ENVIRONMENTAL FACTORS AFFECTING TECHNOLOGICAL PROGRESS FOR NATIONAL SECURITY

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Dr. Ralph D. Bennett was born in Williamson, New York, 30 June 19 He received his Bachelor of Science degree from Union College in New Y in 1921 and a Master's degree from the same school in 1923. In 1925 h was awarded a Ph.D. in Physics from the University of Chicago, and in 1945 he was honored by Union College with a Doctor of Science degree. He has been an instructor in mathematics and physics at Union College, Princeton, and California Institute of Technology, and was a research associate at the University of Chicago from 1928 to 1931. During the six-year period 1931 to 1937, he was an associated professor at Massachusetts Institute of Technology and professor from 1937 to 1946. During World War II he was appointed a Lieutenant Commander in the Nav and rose to the grade of Captain. For his services during World War I he was awarded the Legion of Merit and the Order of the British Empire in the grade of officer. He is a member of numerous scientific societ and is an author of renown. At the present time Dr. Bennett holds the position of Technical Director, Naval Ordnance Laboratory, White Oak, Maryland.

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CAPTAIN MARCY: This morning, gentlemen, we officially begin our series of lectures in the Technological Progress course of instruction. In order to put first things first, we have selected as our topic this morning "Environmental Factors Affecting Technological Progress for National Security," such as research and development.

We are extremely fortunate in having as our speaker Dr. Ralph D. Bennett, Technical Director of the Naval Ordnance Laboratory at White Oak, Maryland. Even a casual visit to this magnificent laboratory is ample proof, if any is needed, of Dr. Bennett's ability to foster and maintain the environmental atmosphere that is so essential to a productive research effort. It is with a great deal of pleasure that I present Dr. Bennett.

DR. BENNETT: Thank you, Captain Marcy.

General Vanaman and members of the Industrial College of the Armed Forces: I consider it a very great privilige indeed to have been invited to address this group. I recognize how carefully you have been selected, and that in your hands rests a very large part of the future of our Department of Defense. I am particularly pleased to come and talk to you about the environmental factors affecting technological progress for national security for it is in this field that I have devoted a very interesting 10 years trying to create a profitable environment in our own laboratory.

The period of the last 100 years has provided the best environment for the advancement of science and the development of technology that the world has yet seen. During this period we have seen leadership in fundamental science develop to full flower in the universities of Britain and the Continent. We have seen it advanced by the endowment of many research foundations in our own country--foundations of which many were made possible by the vigorous exploitation of technology. And we have seen science and its pursuit integrated into our own advanced education, to where, toward the end of this period we have begun to make a respectable share of the basic contributions to scientific knowledge. It is well that we have reached this stage, because with the end of World War II, with the suppression of science in Europe, at least temporarily, partly because of the economic situation and partly because of the Iron Curtain, we shall have to rely more and more on our own efforts for producing the very basic ideas on which science advances and which permit the advancement of our technology.

In our exploitation of science through applied research, we have long held the leading position. We have a very much wider appreciation of the importance of science and technology in this country than exists anywhere else. As a result of this, we have been able to create a standard of living which is unequaled anywhere else in the world. We have enough to provide a standard of living high above that which any other population has ever enjoyed and still have enough left over to provide substantial help to many other areas. This makes it very much worth while to examine the conditions which have led to this development of science and this very great advance in technology in our country.

It seems to me that the first requirement for the development of science was an acceptance of the scientific method; that is, the freedom to accept or reject authority on the basis of experiment and no other. Until we had such a philosophy, it was impossible to really make progress in the scientific field.

In addition to this, it is necessary to have a sufficient fraction of our population equipped with the leisure necessary to think and study and experiment; our technology has made this possible.

In the early days most of the support of scientific effort came from wealthy patrons, either directly, by a wealthy man providing the wherewithal for one or more scientists to work, or, more commonly, from endowments of universities.

If we look to the origin of our industrial laboratories, we find that most of them can be traced back no more than 50 years, and some of them are very much more recent. We find that in the beginning these industrial research groups were usually led by a person of unusual attributes and accomplishments. These leaders, many of whom are still living today, have, first, an ability to attract men to themselves; and, second, they have imagination, enthusiasm, optimism, and persistence. In addition, a leader must be a salesman, in that he has to be able to sell his ideas to industrial management. Scientists have to get acceptance of their ideas, of the long-term nature of their work, and the long-term support it requires.

