REVIEW OF THE SPACE PROGRAM

TUESDAY, JANUARY 26, 1960

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
Washington, D.C.

The committee met at 10 a.m., Hon. Overton Brooks (chairman) presiding.

The CHAIRMAN. The committee will come to order.

I want to say in advance of hearing testimony this morning that from now on all of our witnesses ought to be sworn. For that reason, I will start this morning by administering the customary oath to the witnesses.

We happen to have a very distinguished friend of ours this morning as our first witness. He is Dr. Herbert F. York, Director of Defense Research and Engineering. He is accompanied by Brig. Gen. Austin W. Betts, Director of ARPA, and William H. Godel, also of ARPA.

Now, we all know Dr. York. We know his background. We have had the privilege of hearing from him before. We are delighted to welcome you back, Doctor. We all have a few questions we will want to ask you this morning, so we will begin this morning with Dr. York.

I will ask you if you will, Doctor, to stand up—in fact all three of you at one time would be better.

General BETTS. Could I add Mr. Sutton to that. He is our Chief Scientist.

The CHAIRMAN. They all should give their names to the reporter, so he will have them.

Do you and each of you solemnly swear that the testimony you give before this committee in matters now under consideration will be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. YORK. I do.

Mr. GODEL. I do.

General BETTS. I do.

Mr. SUTTON. I do.

The CHAIRMAN. You are all distinguished witnesses and we are happy to have you all.

You may proceed.

STATEMENT OF DR. HERBERT F. YORK, DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING, DEPARTMENT OF DEFENSE; ACCOMPANIED BY BRIG. GEN. AUSTIN W. BETTS, DIRECTOR OF ADVANCED RESEARCH PROJECTS AGENCY; WILLIAM H. GODEL, DIRECTOR, POLICY AND PLANNING DIVISION, ADVANCED RESEARCH PROJECTS AGENCY; AND GEORGE SUTTON, CHIEF SCIENTIST, ADVANCED RESEARCH PROJECTS AGENCY

Dr. YORK. Mr. Chairman and members of the committee, I welcome this opportunity to appear before you today and present infor-

mation regarding the Department of Defense research and engineering program, particularly the space effort as it is integrated into the overall defense posture of the United States.

In regard to the broad Department of Defense policy on the role of space in our overall defense effort, I would like to refer to the statement made by the Secretary of Defense yesterday which pointed out that we are directly concerned only with those space activities having direct military applications, and supplement this by stressing that the objectives of the defense efforts in space are (1) the development, production, and operation of space systems where it can be demonstrated with reasonable certainty that the use of space flight will enhance the overall defense program, and (2) the development of components which would be needed in systems which cannot be clearly defined at this time, but which will develop as the future unfolds in this new sphere of activity.

I would also like to talk further on the organizational changes as related to space activities and the basic reasons therefor. It was decided in September 1959 that the satellite and space vehicle operations of the Department of Defense would be assigned to the appropriate military department after consideration of the primary interest or special competence of the respective services. Where no one military department has primary interest or special competence, consideration will be given to special competency in associated fields of development. The responsibility for the development, production and launching of space boosters and the necessary systems integration incident thereto has been assigned to the Department of the Air Force. The Air Force is now completing the development of the Agena–B, upper stage vehicle for Discoverer, Samos and Midas, which was initiated by ARPA, and since transferred to the Air Force.

Also, the improvement programs of our current ICBM missiles will undoubtedly povide improved components and considerably increased weight launching capabilities which will be utilized for some of our military space requirements as well as increased payload capabilities for our ICBM's. The Air Force will also, as required, develop the necessary upper stages for these improved boosters.

The specific assignments of the payloads for space and satellite systems are being made separately to the appropriate military department which, in addition to budgeting for the payload, will also budget and reimburse the Department of the Air Force for the necessary boosters, launching vehicles and other unique equipment required in launching and for the necessary system integration. At the present time, the Discoverer (engineering development and test satellite), Midas (early warning satellite), and Samos (reconnaissance satellite) projects have been transferred to the Air Force. Transfer of these projects was effected on November 17, 1959. The remaining space oriented systems of communication (Notus) and navigational satellites (Transit) will probably be transferred during the latter part of this fiscal year.

A recent analysis of the programed space systems funding of the Department of Defense for the current fiscal year, exclusive of the Saturn project which is planned to be transferred to NASA, indicates that approximately 85 percent of the reorganization of the DOD space-related programs, as measured in dollars, has already been accomplished. The remaining 15 percent of the Department of De-

fense space systems effort is principally under ARPA management, the remainder expected to be transferred to the military services by the end of this fiscal year.

As you already know, the Centaur space booster project was transferred to the National Aeronautics and Space Administration last year. The transfer of the Saturn booster project and the development division of the ABMA to NASA is currently pending congressional approval. The National Aeronautics and Space Administration and the Department of Defense will coordinate their requirements and thus eliminate the need for both agencies developing these very large space boosters. Even though these superbooster programs are now being pursued by NASA, the Department of Defense strongly supports these programs and considers that there will be a requirement for them in future military applications.

The DOD-NASA working relationships over the past year have become better coordinated, with many members of my staff, ARPA, and the services meeting frequently with their counterparts in the NASA. These meetings are taking place at various working levels on a day-to-day basis. In addition to mutually supporting relationships on the related space projects of the Department of Defense and NASA, our national missile ranges have been supporting the research and development programs of both NASA and DOD. It is expected that integration of range support for both missiles and space vehicles will be given increasingly greater emphasis as both the missile and space efforts continue to grow. As an interim measure until a permanent management scheme can be developed to coordinate all launching and tracking support activities, Gen. Donald Yates, commander, Atlantic Missile Range, has been appointed as coordinator for all DOD support to Project Mercury.

The currently programed defense systems having space subsystems are Samos (reconnaissance satellite), Midas (early warning satellite), Notus (communications satellite), and Transit (navigational aid satellite.). The two most advanced, and probably most important, space systems are the Midas and Samos. The remaining two space systems are less far along and the scope of their use is less clear. It is expected that considerable effort will be required to implement both Samos and Midas with a major part of the effort lying in the fields of data tracking, data transmission, data reduction, and data anlysis.

Other space-related programs in the Department of Defense include Dynasoar, which is an aerospace exploratory development program designed to investigate the problems of controlled flight at speeds up to Mach 25 (i.e., reentry velocity), and at altitudes up to several hundred thousand feet (i.e., reentry altitudes); components development research in such fields as auxiliary power and advanced propulsion methods; and Projects Shepherd and Vela, described below in the summary of present ARPA activities.

The funding for fiscal year 1959 for the separately identified space-related programs (DOD wide) amounted to $381 million. For fiscal year 1960 the funding is $414 million, and for fiscal year 1961 the funding is $481 million. These figures do not include Saturn or other programs which were earlier carried in the Defense budget but subsequently transferred to NASA.

I have brought a number of charts indicating the concept, goals, and funding of the various defense space systems and related space

projects, which are available for presentation to the committee after the reading of this statement, if so desired. However, a few of the charts are of a classified nature and can be shown and discussed only in an executive session.

In addition to these specifically identified space-related programs, the technology, facilities, and components developed and built for past and present missile programs have provided the major source of, and support for, today's space programs, and the future missile programs will continue to be a major source of support, in all aspects, to the future space programs, both military and civilian. The total research, development, test, and evaluation program for all missiles in fiscal year 1961 will be approximately $2.41 billion. These figures include both the missile items in the RDT & E appropriation, and the separately identified DT & E items, principally for the ICBM's, in the procurement appropriation.

Further, many of the basic and applied research projects of ARPA and the Services will contribute to progress in rocketry for either missile or space flight applications. These include such projects as the ARPA Principia program, and numerous programs in the Services in such fields as rocket propulsion, guidance and control methods and mechanisms, propellant chemistry, and electronic components development especially as related to reliability, long life, and miniaturization.

All together, the above programs in space-related programs, missile research and engineering, and rocket oriented applied research, constitute approximately one-half of the total defense RDT & E budget request.

