaders in the military organization. We need continued support of fundamental research and teaching. We must not have the gap that existed during World War II, when most of our fundamental research was stopped and teaching was greatly curtailed.

It all calls for continuous effort to improve, but if we continue our support of fundamental research, if we make the best use of the people we have, and if we increase the efficiency of our work in government institutions, we shall find that we have in manpower, materials, and skills enough to meet any situation that we may encounter.

QUESTION: Doctor, we have a problem when scientists and military people get together. You have said that the director of research should be only advisory. How do you apply that to the military directors of research?

DR. BUCKLEY: Let me say that any answer that I give to this question I wouldn't want to be taken too generally, because if you take specific situations, they might indicate specific answers. Let me say too that I recognize that among the people in uniform there are some very good scientists with some excellent capabilities of directing scientific work.

But as a general proposition I believe that the organization of scientific work for the military under civilian direction is indicated. Civilian scientists should be under civilian direction.

I think as a general proposition that is right. At the same time I believe that it must be recognized that there must be military command of the situation in the operating sense. But I think the military laboratories need all the freedom of work which we have in industrial laboratories, and even some industrial laboratories don't have all that might be desired. The scientist, to do a good job, has to work in his own way. But where you can get a combination of a military head and a civilian science director immediately associated with him, each understanding the other very well, I think they can do a good scientific job.

However, when you get scientists working in connection with military operations, it is not quite such a simple problem. There it may be necessary to have a scientist in uniform. Some halfway situation like that was used during the war on a civilian consultant basis, and it worked out very well.

I wouldn't want to express an opinion that applies generally outside the laboratories, but I think you will not be able to get the quality of scientific leadership which you need in connection with military work by making the scientist take orders from the military as to how he does his scientific work.

QUESTION: We now have a National Research Council and other government agencies connected with scientific research. What should be the role of the military with respect to basic or fundamental research? In other words, the question in my mind is how much responsibility the armed forces are going to have for fundamental research and in how much they should allow other government agencies in the country to take the leadership.

DR. BUCKLEY: That is a very pertinent question and one to which I think the committee of which I am the chairman will wish to give attention. Any opinion that I give now is purely a personal opinion.

The term "fundamental research" is capable of very wide interpretation. There is an understanding, I think, that RDB, as the military agency for research for the military services, is going to devote approximately 6 or 7 percent to the field of fundamental research. Just what is meant by that I am not too sure. It represents a desire to see basic research get support and not have everything go into the applied end.

Pure research, with no specific practical objective, and no obvious relation to military work, is clearly indicated as suitable for the National Science Foundation, recently established with Dr. Waterman as its director. I think that perhaps some of that kind of work now being supported by the military research and development organizations ought to be taken over by the National Science Foundation. That was conceived in the original proposal for the National Science Foundation. There is, however, work of a distinctly fundamental character that is not pure scientific research, but that does have definite and obvious military application, which is certainly more appropriate for support by the military agencies.

Now, just where the line should be drawn between the two is a matter of opinion and not all people agree on it. This, it seems, is a thing that needs further going over.

QUESTION: Do you believe the Department of Defense will have to get any change in the legislation insofar as the Civil Service Commission is concerned before we can hope to attract competent scientists?

DR. BUCKLEY: This is one of the very basic questions and one to which I don't know the answer. I am giving this answer much by way of an opinion.

There are two ways in which the government laboratories are now being operated. There are some government laboratories that are manned by civil-service employees, and there are also government laboratories which are operated under contract with research institutions, so that the employees are those of the contractor.

Among the latter class are the laboratories of the Atomic Energy Commission. There are a few cases of military contracts of this same sort. Some of these contract laboratories are operated by industry and some by universities. In the case of the Atomic Energy Commission, for example, the Oak Ridge laboratory is operated by the Union Carbide and Carbon Company and the employees are of that company.

One gets the impression that on the average the scientists are happier and doing a better job in these contract laboratories and that they are able to attract better scientists than the civil-service laboratories are. This may be just a passing phase. I don't know. It is certainly something that makes one wonder.

I don't know all of the factors involved, but I recognize that it is a very fundamental question. It is unfortunate that the civil-service employment is not attractive to many of the top-notch scientists and that it is relatively more attractive to the lower-grade ones. But there are still some very outstanding people in the military and other government laboratories, operated under the Civil Service, which convinces me that with proper management, great success can be achieved. This is a very fundamental problem in the organization of science in the Government. I don't claim to know the answer.

QUESTION: Doctor, I would like your comments on the extent of research that the Department of Defense should actually be performing and the extent to which it should call on industrial and educational institutions to carry on the bulk of it.