If we look back at the record we find that by 1925 the future of many of our large industries was dependent on the research of scientific men. We now find that there are few large concerns that dare to face an uncertain future without a group of scientists looking toward new products, new processes, and new markets.

Among the things which made possible this great development in industrial research are these: First, was a pioneering spirit which is essential. It was this which inspired our forebears to carve this Nation out of the wilderness. With the disappearance of the wilderness frontier,

we have a substitute, at least for a part of our people, in the frontiers of science. It is important to science and technology that this pioneering spirit be kept alive.

Closely akin to the pioneering spirit, and also essential to our great industrial research achievement, is the spirit of free enterprise. Without the freedom to initiate new industrial ventures and to accumulate the capital necessary to finance such ventures, our technology would never have flourished as it has.

Besides these, a certain amount of daring was involved, both on the part of the researchers and on the part of industrial organizations. It was the kind of daring which permitted the discarding of useful machines in favor of more useful machines and of good processes in favor of better processes. This was in the nature of a gamble, and daring which permits gambling was also involved in the evolution of our industrial research.

The sociological conditions which led to the phenomenal development of pure and applied science in the recent past are in a state of transition today. We see the traditional freedom of inquiry being discarded behind the Iron Curtain. We see in the party line approach which Russia is imposing both our best long-term hope for success in the present conflict and at the same time a warning lest we throttle our own science by political control.

We see a disappearance from the American scene of the wealthy patrons who established our research foundations and who financed our universities. We are substituting tax-supported institutions for those formerly supported by endowment; and we must be extremely careful that we do not impose political controls on the research which is done in these tax-supported institutions.

I think we can look with confidence to our ability to provide the kind of atmosphere that I am speaking of under these changing conditions. We have seen the Office of Naval Research provide the basis for the development of fundamental science without undue control over its course. We can look forward in the near future to the activation of the National Science Foundation, which will take up and expand this effort, with the help right from the start of what ONR has learned about creating a successful environment.

If we are to preserve our technological leadership, we must maintain the means of fostering the link between it and basic science, namely, applied science. We must, despite the ever-increasing defense burden, preserve the opportunity for venture into new processes and for the development of new materials in our industrial research. We must leave a margin of reward for success in such new ventures. We must keep it more profitable to discard the obsolete and to accept and exploit the new.

This we must do even if it means some limitations of current benefits to the old, the weak, the special pleaders, and even to our friends and neighbors.

In addition to these changes, there are other problems in connection with our diminishing natural resources which throw a severe burden on our technology. For the last 150 years we have been using these resources with abandon. Some of them are approaching exhaustion. We must look more and more to renewable assets, such as the products of forestry and agriculture. We will have to depend more and more on synthetics made from more abundant materials. We shall probably have to substitute metals which are taken from less accessible ores and ores which are more difficult to refine. We may have to evolve methods of exchanging our manufactured goods for raw materials so that both sides in the deal can prosper more than has been possible in the past. Many of these changes may depend on new and improved technology for their successful prosecution.

We may continue to look forward, I think, especially in more normal times, to a reduction in the labor of the individual. This can be done only by providing for a greater output per hour from our working people, and this in turn can come only from better technology. There are things going on in this field which I think represent a danger. The artificial limitation of output as practiced in some areas today may place demands on applied science and its evolving technology, which these are unable to meet. Our houses would be better if we could use more modern methods in their construction, and the methods used in the operation of some of our railroads are rapidly taking the railroads out of the transportation market. These things, I think, are to be regarded with concern.

Now, besides these general considerations having to do with the national scene, there are some local problems in the field of environment which I would like to discuss. We have seen that the universities and the research foundations have been able to provide an atmosphere which seems to be nearly ideal for the evolution of pure or basic science. These universities have provided an atmosphere in which well-trained, creative minds, endowed with curiosity and interest, have been able to make very substantial progress. They enjoy almost complete intellectual freedom, and the leisure of the men so engaged is arranged so that they have ample time for study and experimentation. With the disappearance of substantial income from endowments, it seems likely that the Government must step in more and more to give the necessary support.

