tended some international meetings in Europe. They conceived the idea that it would be a good thing for us to have a similar association in the United States, so that information could be exchanged between us and other peoples around the world.

The Society like photogrammetry started in a very small way, but has continued to grow to its present large size. Due to its growth, it has taken on an important place in our economy and has become a very important phase of our government activity. Whenever government activities or commercial or private activities are undertaken, the needs for basic maps are at once evidenced. Most of those maps are now made from the air photos, and have been compiled by photogrammetric methods. The science of photogrammetry has made great advancements in a very few years.

I welcome you to these meetings. I thank those who have concerned themselves with this program, and all of the other committees, which make these meetings possible. It is not an easy job. There is a great deal of hard work that goes on behind the scenes; you people in the next three days will benefit from all of that work.

The program is as diversified as a program like this could possibly be. We have new parts of our program this year which we have not emphasized before. One is research, which has been handled by our Research Committee. The other is our Photo-Interpretation Committee; the work which they are doing has become a part of the whole program.

We regret that it is necessary to have two meetings going on at the same time in different places. Otherwise it was impossible to get all of the information across to all who are interested.

We have many visitors from foreign lands. They are more than welcome. We are always pleased to have them in attendance at our meetings. A little later I will introduce some of them to you.

Our opening speaker for today is Rear Admiral Calvin M. Bolster, Chief of Naval Research. He is one of the Navy's top research authorities, and an outstanding aeronautical engineer. It is a pleasure and honor to have him address the meeting.

THE ROLE OF THE SCIENTIST AND SCIENTIFIC RESEARCH IN CURRENT PROGRAMS OF THE NAVY*

Rear Admiral Calvin M. Bolster, Chief of Naval Research, U.S. Navy

WHILE I have no prepared speech, I do have a message to give to you.

As you probably gather from my history, I have been very deeply involved in research and development work a large part of my active career. This has been lots of fun. It is a very fine career and I cannot imagine anything being more fun than to be able to do research and development in the Armed Forces, where you have so many ways, with excellent facilities, to accomplish your objectives. I think that it has also an implication of very great responsibility to the people who are so engaged.

I want to assure you without delay that I am not going to talk about photogrammetry because that is one thing, and one field, in which I have not been involved at all. However, we, in the Navy, under our various programs, are

* Opening Address, Eighteenth Annual Meeting of the Society, Hotel Shoreham, Washington, D. C., January 9 to 11, 1952.

doing research in this area. The Navy is greatly interested in many aspects of the things you are doing, but I, personally, have had no direct contact with this particular field of science.

I thought a subject that might be of interest to you—and it is too big a subject to cover adequately in the short time I have, but a subject that is bothering lots of people these days, and one that we think very strongly and keenly about in the Navy—would be the role of the scientist and scientific research in our current programs. In particular, how can we effectively use the national scientific potential in the Navy's weapon and equipment development programs?

REAR ADMIRAL CALVIN M. BOLSTER

I personally feel that in this country—not only in the area of research, but in many areas—we are in a rather difficult situation. We are in a period of semiemergency, where the country's scientists all want to help—they all want to get in the act—and we want them to help us. And yet, certainly, we have to continue the people who are in the schools at their daily work, teaching and instructing the students. So we cannot call all these people into laboratories and disrupt all the normal and excellent work going on in the universities.

Therefore, how do we do this?

I feel that in the Navy, we are unusually fortunate in this particular problem because, at the end of World War II, Mr. Forrestal realized that there had been something missing in the Navy "R and D" programs up to that time. As you probably all realize, the Chief of Naval Operations and his office are essentially responsible for the operational aspects of the Navy, and they, therefore, generate the operating requirements; these in turn generate research and development programs. For instance, if you are in the Bureau of Aeronautics and you get a requirement to build a gadget to do something, they do not tell you *how* to do it, but they tell you *what* they would like to do. You may develop an airplane, a helicopter, or whatever is needed to do the job the best way you can. You will also have to develop a lot of components to make the end product possible—power plants, electronic equipment, and all kinds of things that will be required.