The projects which will remain in ARPA after the presently planned transfers are accomplished are: Project Defender, which is a research, experimentation, development and systems feasibility demonstration undertaking to obtain technologically advanced defense against extra-atmospheric offense vehicles, including ballistic missiles and space vehicles. The project is aimed toward exploration of fundamental phenomena, development of new systems concepts and the application of new techniques.

The Defender project now consists of more than 50 programs in the area of missile flight phenomenology, characteristics of the upper atmosphere, radar development, reentry body identification, etc.; Project Principia, which is a research program to develop more optimum performance for solid propellants for missiles and space boosters; Project Pontus, which is concerned with basic research in materials—it includes fundamental theoretical and experimental work aimed at realizing a major advancement in structural and power conversion materials; Project Longsight, which is a series of studies and systems analyses in the military sciences field to obtain on a continuing basis recommendations as to projects which should be initiated to satisfy the future military needs of the various services; Project Shepherd, which provides for the development of a satellite detection and tracking system which will include a National Space Surveillance Control Center; and Project Vela, which provides for the development of adequate means for the worldwide policing or surveillance of a moratorium on atomic weapons testing. The new obligational authority being requested for fiscal year 1961 for these ARPA programs is $215 million.

This concludes my prepared statement. I have with me Brig. Gen. A. W. Betts, the newly designated Director of the Advanced Research Projects Agency; and Mr. William H. Godel, the Director of the Policy and Planning Division of ARPA; and also Mr. George Sutton, who is the Chief Scientist of ARPA; who are prepared to discuss in more detail the ARPA program within the Department of Defense, and I will be glad to attempt to answer any questions the committee may wish to put to me.

The CHAIRMAN. Thank you very much for a very good presentation and statement. It is a little difficult to follow you because you jump from one thing to another so rapidly. However, your statement is excellent and I want to thank you.

May I begin the questioning this morning by asking you this: Yesterday and in preceding hearings there was a lot said about the military requirement for certain projects.

What is really meant by military requirement?

Dr. YORK. Well, we use that term in a rather special sense. What we mean is that when we state there is a military requirement, we mean there is a specific need for a fairly well defined system to accomplish a military objective. So that we say there is a military requirement, for example, for the Midas system, because we need to increase our capability in early warning and so on for the others.

The CHAIRMAN. Who sets that military requirement? Does DOD set it or do the several services initiate the military requirements?

Dr. YORK. They are set variously. Mostly by the service involved. If there is a question about it, then it may be set by the Joint Chiefs or by the Secretary of Defense.

The CHAIRMAN. Now, with regard to requirements for space activities, who sets those? Does the Joint Chiefs, the military department, or the DOD?

Dr. YORK. Actually it is really all three, but these have—in the case of these space-related programs, these have been all gone over with the Joint Chiefs of Staff.

The CHAIRMAN. All of them have been approved by the Joint Chiefs of Staff, is that correct?

Dr. YORK. The four which are to gain specific objectives. The weapons system, the navigational aids satellite, and so on. The Dynasoar project, I don't believe has gone to the Joint Chiefs of Staff.

The CHAIRMAN. Have all your other programs gone to the Joint Chiefs and been approved? When you say "gone to", do you mean they have actually been approved or not?

Dr. YORK. In the case of those four, I am not sure what is in writing, but I am sure it is accurate to say they have been approved by the Joint Chiefs. The Dynasoar program has not, nor have most of these component development programs.

The CHAIRMAN. Which four are you talking about that have been approved?

Dr. YORK. Early warning, reconnaissance, navigation, and communication.

The CHAIRMAN. Don't those projects have a requirement for a large booster?

Dr. YORK. They require ICBM-type boosters in order to achieve them.

The CHAIRMAN. Will anything less than a million pound thrust booster be sufficient for those projects?

Dr. YORK. Oh, yes.

The CHAIRMAN. Can you handle those projects with a small ICBM?

Dr. YORK. Yes. The payloads as they are now understood for all of these are quite well within the range of an ICBM base booster system.

The CHAIRMAN. Then according to your testimony, when those programs are completed or ready for operation, the booster system is now available for that purpose?

Dr. YORK. For these programs as we now see them. But we are sure that other things are going to develop that we don't foresee and, therefore, we very strongly support the development of a bigger booster system.

And furthermore, we are developing ourselves ICBM base systems that will launch two or three times as much, 2 or 3 years down the road, as we can launch this year. I mean we are much interested in larger payloads.

The CHAIRMAN. When these satellite programs are further developed and they need larger payloads, they will need larger boosters.

Dr. YORK. When they need much larger payloads, that is right.

The CHAIRMAN. What troubles me is the fact that I understood yesterday the Secretary of Defense to say we had no present requirement—meaning present military requirement—for a large booster. It seemed to me that if we wait until we have the military requirement to develop the large booster, we are in serious difficulty.

Dr. YORK. Precisely, and that is why we do support the development of larger boosters.

The leadtime on boosters is so long that we can't afford to wait until we have a specific military requirement to then start the booster. Therefore, we have a program underway to uprate our ICBM's and to optimize their use for launching. Through this mechanism, we can get payloads about three times bigger than we foresee the immediate need for and we support the Saturn program very strongly and the Nova program.

The CHAIRMAN. It seems to me when you say you have no present military requirement, actually you are straining a little bit because the requirement can't wait until the missile is perfected.

Dr. YORK. That is right.

The CHAIRMAN. Your requirement is made ahead of time.

Dr. YORK. That is right.

The CHAIRMAN. Just like the requirement for the Navy project.

Dr. YORK. We don't propose waiting for the specific requirement to develop.

The CHAIRMAN. Now, who set the figures for the required funds for these projects?

Dr. YORK. Well, they are a result of what I am sure you all understand, in outline at least, of the budget process in the Department of Defense. These are figures which, first of all, come from the services. These figures largely came from ARPA. Some of them came from the Department of the Air Force in their first cut at their plans for the year 1961.

These then were worked over by the Office of the Secretary of Defense, we, the Comptroller, and the Joint Chiefs. The Secretary

discussed yesterday how he had discussed with them the question of the total size of the budget. The decisions are reached through a series of conferences between the interested parties.

The CHAIRMAN. Now, in working out this new proposed legislation amending the Space Act, were you consulted on that?

Dr. YORK. Yes; we were consulted.

The CHAIRMAN. By whom were you consulted? The President? Dr. Glennan? Dr. Kistiakowsky?

Dr. YORK. There were numerous meetings between primarily Dr. Glennan and his people and the Secretary, the Deputy Secretary, myself and others, in the Department of Defense.

The CHAIRMAN. Did you assist in drafting the bill?

Dr. YORK. I didn't assist in drafting the bill in the sense of getting right in and working on it. Our legal people, as well as our other administrative people, went over the thing and made many suggestions as to changes, and so forth.

The CHAIRMAN. You consulted the military services?

Dr. YORK. Yes; we consulted them at various times.

The CHAIRMAN. And you support the bill?

Dr. YORK. Yes.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. We are very glad to have you here, Dr. York, General Betts, and Mr. Godel.

You say that by the end of the year the remaining 15 percent of the Department of Defense space efforts will have been assigned to the Armed Forces.

That leaves the question of what will happen to ARPA when this is accomplished?

Dr. YORK. It has the remaining space programs that would be transferred. On page 6 of my prepared statement is a list of the projects that will remain with ARPA after the presently planned things are accomplished.

These are the things related to ballistic missile defense, but in addition, there are some—call them basic applied research programs, basic programs in materials, solid propellants, and in general, studies and analyses; and also, at least for some longer time, the Project Shepherd and then Project Vela, also is an ARPA program, so it is a sizable number of programs, but they are all nonspace.

Mr. FULTON. I am glad that you brought out the facts on Project Defender, overall, because actually the Project Defender is not a substitute for, but it is one of the same type of projects as the Nike-Zeus defense project, the antimissile project.

Secondly, it has 50 separate program ramifications, doesn't it?

Dr. YORK. Yes.

Mr. FULTON. So in that field we are not without doing something, when we don't make the final decision on putting the Nike-Zeus project into operational status, because we are advancing in many other fields. Is that not the case?