Our managers of industrial research have also provided an environment in which applied science has prospered. They too have learned to use trained minds, endowed with curiosity and interest and enthusiasm, but with a bent toward the practical. They also have allowed freedom, but within a more limited field, pertaining to the industry with which the

research is associated. They enjoy an advantage over their friends in the universities, because they have no teaching role, no extraneous duties. Industry has certainly learned that it is profitable to support adequately ventures of this sort.

There is a third great area which is becoming increasingly important in this country--that is the area of pure and applied science, supported by and in the Federal Government. This is not a new thing in the Federal Government. Scientific organizations such as the Geological Survey, the National Bureau of Standards, and many others have long made important contributions to science. But it is only recently that the Federal Government has gone into pure and applied science on the present enormous scale.

For instance, this year in this country the total expenditure for research and development will approach two billion dollars. Of these two billion dollars the amount of some 1.1 billion goes to work supported directly by the Federal Government. Of the 1.1 billion dollars the Department of Defense has the lion's share, almost 700 million; it is being increased rapidly because of the Korean trouble. Of the 700 million dollars something over one-third goes to the direct support of laboratories and research and development establishments within the armed services.

These research and development laboratories of the armed service vary greatly in size. They are for the most part highly specialized and provide services that cannot be obtained in any other way. There are about a score of such establishments, most of which are larger than all but a few research and development establishments in industry. It must be remembered that the importance of these establishments to this country is not to be measured by the size of the financial investment in them. This Nation will depend on them to produce certain essential items. They will produce most of the weapons and many of the items of equipment which our armed forces will use in time of war. They employ approximately 10 percent of the total talent in this country devoted to research and development. It is therefore extremely important that the management of these establishments be good and that the environment which they offer be such as to attract their share of first-class talent.

The environmental requirement for creative scientific and technical work may be summarized by the phrase "a place where a man may work effectively." It is a good general rule to follow that anything in the environment which hampers the scientist or research engineer in getting his work done is detrimental to the acquisition and retention of good talent. Anything which aids him in this endeavor will add in the long run to the quality of the talent and of the establishment. Thus the fewer the restrictions in the way of things which interfere with rapid progress of work, especially arbitrary ones, the better the establishment. The research administrator who imposes unnecessary restrictions, or the administrator who fails for a moment to do valiant battle against arbitrary

restrictions imposed from above, will not have a good shop and will not be able to attract good technical talent.

I have mentioned the importance of being able to attract good talent. This is of vital importance in the research and development business because it is a business of ideas, and ideas originate in the minds of individuals, not of masses. The number of individuals available who can supply ideas at a sufficiently great rate is very limited indeed. The man who can provide ideas is worth a place where he can work out those ideas expeditiously, and that is why we have to provide a place where a man can work effectively. This is so important that we must continue to expound it to our superiors all the way up the line; we must make sure that we provide, or they get the means to provide, the very best possible atmosphere for work of this sort.

Among the conditions which are necessary to achieve this goal of a place where a man can work effectively is this: He must have professional supervisors. A young man who wants to build a career in science will look to his leader for his future. It is essential that those leaders be men of his own profession, and men who are building their own reputations in that profession. They must be fully qualified professionally to supply leadership and bring opportunities to young men. They must understand what a young man needs in order to advance and must see that the young men do advance. They must make sure that the young men get opportunities. This can be done only, in my opinion, by the fully qualified professional man.

Another thing we must be careful about is making sure that the opportunity for advancement in these laboratories goes all the way to the top for professional people. We must transfer the technical responsibility to the men in uniform (who are responsible in the last analysis in these laboratories) at the highest possible level. It is important that we do this, because the top level that exists in these laboratories is the thing at which the enterprising young men look. They look to the very senior men for their leadership; and if the responsibility is transferred to men in uniform at too low a level, the young man who is enterprising and has an eye to the future will be discouraged and will be very likely to go somewhere else.