Similarly, in the Bureau of Ordnance, you will be working on ammunition, guns, propellants, or similar ordnance items. The Bureau of Ships also has its development problems.

There is a common need of all these material bureaus for supporting research and this is the thing that Mr. Forrestal created in the Navy, an activity which is charged by law with conducting research and development in support of the material programs.

I am very fortunate, because I have been in this work for some time and since the beginning except for two years when I obtained the experience of administering a large research and development program from the Bureau point of view. I am back running the Office of Naval Research, and feel that this is very fortunate for me because, having lived with it, and worked with it, I believe I understand the total problem better than if I had come to it cold.

However, what I want to point out to you is that when we first started operating under the public law that created the Office of Naval Research, we created what is essentially a basic research program.

Through the years, this program has been kept pretty well at a constant level. In doing that, we did a lot of things:

First, we did what we were supposed to do, that is we did research in all of the areas that needed attention on an across-the-board-basis, for the Materiel Bureaus, but, above and beyond that, we created a tremendous potential of people in the country that know what we are doing and what our needs are.The thing that is amazing is how this pays off when you get in a jam and you really want help, such as we did when Korea hit. We were able to go to these people and draw them in on a consulting basis and get them to take special jobs. We knew where they were and what their talents were. We have been able to show repeatedly that this is a very sound practice.

We are now in the continuing situation of where we want to use the scientific potential as well as we can on a long-term basis, for both the current and the long-range needs of the Navy. To do that effectively takes a lot of careful planning.

Actually, we are continuing the basic research program, and in addition, we have a number of people engaged in a much larger applied research program.

If you were in a Bureau and you had a problem that was particularly hard to solve, or something that was a little more than just an immediate requirement, we would try to undertake it for you whether we could do it in a week, or a month, or in several years.

Also, for the immediate problems, we are able to try the unorthodox approach; frequently this unorthodox approach, as many of you know, is the one that will work, and perhaps work better than one you would normally use.

We also have the ability to do things in the development area. By that I do not mean that we would develop a complete airplane engine or a complete submarine propulsive system, but by having available to us new scientific concepts, we can try to prove a principle. In fact, we do this over and over.

As an example, in the area of under-water propulsion, we have proven that you can by other than conventional methods obtain surprisingly increased performance. This is something that the Bureau of Ships, or the Bureau of Aeronautics, or the Bureau of Ordnance, all of whom are interested, would not have been willing to spend time and effort to prove. After we get such a principle so that we know it works, we turn it over to the interested parties, whether, for instance, they want it for a torpedo, a submarine, or perhaps as a JATO unit on a flying boat.

I should like to say that in the total Navy research and development operation, we are able to do this type of thing—tap the scientific potential—in many ways.

For instance, the Chief of Naval Operations requires scientific help and we provide for him a group known as the Operational Evaluation Group.

This is a group of scientists that actually evaluates the equipment that is developed in a scientific way, to see if the equipment itself is O.K., or to see if the way it is being used is sound.

We also are doing work which is of great interest and help to the Chief of Naval Operations and the Fleet in the area of logistics, through the application of better scientific principles to the solution of logistics problems.

This same type of scientific help can be afforded in many areas—undersea warfare, guided missiles, all kinds of things—and, as you probably realize, the

Navy has a very complicated problem. We have many types of missions to perform.

Taking just the one field of aviation, we have to provide interceptors and fighters to operate from carriers; we have to provide airplanes that will operate from slow-speed ships, to protect convoys against air attack or against submarine attack; and we have to provide shore based aircraft for such jobs as mine laying and long range patrol.

We have seaplanes, and planes, carrier based planes, and we have airships.

When you add to that the problems of operating on the surface of the sea and under the sea with the weapons peculiar to those environments, you can see that it is a very involved problem. To administer a program of this type intelligently, is difficult, and takes a lot of people and a lot of know-how.

This is the reason why I say that it is extremely important that we tap all of the scientific potential that we can secure.

This business of how we use scientists is of great interest to all the services, and one of the things that has happened in the last year or so has been an effort on the part of the services, working together, to tap this potential.

One way in which this has been done is by the creation of large joint-study projects.