Dr. YORK. Project Defender is about a $100 million program altogether.

Mr. FULTON. Likewise, when we get to these other projects like Project Vela, for example, your Principia program, your Midas, your Samos, your Notus, and your Transit programs, all would have a

bearing on an antimissile defense. We are learning the characteristics of these missiles, on their flight, their reentry, on early warning, on communications, on navigational points. So we really are moving ahead on research in the Nike-Zeus field without putting the particular Nike-Zeus equipment into operational status. Is that not right?

Dr. YORK. That is right. There are some other things, too, that relate to antimissile defense which are not in Defender. The Air Force has separate studies on the question of possible new antimissile systems and the Navy has a small study project. A study project, here—just to amplify that—that is another technical term we use. A study project may be a million dollars effort in engineering. It simply means that we are not going ahead and building something right now, but a study is a sizable effort.

Mr. FULTON. It is a research project which is in action rather than just a piece of paper, sitting on somebody's desk, or in somebody's mind. It is actually a project that is under contract in many instances, to outside institutions or companies, or even within your own DOD.

Dr. YORK. Normally, they are outside. I mean they are by contract, contracts running from a half million dollars to a million dollars.

Mr. FULTON. I am not going to use the rest of my time, but I certainly would like to see the charts you may have that could be made public.

Could we see those?

The CHAIRMAN. Are they available?

Dr. YORK. We have them here. Do you want to do that now?

Mr. FULTON. I would like to see that.

The CHAIRMAN. Why not do this, Mr. Fulton? I think in fairness to you, that shouldn't be taken out of your time.

Mr. FULTON. I am through, but I think if we are going to go into the budgets and what these projects are, these charts that can be made public would be very helpful.

The CHAIRMAN. When would be the best time to take them up, Doctor?

Dr. YORK. We can take them up now. I don't claim that they add an awful lot to what is here, but I can take them up now.

The CHAIRMAN. Before we recognize Mr. Teague, we will take them up, and then I will recognize Mr. Teague.

Mr. FULTON. Just while you are setting that up, Doctor, you do recommend the legislation that has been submitted to Congress for the transfer of the programs from the DOD to NASA, do you not?

Dr. YORK. Yes.

Mr. FULTON. So that the Saturn project is to be transferred and the vehicle that has been prepared is satisfactorily capable of performing that function?

Dr. YORK. That is what we have tried to make sure of, that there would be a sufficient and proper effort on that.

The CHAIRMAN. You may now proceed with the charts.

Dr. YORK. These are charts prepared for a multiplicity of uses. They describe military programs using space subsystems. We have said it that way just to point out that in most cases the problems to be solved are not so much problems in rocketry as they are problems in data acquisition, data transmission, data reduction, and so forth.

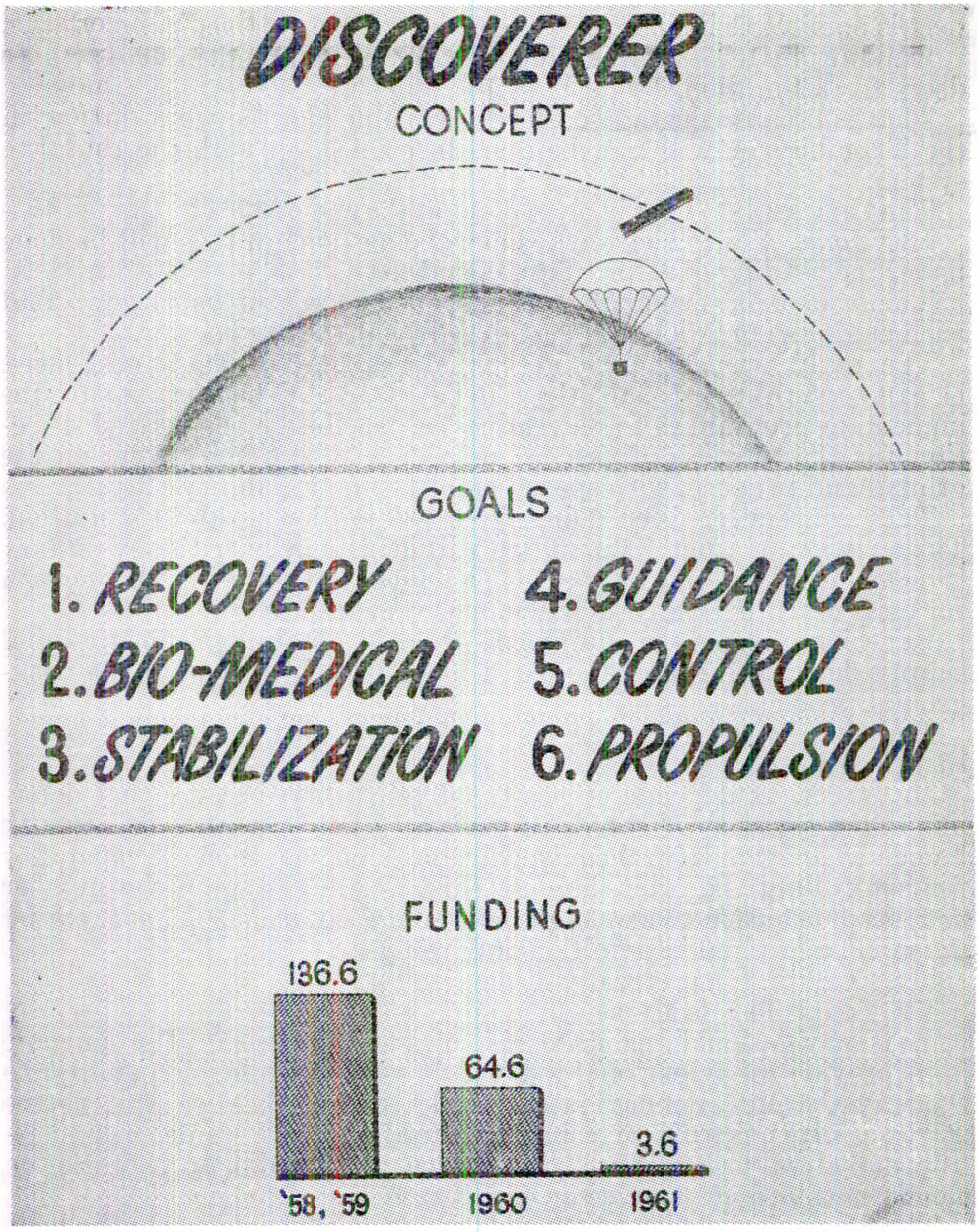

FIGURE 1

The only two charts not here relate to reconnaissance and to a summary of the complete program.

The Discoverer program is an engineering research program whose purpose has been to check out the equipment needed for recovery, stabilization, guidance, control, and propulsion; equipment that will be needed in all of our future programs—Midas, Samos, and so forth.

The reason for the Discoverer program is that using a smaller booster, the Thor-type booster, we can get enough of this kind of equipment into space to check it out prior to the availability of the Atlas booster which would be needed to check out a complete system.

It is possible to include in some of these flights biomedical payloads.

Funding in 1959–58 was $136 or $137 million, and in 1961 it goes down to $3.4 million.

That is because the big booster is available and the work done with the Thor booster will now be done in connection with the complete system.

The CHAIRMAN. That is phased out at the end of 1961?

Dr. YORK. Yes. The work that is being done in this will be done under the heading of Midas, Samos, and so on.

This was an interim program designed to enable us to get ahead with engineering prior to the availability of the big booster.

The early warning satellite, or Midas, the ultimate goal here, is early warning of ballistic missile attack. The purpose of the immediate program is to determine the feasibility of intrared detection for the purpose of perfecting a data processing system on the ground and in space, with special emphasis on reliability (fig. 2).

The program has been going from $23 million up to $102 million. The question of what 1962 will be will depend very critically on how it goes. That is, when it begins to actually start using this system for early warning, the costs will mount very rapidly.

But reliability of the equipment—that is, obtaining long life—and simply determining how the earth looks in infrared, what the background problems are——

The CHAIRMAN. What do you envision to be the ultimate cost of that program?