Another thing which is essential in attracting able men is stability. Here we have a difficult problem in the laboratories of the armed forces, because the stability of our establishments is, at least in part, beyond the control of the bureaus and services responsible. There is a solution to this problem which has been worked out with considerable effectiveness by the Bureau of Ordnance. It involves, in the first place, staffing the laboratories at a level which looks as if it could be supported through thick and thin for a reasonable number of years. This means that the men responsible for the operation of these laboratories must resist

attempts to expand them too rapidly or attempts to contract them too rapidly. We estimate at White Oak that we cannot safely, without jeopardizing our reputation, reduce the size of our establishment at a greater rate than one percent a month. A reduction in force cutting off abruptly 20 percent of the staff would ruin our reputation. Conversely, except under the stimulus of a full-scale emergency, it would be very difficult for us to expand at a greater rate than one percent a month. This stability is very important in research and development.

The slack in operations of this sort can be taken up by contract work, which is the procedure that the Bureau of Ordnance has used. Contracts by their nature are temporary, and the contractor who holds one faces instability because the contract usually runs for only one year, or two at the most, at the end of which it can be a finished transaction. The contractors recognize this and make provision in the price they set to cover the cost of these fluctuations.

Another thing that a young man looks for when he is going to a research and development establishment is an opportunity to develop himself in his profession, which is very important. We find in our recent experience at White Oak that the thing which interests our young recruits most is the fact that we can provide, through the help of local universities, an opportunity for our young men to continue their technical education. This is perhaps the most important single factor in attracting able young men.

Another thing that a young man will look for is an opportunity to build himself up professionally through the publication of the results of his work. Here we have a very difficult problem because of the requirements of security. However, if we interpret the requirements of security as broadly as we can, and encourage our people to publish everything of a basic nature, we can reach, I think, a reasonable compromise in this difficult situation. We must make sure that nobody arbitrarily turns down an article for publication just because it is easier to say "No" than to worry about whether it really is an article that is allowable for publication.

Another important means of broadening the contacts and outlook of our technical people is attendance at meetings of professional societies. This must be encouraged. It is more important in our establishments than it is in industry, because of the confining nature of security and the lack of ability of our people to discuss their work in detail with their fellow scientists and research engineers elsewhere in the country. Therefore we must make every effort that we can to provide a means for attendance at meetings of this sort. Our establishement is still having a selling job to get enough money to provide adequately for this.

The operation of a large research and development establishment requires teamwork, and that teamwork can be built only through careful training

of the abler men to come up through the line to positions of greater responsibility. I think it is important to recognize that we must train these young men. We must give them an opportunity to develop their administrative side as well as their scientific side. We have been trying to accomplish this at White Oak, with some success. In fact, our success has sometimes been embarrassing to us because our people are in very great demand by other agencies.

In addition to these intellectual things which scientific work comprises, there are certain material aids which are essential to any successful or satisfactory operation of an establishment such as ours. It is very important to provide adequate housing, and it is highly desirable that this housing be so located that our staff has access to shopping centers and centers of culture, easy transportation, and all the things that are available to an urban population. This may make the difference between a very expensive and an economical operation, as some of our laboratories have learned. Some of these laboratories, because of the nature of their work, had to be in isolated places. It may double the total cost of research and development if it is necessary to build and maintain a town and offer bargain rents, free transportation, free schools, and many other things that cost a lot of money, in order to induce scientists and technical people to join your staff.

Today an ample supply of the things that an experimenter needs is very important to successful research and development. Nothing can be more frustrating than the inability to acquire an essential piece of apparatus. Here in the armed forces we are faced with a considerable problem, because our supply departments over the years have been built up for the purpose of providing identical items in great numbers at the lowest possible cost. The problem in research and development is usually to get one thing and get it just as quickly as possible because it is holding up an expensive program. We don't care very much about how much it costs. For instance, a man working in our laboratory may need a fifty-cent vacuum tube, which he knows is available at the corner radio store. If our supply system cannot acquire that tube within a little bit more time than it takes to send a man to get it at the corner store, then our scientist is going to become impatient. If in addition there is a quibble as to whether fifty cents is the absolute minimum price, with the quibble holding up a program which costs a dollar a minute (and this would be an average program in our laboratory) can we blame him for being disgusted with the management, and transferring to a better-run establishment at the first opportunity? We have had a great deal of success with the Naval supply system, but our problems are not yet fully solved. We must all work on this problem and generate a philosophy that fits these peculiar establishments.