A typical example has been one that started out as a study project at M.I.T. in the area of air defense. The typical way these projects work is that you get together a group of scientists of various talents. They do not all have to be interested in that particular field; we think we get more when they have diversified backgrounds. However, we get them there, and then the Air Force, the Navy, and the Army tell them our plans, our requirements, and our weapons development programs in that particular area, They sit down and think about it a while and then come in and tell us their ideas as to how we might do better.

This is a very healthy thing to do. It happens, that in the area of air defense, they have gone further than that and have created an actual laboratory to do this work.

Although the Armed Forces have several very excellent projects of this type, we do have some troubles with them, as you do with everything you do. But I think again they are going to pay off, and I think they are going to turn out to be a very important part of our over-all progress.

Somebody called me this afternoon and asked if I was going to spring some secret weapon on you people. I certainly am not. I told them if the Navy had any secret weapon at all—and I am certainly prejudiced in this—I thought that our secret weapon was the great background of fundamental knowledge and scientific potential that we have created and are creating, to support our development programs. That applies to your program, as well as our own.

Part of my responsibility in the Navy is to be responsible for patents and inventions, and I feel that I should also tell you that we—and I personally—do not feel that all of the wonderful successes of the future are going to come out of some test tube. I feel as strongly as ever that we are still going to make very great progress out of the contributions from the inventor. We feel strongly in the Navy that the inventor needs more encouragement.

We in the Armed Forces, under sponsorship of the National Inventors Council, are trying to encourage legislation which will do this very thing.

You may or may not be aware of the fact that in England, a man who makes a very important contribution to his country in the way of an invention—and that does not mean he got the patent on it, but that he thought of it—can get an award of very great magnitude.

Air Commodore Whittle, for instance, received a tax free award of £100,000. He is the engineer directly responsible for the original development of the jet engine.

The British have a very fine award system. At the end of the War they had made something like 500 substantial awards to people, not for scientific research, but for ideas, and for inventions. I feel that this country needs something like that; we need a similar incentive over here.

The man working in our laboratories, or the man working in any laboratory needs an incentive to go home and think about his problems and to work on them in his spare time. To me this is the way you make progress.

In addition I want to say that with the continuing increase and emphasis—and I certainly think it should be there—of research and development by the Armed Forces, it seems to me that all of us and particularly those with major administrative jobs have a great responsibility to see that these programs are sound and that they are well planned.

We have many problems in the administration of research and development programs. In the Navy, we have a very elaborate arrangement. We have our own laboratories. We have contract programs. We have development programs. All I am saying is that I want you people to know that we realize, as well as you do, that we have to continually examine these programs and keep them on the track.

I assure you that we are very much aware of this responsibility. We feel that it is much more than just a question of developing improved weapons and equipment. We have to look at the work from the point of view of economy, practicability and available resources. It is a challenging responsibility but one in which I am personally proud to be engaged.

It has been a pleasure for me to tell you what we are trying to do.

LUNCHEON ADDRESS*

A WASHINGTON COMMENTARY

Paul Wooton, Washington, D.C.

I ALWAYS speak on one subject, "What I am Hearing in Washington." In that I am different from Mark Twain. When asked to deliver a lecture, he would send a list of 25 subjects and say "Check the subject you want me to speak on." One fellow wrote back and he said, "Which of the twenty-five is the best?" He wrote back "They are all the same speech."

I have the same subject every time, but if I talk a week apart, I must change my talk because "News marches on." Also, it is my understanding that one of the reasons—possibly the primary reason—for selecting me as a guest speaker today was that I would tell you about Princess Elizabeth's visit to Washington a few weeks ago.

I remember when this Society started. Bee Brown† had an office in the Press Building and gave me a little story about the organization meeting for *Engineering News Record*. He was one of the very first, I believe, to use aerial photography in private practice. I think probably the Army work started him. It is astounding how this Society has grown from that little group to your present large membership.

* Eighteenth Annual Meeting of the Society, Hotel Shoreham, Washington, D. C.

† W. N. Brown, Washington, D. C. One of the Charter Members of the Society.—*Ed.*