Dr. YORK. It depends critically on reliability, because that determines the number of satellites per year that you have to actually launch in order to have them working and it depends on the capability for controlling the orbit, because this determines again the number you need in order to get high percentage coverage. If everything goes well, a few hundred million dollars a year.

Mr. FULTON. That is really Midas, isn't it?

Dr. YORK. This is Midas.

The navigational satellite is a smaller one. Its purpose is to provide a navigational aid which works in a fashion similar to the way the old astronavigation works, except that we provide the star, ourselves, instead of using a natural one, and we detect and locate ourselves with respect to it by means of radio, so it works on cloudy days and what have you (fig. 3, p. 106).

The immediate goals of the program, the ultimate goals for location of ships, submarines and potentially, aircraft. The early phases involve cleaning out the feasibility of the Doppler technique, and correction of ionospheric refraction and that sort of thing.

This funding is only sufficient for doing these first experiments and feasibility correction.

If it works out to be an important navigational aid, that those concerned with navigation like, then the funding has to rise considerably. But with that and with the other one, the one important point to emphasize is that the future course of the funding, or of this program, the navigation program and the early warning program, don't depend on the future course of space programs in general, but rather, on how important is early warning and how good is this way

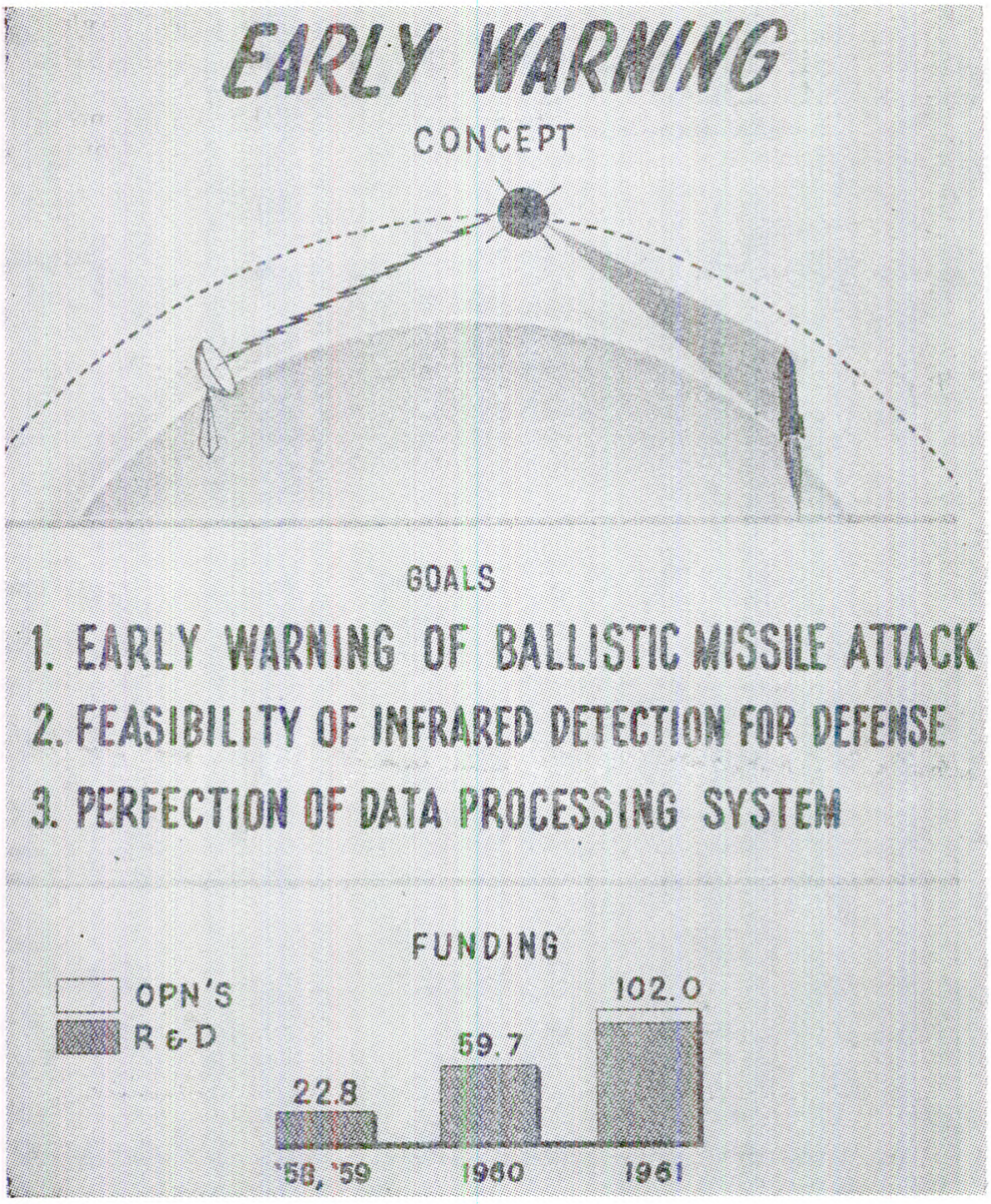

FIGURE 2

of doing early warning as compared with others, how good is this way of doing navigation as compared with others.

Mr. FULTON. Your name for that is Transit?

Dr. YORK. This is Transit.

In other words, to go back, we judge these all on their functional bases, when it comes to funding or otherwise and not on an environmental basis. Not as a space program, but as a navigational program.

This is a simplified chart of the communications concept. This is the Notus program which has several parts to it. The ultimate goal here is real time global communications (fig. 4, p. 107).

We have also the Courier program which is communications, but not real time. The Courier is the one where you load a tape recorder with