We operate our research and development establishments in the armed forces for the most part under the civil-service system. This system

has as a basic tenet that competition for its positions shall be free and open. This imposes a heavy burden, and I see no easy solution. However, the Classification Act of 1949, and the other laws and regulations which have been enacted for the decentralizing of civil-service operations, can do much to alleviate this problem. We must take full advantage of the possibilities of decentralization.

We have found in our operations that the Civil Service Commission and the people in it are only too glad to have suggestions and will be as helpful as they can. In fact, we have had, I think, a little better success in our operations in this respect with the Commission than with some of the agencies of the Navy itself. We have to get a more widespread and deeper comprehension of these problems on the part of the people high in our commands, and that is where you people will be before very long.

In our establishment at White Oak we have set ourselves a goal which envisages a productivity in our establishment which is second to none. We appreciate the difficulties in achieving this goal with the system under which we have to operate, but we also try never to forget the great opportunity with which we are presented. We recognize the importance of our laboratory and of similar establishments to the continued freedom of this Nation. Armed with the ever-present realization, on the one hand, of our great opportunity and of the great national need, on the other hand, we shall persevere in this endeavor. With the help of men like yourselves, and the many others involved in charting the course and maintaining the effectiveness of our Department of Defense, I feel sure that we shall achieve our end. Thank you.

QUESTION: I have two questions. First, what is your method of procuring new talent? Second, how do the advantages of White Oak compare with those of private industry?

DR. BENNETT: I will answer the second question first. I am very happy to have been invited to the fiftieth anniversary of the opening of the new research laboratory of General Electric Company, which resembles White Oak outwardly in its nature and which in its structure is almost identical. I am glad that we have something good enough for industry to use as a guide. I would say that on the average we have very much better facilities than universities and probably better facilities than most of industry.

One of our troubles is that some of these wonderful facilities that we have are not being worked to capacity. That discourages people who come in and see, for instance, a great wind tunnel working just one shift, as ours is, whereas its capacity is tremendous.

We have another problem in getting new talent, and on this we have expended a great deal of energy and effort. We are behind the eight ball

right from the start because the feeling is general throughout this country that working for the Government is no good. We have to dispel that feeling. One way to do that is to build establishments like White Oak and operate them on an effective basis. We can do that if we twist these regulations around a little bit--not very much.

How do we recruit people? Every fall we run a campaign in the universities and colleges in the East. We send our senior people out to talk with the professors and tell them what we are doing and tell them what people we need and the opportunities they will have.

Then we have this register business to go through with Civil Service, which is a serious handicap. We have been able in our Potomac River Naval Command Board of Expert Examiners to do away with some problems, but not all of them. They are still difficult.

But we do have the job of convincing the scientific public that it is a good deal to work for the Navy, the Army, or the Air Force; that we do have intelligent management in these establishments; that we can produce establishments where a man can do effective work.

We start with the youngsters. We bring them in and give them a one-year training course. We encourage them to take courses at the University of Maryland with the idea of getting a master's and occasionally a doctor's degree. We send them to scientific meetings. Then, after we have a man who has spent a year at the laboratory and likes it and recognizes what we are trying to do and that it is a good place to work, he is our very best advertising, by his going back to his old school and telling the boys about it.

It is a long-term proposition. Stability is vital here. We feel at White Oak that if we had to reduce our force, we would reduce it far enough that we could still take in young men when they graduate from college.

The problem is to overcome this negative view which exists in the country, to really offer a good place to work, to really be conscious of what it takes to make a good place, and then insist that we have it. We have to make a sufficient furore up the line as far as may be necessary to get the restrictions removed and to get the support we need.

QUESTION: Doctor, I think most people recognize that we have outstanding equipment throughout the research and development organization for the military departments. How would you rate our scientific personnel as compared with those in universities and industry? It is in that way that we can judge how well we are doing, since research and development depends upon the ability of the individual men.

DR. BENNETT: In a word, not so good. You can measure the quality of your staff in two ways. You can look first at the more basic side of it. We don't do very much basic research in these establishments. It is vital that we do some. That is the thing we have to sell up the line--that it is vital that we have a few people roaming around who don't have to do anything but what they want to do, which is to think. But we have to get somebody who has something to think with.