DR. BUCKLEY: It is very difficult to appraise that from where I stand. As I mentioned in my original remarks, the part played by the defense organizations themselves has been growing faster than the other part. It is my feeling that there is a little danger in this thing, and that we would be well advised if, insofar as we have to expand development at the present time, we expand it by contracts as

opposed to expanding it by building up the size of the internal research and development in the services.

My reason for taking that position, which I would say is a tentative one, is that I think there is danger here of overbuilding at the expense of quality in the government institutions. I think there is danger of a deterioration of quality in endeavoring to get more quantity output. That danger might exist also in industry, but we can let industry worry about that for itself.

QUESTION: Doctor, how does your committee keep up with the times? Where does your research committee get its information? Do you get reports from industry or from the other government agencies, or how do you keep up with what is going on?

DR. BUCKLEY: That is a very good question. I must answer it by saying that we make no attempt to be comprehensive in that respect, and obviously we cannot. We cannot keep up with all that is going on. But we do hope that by looking at various segments of the problem we can get a picture of some of the fundamental difficulties that may apply in all areas. There is no assumption that the committee is a top-level superadvisory committee for all science.

We do endeavor to get a picture of some of the current problems in the utilization and mobilization of scientific effort. We don't have to look at everything and know all that is going on in science to do that. We can look at a small sector of it and see what is going on there and then perhaps question whether that applies to other areas and what might be done about it. It is that kind of approach. That is the only practical approach that we can make. If you can advise me of any better approach, I shall welcome your advice.

There seem to be committees to do everything. There are committees on top of committees in Washington. We are not a committee on top of other committees. There are reports on nearly everything; I find it much better to get the reports written or summarized by other agencies. We endeavor to make contacts with people involved with the various problems in which we are interested and to hear what they have to say and to give informally our opinions to them.

QUESTION: Doctor, isn't it true that even though they do have a lot of these committees as advisory to look into these various projects, they are necessary because in selecting some of the most prominent people in science and industry and some universities to make up these committees, normally all of these gentlemen have a job of their own to perform on the outside and they are not on this thing 100 percent of the time, that only a portion of their time is available for that; consequently, aren't you going to need more committees to assist in getting a rounded-out opinion on what is necessary instead of coordinating them in one group?

DR. BUCKLEY: Yes, of course. I did not mean to disparage the committees by remarking as to their number. I think we must have a number of committees. On the other hand, I think that some agencies could make better use of the committees that they have. There is some tendency on the part of some committees to serve as window dressing rather than to look outward for sound things that they should do.

This is not a general comment, but I have seen it happen. Indeed, I have been in on committees where I felt that the principal function was that of window dressing; I don't believe that has any value in research.

Also there is some tendency to try to get committees at too high a level, in other words, to try to keep the committees too far from the level of the people who have the operating problems and the people who are in active charge of administrative affairs.

We may have too many of these committees with only part-time personnel on them. What we need is more well-qualified civilian aid than we have at the present time. We are short of civilian scientists who will give us all of their time.

When OSRD was set up, it did get the full time of a large number of very good people. Under the circumstances which exist at the present time it is harder to get such qualified people to give very much of their time.

QUESTION: Doctor, my question is based on the assumption that your committee in its advisory capacity to the President is going to be confronted at the same time with the question of how much of a research and development load this Nation can undertake. In that connection, based on your observation that budgetary figures are meaningless, especially when it is realized that some 50 million dollars of our present budget is based on information made available by the telephone company, how do you presently plan your approach to this question?

DR. BUCKLEY: That is a very pertinent question--How far do we go in this country and how far is it sound to go? This is a question on which my committee may have advice. It does not have authority, you understand.

But how does one appraise the amount of research and development effort that is sound to apply? I can only say that I have seen it done in the particular industry with which I have been concerned. There it has not been just a matter of dollars and it has not been just a matter of men or of buildings. I frequently put it this way: It is the cost of doing the additional work measured against the cost of not doing it. It is a matter of common-sense judgment. People in authority have to use their common sense in this regard.

I think you cannot say that your research and development program can only be so large because there are only so many men, so many scientists. I will tell you why that is a fallacious argument. It is a fallacious argument because there is a lot of work that is not for the military departments that is being done by industry and the universities, and more could be diverted to military purposes. But it might not be good sense to do it.

Whether it is wise to go further I don't know. But it has to be judged from a common-sense point of view, and I don't believe that the full measure of common sense is being applied at the present time. How to get a better measure of common sense applied to it is certainly one of the problems. I don't think that my committee would be omniscient in this regard.

COLONEL DIEHL: Dr. Buckley, on behalf of the staff and faculty and the student body of the Industrial College, I wish to thank you for a most informative lecture and discussion period.

(27 Dec 1951—750)S./en