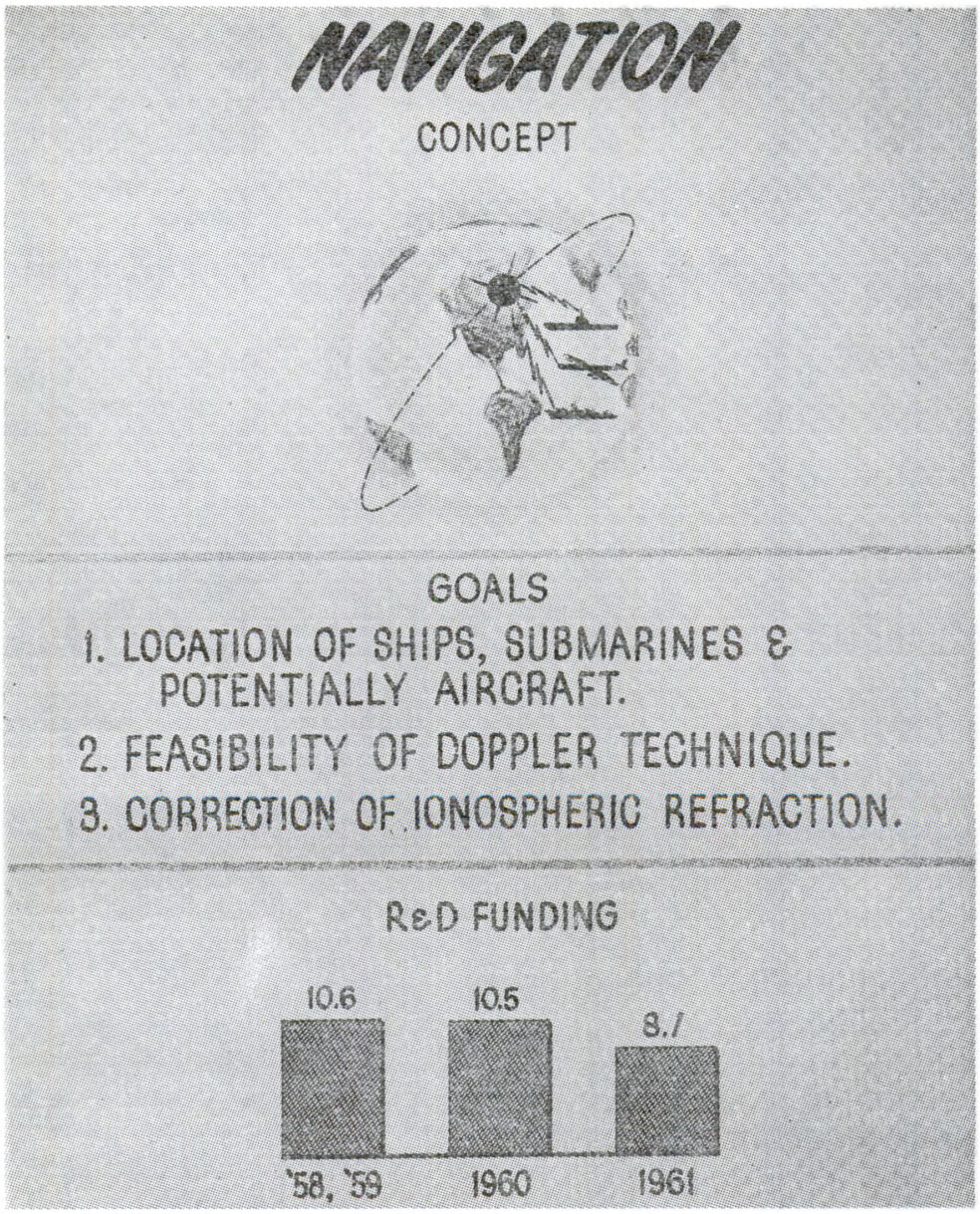

FIGURE 3

data and at a later point in its orbit, you use an electronic key to get it to disgorge. But ultimately we are talking about a real time global system.

Communications is one of the big military problems that has been with us, always. The total amount of band width we need is continuously rising and we are getting into more and more difficulty trying to use the existing techniques and expand on them, so this is important as a means toward expanding a military communications capability.

Eventually we hope also to be able to use this to get a link with aircraft and ships in the polar regions and we want to get a large worldwide traffic capability.

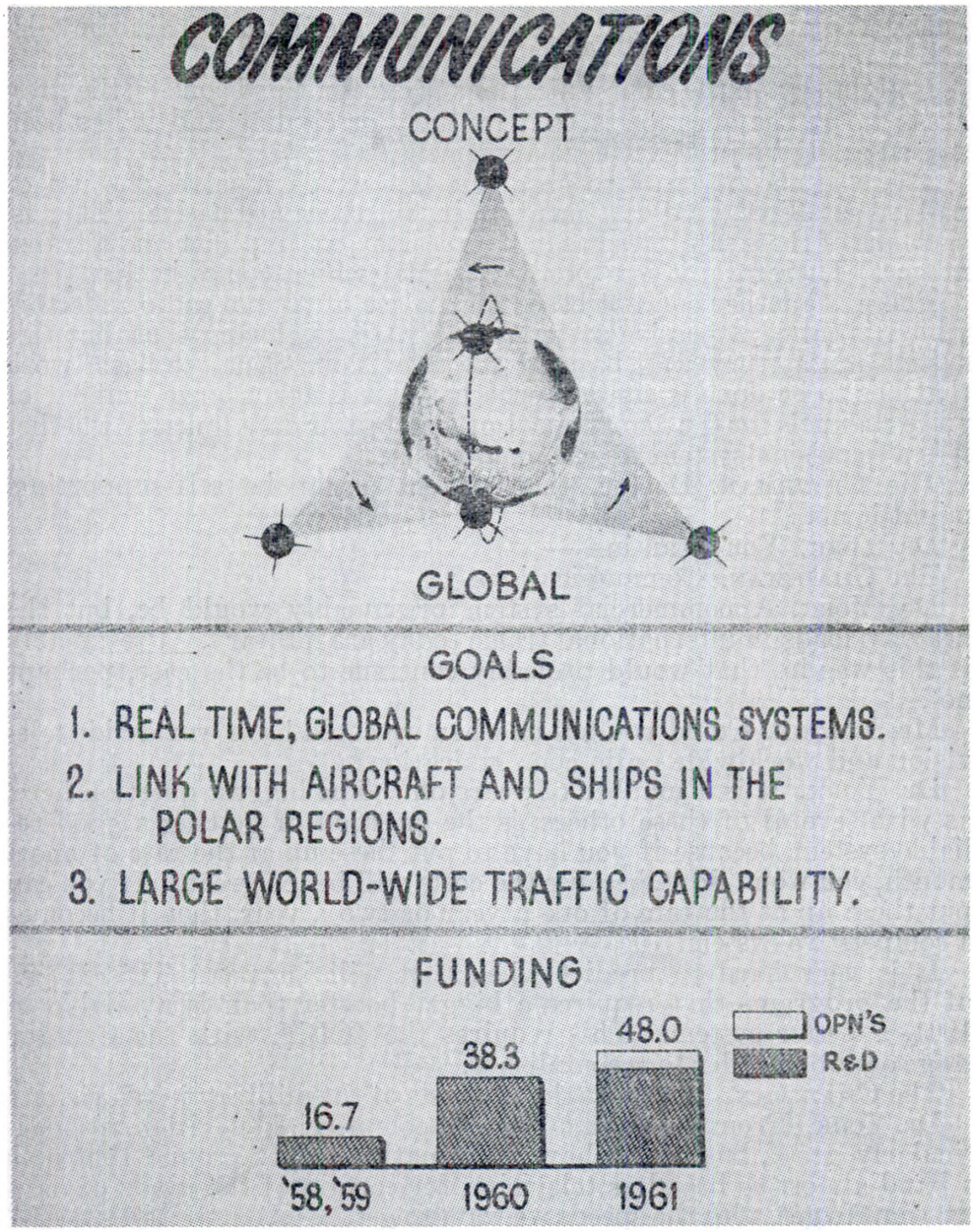

FIGURE 4

To do that, in addition to the Courier, which is short term, we conceive of a system that is based on the so-called stationary satellite, where you have three satellites in a so-called 24-hour orbit. These can reach all parts of the earth except that within 20 degress of the poles. In order to reach the poles, we have to have in addition, a number of satellites at a lower, but polar, orbit.

The funding goes from $17 million to $38 million to $48 million, but if this develops as a useful communications system, again there will have to be a marked rise in the future, perhaps even in 1961.

Mr. FULTON. When is your target date on that and would it mean the establishment of a worldwide television and radio system?

Dr. YORK. The capability of a 24-hour satellite is within the television and radio range.

I might say on the communications program, this is one of the gray areas where the question is, is it military or civilian and it has been settled easily by just executive agreement.

There is another way to go about this which involves the use of passive satellites. I didn't mention it, but these are active. That is, each one of these satellites has in it a receiver, an amplifier and a transmitter. Therefore, it is a powered signal which comes back.

There is another concept based on the use of simple radio reflectors which is called a passive system. NASA is exploring that, but this system might very well be used for television. But the basic work that has to be done is similar, whether this is for a large number of voice channels for the Department of Defense, or data links, or whether it is a television system for commercial use.

The CHAIRMAN. Doctor, that system might be self-supporting, might it not?

Dr. YORK. You mean in——

The CHAIRMAN. Communications.

Dr. YORK. A commercial system presumably would be, but the heaviest loads in international traffic today are military. Presumably if this was in, that would probably continue to be the case, perhaps not.

Mr. FULTON. Could you tell us when we could have worldwide television and worldwide radio communication?

Dr. YORK. It is a number of years off. The biggest question here, as with several of these others, is the question of getting a good reliable system, because if you have to put these up at the rate of one a month, you won't do it, because the costs will be too great. If you can put these up at the rate of one a year or two a year, then it becomes a competitive system.

It is very hard to predict when that will happen. This is one of the programs that requires a bigger booster than is available in 1961, a better system. This requires the ICBM, with the Centaur stage on top in order to accomplish it.

The CHAIRMAN. What are the interests of the military in television?

Dr. YORK. From the point of view of commercial television, not particularly great, but we do have information to get around that uses a band almost as broad as television for certain of the kinds of data we want to get, with the speeds we want to get.

We are interested in a large number of voice channels, other communications channels, a number such that it is equivalent to television. I did not say we were specifically interested in television.