Now, as to outstanding men in the physical sciences, how many do we have? That is one way to judge. Nobody in the Government has won the Nobel prize. I think that is bad. I think we ought to be able to produce an atmosphere which would lead to such achievement.

Another measure, again on the basic science side, is this: How many members of the National Academy of Sciences do we have? The National Academy grew out of the efforts of a Navy man, Gideon Wells, during the Civil War days. At that time it had 45 members, of which 9 were Navy people. It now has 450 members, of whom not one is employed by the Navy. I don't know whether the Air Force or the Army is any better off. That to me indicates that we are not doing well enough. We don't have good enough quality on our staffs.

Our achievements in engineering, can be gauged by the number of engineering prizes they win of which there are at least half a hundred. I made a study to find out how many of them have been won by Navy people. After looking over a lot of records, I have been able to find only two or three of those prizes being won by Navy people, and yet there are a large number of prizes awarded every year. We don't get enough, and our quality is not high enough.

Why isn't the quality high enough? Because we don't appreciate the high level of quality that research and development requires. We don't appreciate the importance of twisting the laws and regulations around so as to get that quality. I think we know how to get it. We have to get the people up at the top acquainted with what it takes to run these laboratories. A warm body without ideas in one of these establishments is a terribly expensive investment. It costs $20,000 a year for every one of them. If they don't produce, it's bad.

QUESTION: Wouldn't you be better off in handling your technical personnel if you had a competitive system based upon whether they had the required qualifications and talent rather than being tied to the job analysis system in civil-service positions?

DR. BENNETT: Well, the job analysis system in the Navy certainly is elaborate. It is the most elaborate and fancy in the whole world. I have spent years fighting it.

I don't know whether I can answer your question, but I do think we have vastly overdone this business of trying to delineate the job of a scientific man in too great detail, and I haven't had much luck trying to alleviate the system. It takes too much effort on the part of management and supervisors to bring job classification and personal qualifications together, in order to recognize real talent.

QUESTION: As I understand it, basic science has been done to a much greater degree in Europe than in the United States. That was true in the past and may possibly be true at present. I wonder if that is not a result of the fact that in our American universities and research laboratories we generally push this idea of productivity. We have pushed that idea to such an extent that those men who have the capability of coming up with ideas are so pressed for time on some specific project that they do not have the leisure that is necessary if they are to do research in the field of basic science.

DR. BENNETT: I think there is a great deal in that. I don't know too much about the way the universities operate in Europe; but it is my understanding, first, that to become a professor, particularly in Germany, you have to be really a "hot shot" in your field. You have to be very productive.

Second, when you get to be a professor in Europe, you have a guaranteed income for life, without any cut in salary on retirement, and you are outstanding in your particular area. In other words, a man in that position over in Europe probably has more freedom to think than a man in a similar position in any of our universities.

The importance that is attached to such work and the respect with which such people are treated in Europe are considerably higher than in the United States. That may contribute to this situation. There is always that urge toward productivity in this country, and sometimes I think that stimulates the doing of second-rate work just to get it out. If the people who did this sort of thing were in a little safer position and there were a little less requirement to keep up an immediate show of productivity, we might get better long-range results.

But we are learning about this. In 1900 and before, everybody had to go to Europe to get a technical education. There were no places in this country, except perhaps Johns Hopkins under Gilman and one or two others. Now the technical education here is almost as good as in Europe, although I think we waste an awful lot of the time in our secondary schools.

We are learning to provide these people with the same things that they used to get in Europe. We are getting our share of the Nobel prizes now. I think that in another 25 years we will probably be well ahead in the leadership in this phase of science.

QUESTION: We have heard that a great many scientists, especially Nobel prize winners, make poor administrators. Would you care to comment on that in view of the need for administrative operators in your laboratories?

DR. BENNETT: It is true that Nobel prize winners may not always be good as administrators. I think it would be safe to say that it would be very unusual if a man who had won a Nobel prize were at the same time a good administrator. That would be true at least in the sort of rough and tumble situation that you have in the Government, where you have to do a lot of pushing and heaving and put up with a lot of frustrations.

I would say that the requirements for the two types are quite different. We have people in our laboratory who are not good administrators, but they are good scientists. Although the civil-service system impose some problems, it does make ample provision for moving these competent men right up the line to the highest grades. To accomplish that, you must have an administrator who appreciates these people and goes in and fights for them.