Mr. BASS. How can you keep such a system exclusive, except by agreement?

Dr. YORK. This again, is a problem in electronics. There are various things you can do, depending on exactly what you think the problem is. Such as have a coded key that has to be sent up before you can get into it, and things of that sort. And then, of course, you keep it confidential by means of using coded messages, the same as we do with broadcasts, now.

Mr. FULTON. As a matter of fact, for a military application, that kind of communications system could be used for jamming. Then if

your radio bands and communication bands were narrow enough so that they were practically line-of-sight, nobody else could jam you. There is that tremendous gain. I don't see why we don't move faster to get that ability to jam out all other ordinary radio communications, not only in the atmosphere, but on the ground level. For example, tanks would be blocked. When we do have a system that would jam everybody and they couldn't jam us, it would seem to me to be of tremendous military gain.

Dr. YORK. Well, we are concerned with the question of how this might be jammed and what you do about it, and there are real possibilities here, but now this comes to the electronic game of measures, counter-measures, counter-counter-measures and so on, and we wouldn't be discussing just how we plan to go about achieving the security of the system.

Mr. FULTON. Could I finish with one thing. General Electric of Philadelphia had some people here, I believe, Mr. Chairman, a year or so ago and they felt they could get up three communications satellites within a 2-, 2½-, or 3-year period that would have the capability of four bands apiece and the equivalent of handling 500 digits a second on each band. That would be 2,000 units a second on each of the satellites.

What has been done on that? I am surprised to hear that the point in time is now receding when we have had testimony previously that it could be done quickly.

Dr. YORK. These are not contradictory, really. You can get a satellite up that will do that in a couple of years, but it probably cannot be a reliable component in an important worldwide communications system at that time.

There will be satellites flying within a couple of years in this program. When I made my first remarks, it was with respect to when you could expect to have a reliable communications system for an important purpose.

The CHAIRMAN. You are not getting all the money you really can use or need on that program, are you?

Dr. YORK. You could make it go faster with more, but this seems to be the best balance.

Mr. FULTON. How much would you recommend more, then?

Dr. YORK. This is the figure we are recommending in the 1961 budget.

The CHAIRMAN. What did you recommend before the Bureau of the Budget got hold of you?

Dr. YORK. As Mr. Gates has described a number of times, the services and ARPA were asked to submit two figures: A lower one and an upper one for each of these programs.

This is somewhere between the two. I don't remember what the figures were. I am informed they were both the same.

Well, there is the ARPA submittal to the Department of Defense.

The CHAIRMAN. How much more could you use to speed that program up?

Dr. YORK. What the more would mostly go into would be long-lead-time items for use out in 1961. I can't answer the question directly.

Mr. FULTON. Could you prepare that for us? To my mind, after hearing this previous testimony from other people, it seems as if this

program is being lengthened by several years over what I thought was applicable.

Dr. YORK. I don't think that these two pieces of testimony really are in conflict.

Mr. RIEHLMAN. Do I understand correctly that you do have a target date of at least 2 years before something constructive can be done?

Dr. YORK. No, there are satellites in orbit, in this program sooner than 2 years. There are satellites in orbit this year in this program.

The problem is trying to make a judgment as to when you can get necessary reliability and component work done. It is not a problem in space flight.

Mr. RIEHLMAN. Do you have any idea when that could be accomplished?

Dr. YORK. Several years before this can be a useful military communications system.

The CHAIRMAN. Doctor, if you had all the money you needed for that program, and I think it is vital, when could you make it workable?

Dr. YORK. You couldn't speed it up with more money right now. The question is, we are still a year and a half from the end of fiscal year 1961 and we have the problem here that we have with all development programs, of trying to predict what we are going to need almost two years from the time we make the prediction.

If this program needs more and if in terms of military requirements and communications, it is deemed worthy of more, then we will see what we can do about getting more.

Mr. FULTON. Could I ask you this question along those lines: General Electric, Philadelphia——

Dr. YORK. General Electric is one of the contractors on this.

Mr. FULTON. They said that for one to two hundred million dollars there could be three satellites up, each with a capability of 2,000 units per second in operation within a 2-year period from about a year ago. Why aren't we doing just that? It seems to me we get so refined and try to put so much in them. Why don't we just go for a straight-out satellite that can give us that kind of a transmittal or——

Dr. YORK. Our purpose is to solve the military communications problems and to solve the military communications problem, we need a reliable communications system.

We are, in fact, going ahead on a rapid basis with respect to Courier, which is a smaller item than the present communications system.

The CHAIRMAN. I am going to suggest at this point the doctor be that they are dead or that they were put up by someone else, with an opportunity to ask any questions.

Dr. YORK. This is the development of the system and, in fact, the use of the system that is in operation now, whose purpose is to detect nonradiating satellites. Nonradiating for whatever reason, either that they are dead or that they were put up by someone else, with an attempt to hide them, and to keep track of them (fig. 5).

There are a number of reasons for wanting to do that. One is we just want to know what is going on. Second, we want to have a good catalog of these things to avoid spoofing of our ballistic missile early warning system. We need to keep track of all satellites.

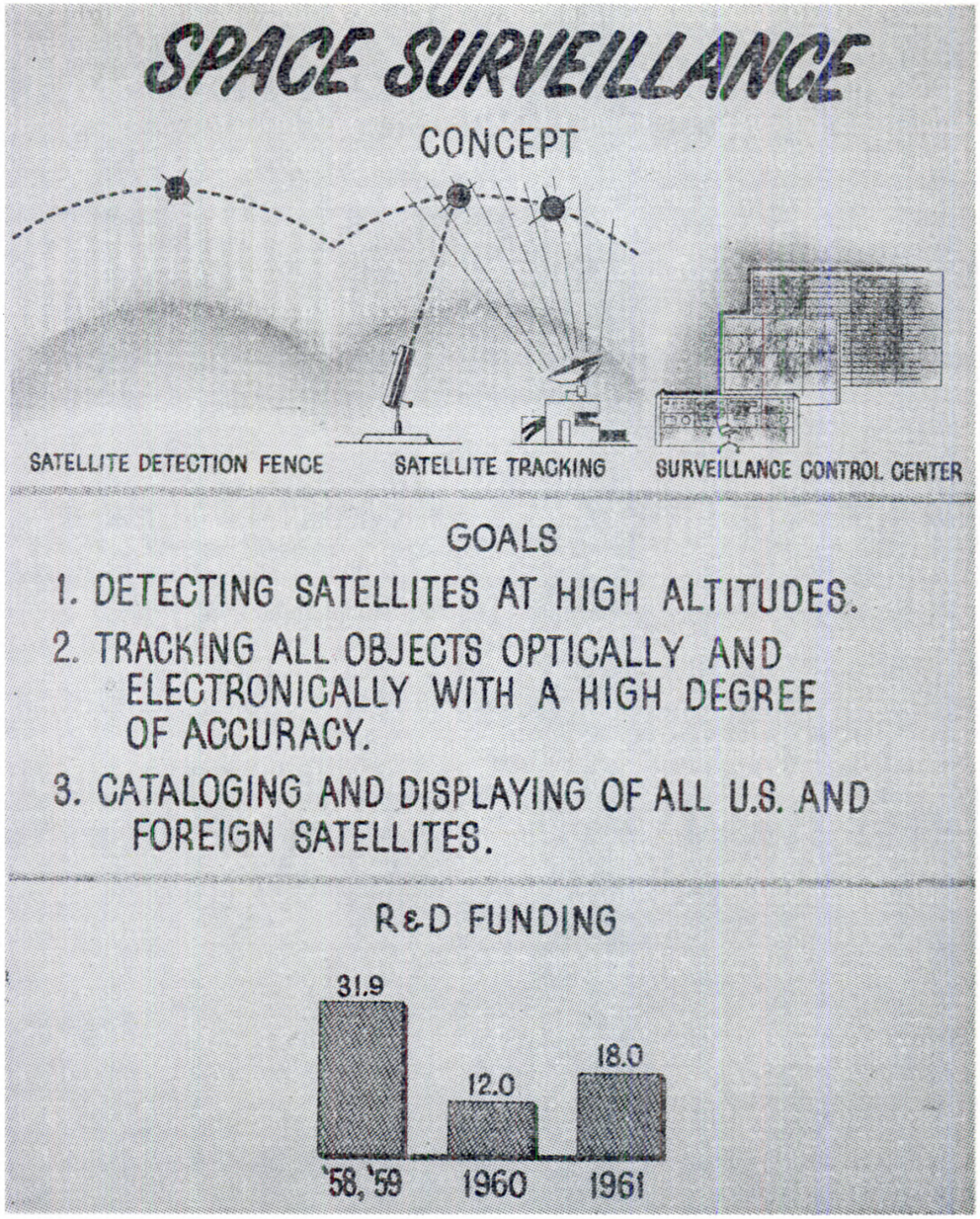

FIGURE 5

There is a system in operation now and the R. & D. indicates an improvement in that.

We have a number of things going on in studies and component development which we have mentioned. We are looking into new types of power sources. We are looking into advanced propulsion techniques, the general application of satellites, the development of components for more than one project—the Discoverer program, for instance, is similar to these, and looking at the development of components to test feasibility of projects which are not now fully approved for development (fig. 6, p. 112).

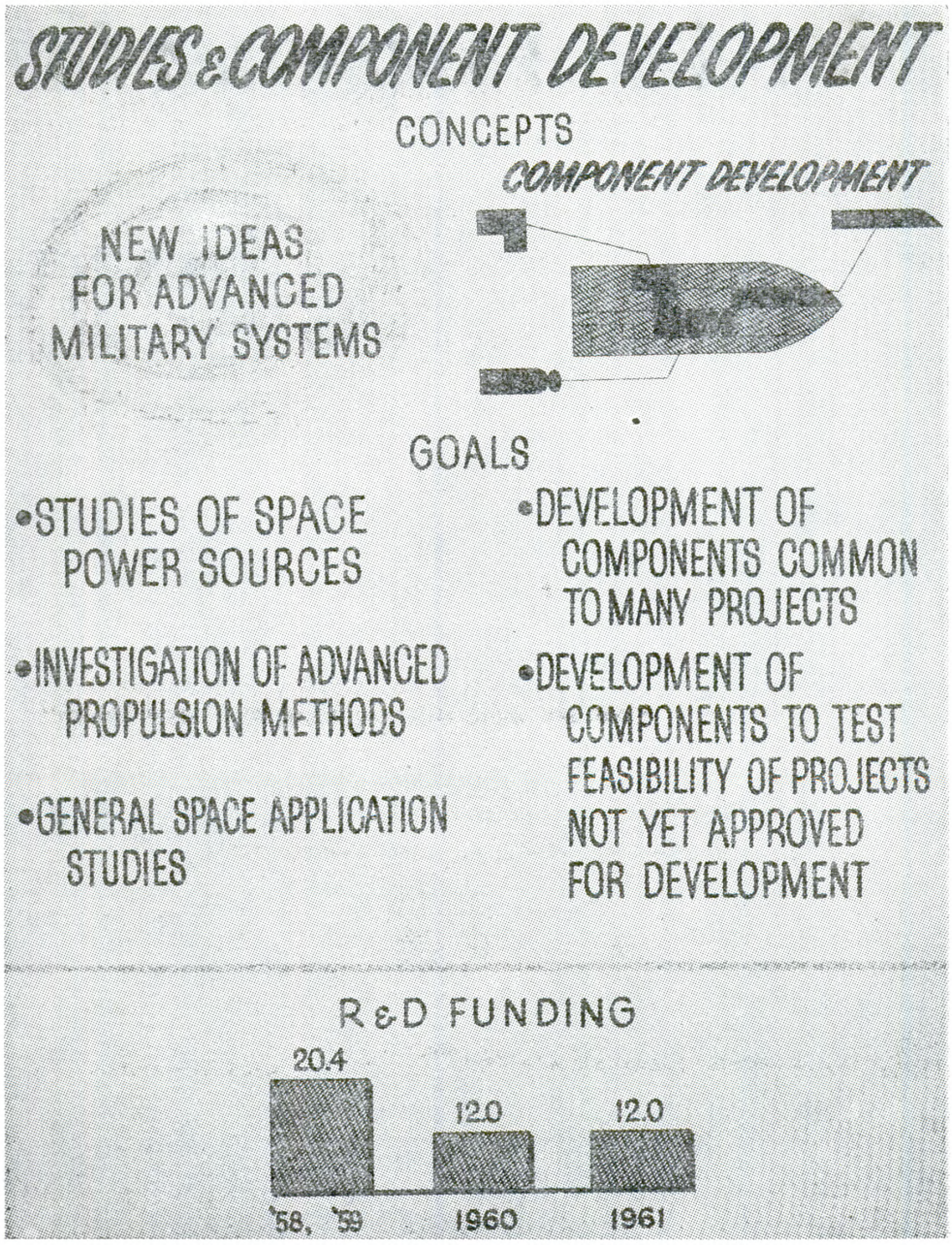

FIGURE 6

The total amount of money in this—this is not a particularly good picture of what is going on because a quite large amount of money in this field is carried in the applied research budgets, particularly of the Air Force, but also in the other services, and doesn't show as being separately related to space, but nevertheless, makes a direct contribution.

We have carried on vehicle development. The money singles out the Agena program which is the second stage for use with Thor-Atlas. There are others. There are being carried on, again

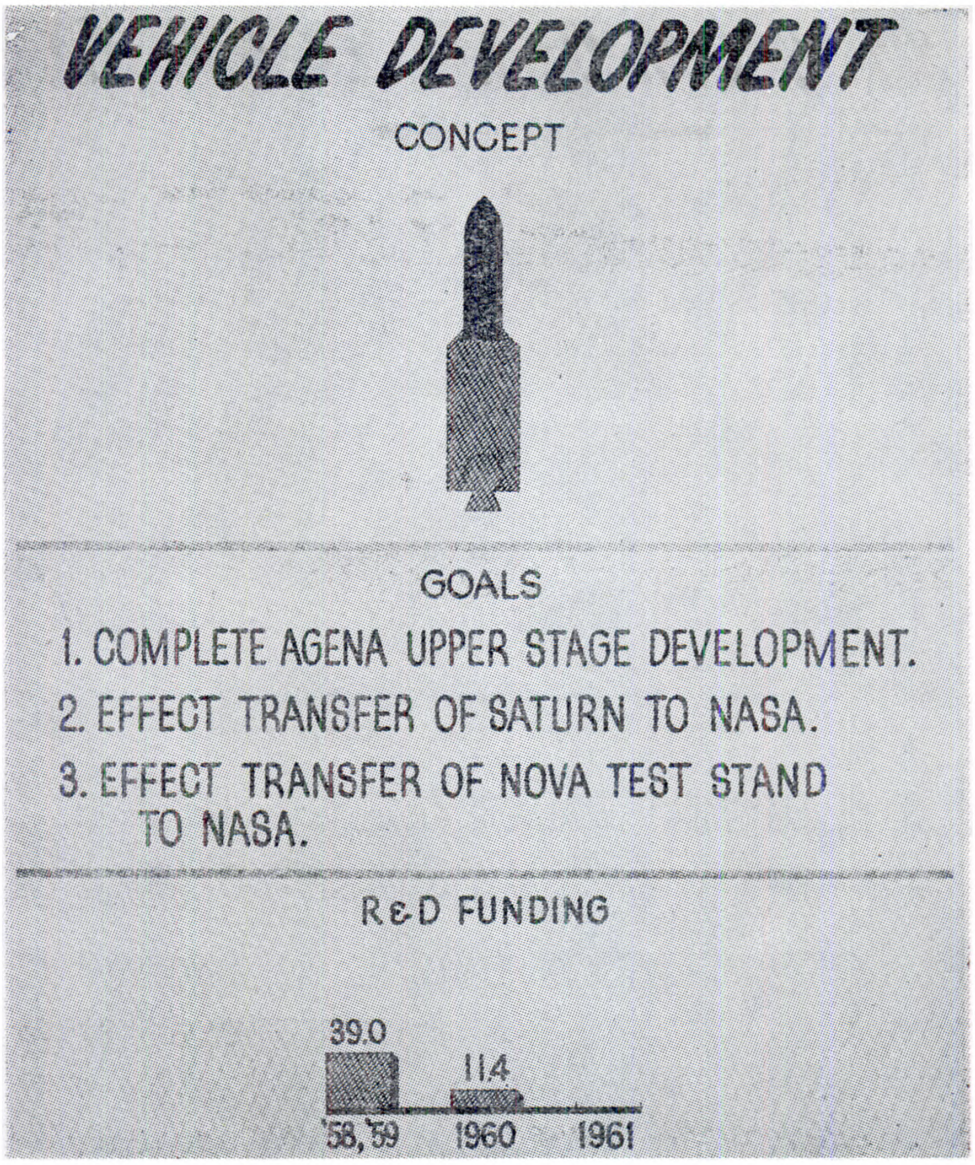

FIGURE 7

either in the applied research projects or as part of one of the programs. This was brought for assistance in comparing with past budgets when there was a separately identified item (fig. 7).