QUESTION: Getting back to the personnel problem again, I am concerned about the amount of endeavor that is required in selecting and retaining the man with the inquiring mind, such as a lot of college graduates have. It is my understanding that at such research laboratories as that of General Motors they will select college graduates, give them the facilities of the laboratory in their general area of interest, and then measure them in a year or so to see if they have made any progress. If they haven't, they are looking for another job. Can we do such a thing in government research?

DR. BENNETT: Surely, but it is desirable to recruit by a personal approach. If I want to find at MIT a good man who has, generally speaking, better than average prospects as an electrical engineer, I go to the electrical engineering staff and say, "Joe, who are your good people?" I know of no substitute for that direct personal approach. You have to find them out by getting the estimate of another mature man as to who is most likely to be able to do the job that has to be done. In order to do this, we send the same scientists and technical people back to the same universities year after year to get acquainted with the faculty and get that sort of information. That is the start of the solution.

The next thing you have to do is to persuade these young men that you are offering them the best kind of career. That is rather difficult. If you depend on the notices of the Civil Service examinations that are put up in postoffices or on bulletin boards, you have to take what comes along. That way you don't get very much. You have to get out and make an energetic, active effort in order to get enough of the good men to apply for the examination and get on the register.

If you can persuade good men to get on the register, the problem of hiring them is not difficult. You can tell the good from the bad. Our board is run by scientists, by technical people. They are the ones who get us the appointments.

QUESTION: It is my understanding that the Navy laboratory at Dangerfield is run 100 percent on contract with the Consolidated Vultee Corporation. Would you comment on the relative success of that operation in comparison with a laboratory such as yours insofar as being able to attract and hold good personnel is concerned?

DR. BENNETT: During the war we had to have a lot of establishments such as Dangerfield near at hand. The Applied Physics Laboratory at Silver Spring, which is run entirely on contract, was one of them. We had to set up these establishments and do it quickly.

These laboratories were set up during wartime. They have certain advantages. They don't have the civil-service problem. They don't have rigid pay scales imposed on them. They also have many other advantages. The hope has been that the advantages of contract operation will be great enough and the productivity will be enough greater to perhaps enable us to expand the sort of enterprise that we have at White Oak.

It is too early, I think, to say which method is better. We find that the people who run these contract laboratories have their headaches, too. When you compare our success with that of a place like the Applied Physics laboratory, I feel that we haven't done too badly in attracting and retaining a good staff. I wish we had done very much better. Contract laboratories do have some disadvantages. They don't have the stability that we have, because their contracts have to be renewed each year. They have to evolve retirement systems and other special benefits of a sort which we already have had long established.

The problem comes in adjusting our administration of these government laboratories to the civil-service, supply system and other regulations and agencies, so that we can operate effectively within the Federal Government. There isn't any reason in the world why it can't be done except where there is lack of appreciation at the high levels of what it takes and the importance of doing it and adjusting the regulations so we can do it effectively. I think we will have it eventually, and I think in the long run that ours is going to be the more stable type of operation. I hope we can make it the more productive.

QUESTION: Do you have access to the scientific information that other countries have? If you do, would you care to comment on which countries and how you obtain it?

DR. BENNETT: We have to depend on the Office of Naval Intelligence and the Central Intelligence Agency for foreign information. We don't have any inside information from behind the Iron Curtain.

Some of the individuals on our staff know people in other countries. I know many people in Britain. I try to go over there about every other year and visit scientists in the university and government laboratories. Some of our people know people behind the Iron Curtain. Maybe that is an advantage, maybe not. I don't know. That is a very delicate situation. Many of our people know people in France, Switzerland, and the Scandinavian countries, and they go over there on occasional visits.

So we have to take the things that are gathered through CIA and ONI. In addition, we have coming out of Russia such publications as they will release. Our scientists examine such publications and find out what they can, but don't have any magic access to foreign information.

QUESTION: I understand that the Civil Service Commission has a provision which exempts new employees from being on the Federal register; that it prescribes certain limits within which you can hire personnel outside of civil service, with a provision that after a period of from fifteen months to two years they can be brought into the civil-service orbit if they are satisfactory. This would give you an opportunity to compete with industry for these young men who are coming out of the universities. You can bring them in without the necessity of an examination. Have you explored that idea in any way with respect to scientists?

DR. BENNETT: We can make temporary appointments at the present time in fields where there is a scarcity of names on the Federal register. We are able to go out and look at the qualifications of a man. If he is unable to meet the Civil Service qualifications, we are slightly skeptical about him. But if we find a specialist who meets certain qualifications in a narrow field and can do the job, we can bring him in under a special arrangement. Then, if he can qualify through the provisional appointment system, he can get permanent employment. We think that is an ideal arrangement.

We are very much concerned over the rider to the appropriations bill which requires that there be only temporary appointments, only temporary transfers, and only temporary promotions. We don't see how in the world, in the present state of the unofficially recognized emergency, we could ever get these young fellows, in the face of the serious competition of industry, to come in for temporary jobs, if they have a prospect that in three, five, or eight years they will be kicked out by veterans' preference or some other artificial criterion after they have done a good job for a long time. If we can maintain the facility which temporary

appointment gives us and maintain our registers so that we can qualify people and get them on it, that will be ideal in this emergency. I hope we can do that.

QUESTION: How do you get around this administrative load that is involved in the appointment of your staff? I am thinking about all the manpower reports and the different forms that are put out by the Civil Service, and all the manpower boards that come out for interviews. When you want to purchase something, you have to make out seventeen copies of the requisition. Another question is, How do you get rid of personnel who are not qualified for the job?

DR. BENNETT: Answering your first question, we have a guardian angel in the form of the Chief of the Bureau of Ordnance, who fends off every inquiry and every board and every investigation that he possibly can. That reduces our problem to a minimum. The rest we have to take in our stride.

There are two lines of advancement for a man in these government laboratories. If he wants to become a research administrator and has the requisite qualities, he will first become the leader of a group, then the leader of a division comprising several groups, and then maybe of a department. Eventually he may become the head of a laboratory.

That requires that at about the age of thirty-five or before the man must decide, according to his success and aptitude, whether he will try to go up the administrative ladder or whether he will remain a lone scientist. There is opportunity for promotion in either. We find some of both kinds in our laboratory. If he decides he wants to be a research administrator--and there are probably more people qualified to do that than to be very high-powered scientists--he must recognize the fact that as he gets older he is going to do less and less scientific work and more and more administrative work.

We unquestionably have in the Government more administrative details to worry about than they do outside, and we fight that all the time. We have had some success, but we need more. The administrative load can be reduced and we are working at it. We all have to work at it all the time, because it reduces with productivity.

It can be helped by having an active and energetic personnel department composed of administrators and clerical people who handle administrative details and get necessary statistics without bothering the scientific people too much. You have to have a "can do" supply department, which may require a lot of forms, but will keep them to the minimum. We can't go so far that way in the Government as they can in industry, but we can approach it. Our board of advisers has examined our situation as compared with some of the great industrial laboratories, and they estimate that we don't spend more than maybe 5 or 10 percent additional effort

because of the higher level of accountability required for public funds. This accountability is really the basis for much of our red tape.

In connection with getting rid of inefficient people, you have to do it boldly. You can't have all sweetness and light and still get rid of the duds. You have to have administrators who will face up to the evaluation of people and then go through the unpleasant and boring procedure which the Civil Service provides to get rid of them.

It is necessary to keep records on such men, so that if we must fire one, we have a case to show that he is inadequate. With a well-documented record ineffective people can be and are discharged. It is a tremendous stimulus to the rest of the organization to see a dud thrown out. But it takes a lot of effort and time on the part of the administrator.

I think, speaking from my point of view, of course, there is far too much protection for the individual in our system. I would like to see it made very much easier to get inefficient people out. We have to work on it and put in the energy that is necessary when you get an obvious dud. Of course, if you are smart enough, you can throw them out before the end of the probationary period; but it is sometimes very hard to be sure of an early judgement. The provisions are there, but they are very difficult to put into effect. I wish they could be made easier.

COLONEL DIEHL: Dr. Bennett, on behalf of the student body and the staff and faculty of the Industrial College I thank you very much for giving us your time for this most instructive lecture.

(9 Nov 1950--350)S.