The goal here is really research in manned aerospace flight. With the X–15 we get up to mach 6. We would like to know for whatever reason we may need the information, what the problems and possibilities in controlled flight up to mach 25 are, up to extremely high altitudes (fig. 8, p. 114).

One possible application of knowledge in this field is for controlled reentry from orbit.

If there ever should develop a manned military system, we are surely going to need to be able to get the man back in a controlled fashion, and where and when we want him.

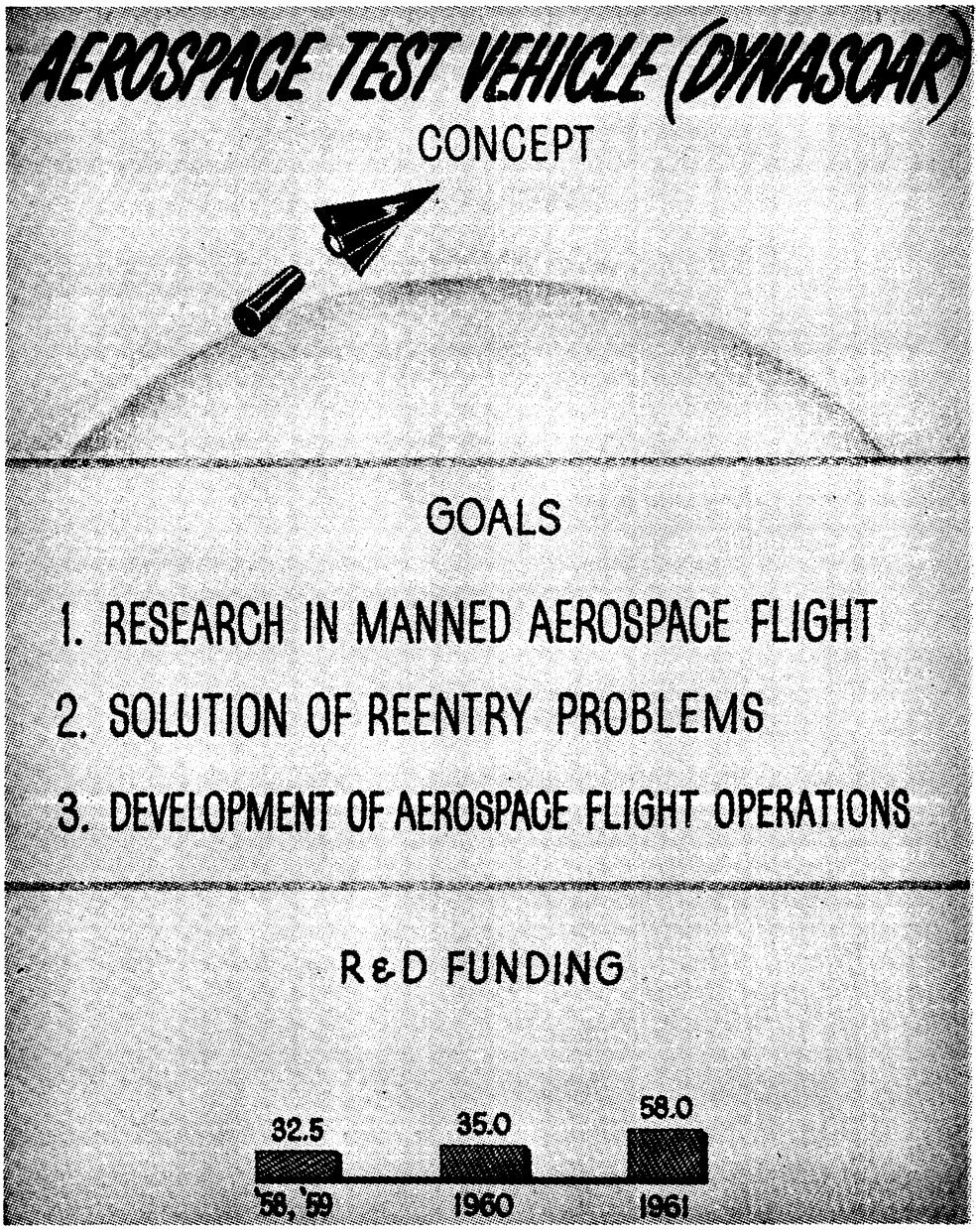

FIGURE 8

There is no specific military requirement for a man in space, but there is just our recognition of the fact that one may develop and the lead time is so long that you have to get at this program now.

Mr. ANFUSO. Mr. Chairman, could I ask a question before we lose the thought: Dr. York, wouldn't you require at least a million pounds thrust to get the Dynasoar up and make it stay up for a long period of time and to have it maneuver as you would want it to?

Dr. YORK. To do everything you might want to do, you require a considerably bigger thrust. On the other hand, for the purposes of simply carrying out an exploratory development program of an aerospace test vehicle, this can be done—it either can be done entirely or it

can be done almost entirely with uprated boosters of the ICBM type.

Mr. ANFUSO. But you are working on a larger thrust?

Dr. YORK. This is one of the reasons we are interested in a much larger thrust rocket is because ultimately—what we are talking about in the early phases of this program is the development of a glider that can fly up to reentry conditions.

With the existing boosters uprated, you can get either all the way or nearly all the way with that. On the other hand, if you start using this for something, you have to do more than just come back. Presumably you went up there for some reason other than to just come home. This is for the purpose of exploring how to come home. If you ever start using it, you will need a bigger booster.

Definitely if we are going to have manned space systems of any sort that do more than just explore the problems, such as Mercury does in the short term and Dynasoar does in the long run, you need bigger boosters. It is for men that you need bigger boosters.

Mr. ANFUSO. Thank you Mr. Chairman.

The CHAIRMAN. Thank you, Doctor.

Now, Mr. Teague?

Mr. TEAGUE. We admit we need bigger boosters. Why aren't we working on something bigger than a million and a half? Why aren't we working on a two, a four, a six or a ten?

Dr. YORK. We are. That is we, the United States. NASA has a program called Nova which is a million and a half pound single-barrelled rocket engine. You can get it better from them what their plans are, but it is planned to ultimately multiplex this up to 6, 9, or what have you, million pounds of thrust.

I think that is very important, incidentally, because really for space exploration, Saturn is quite a bit bigger than what we have got, but we are going to need something bigger.

Mr. TEAGUE. Could we go faster in this program?

Dr. YORK. Which program?

Mr. TEAGUE. Development of larger engines?

Dr. YORK. You probably could.

Mr. TEAGUE. Is it money?

Dr. YORK. That is a NASA program.

Mr. TEAGUE. The military is not interested in larger boosters?

Dr. YORK. We are, but when you get down to program details, you would have to ask them. I mean we are interested in seeing bigger boosters come along.

Mr. TEAGUE. Did you do anything along that line before it was taken away from you and given to NASA?

Dr. YORK. We were in the big single-barrelled booster program, but it was really hardly started by the time the present arrangement was made.

Mr. TEAGUE. From an engineering or scientific standpoint, is that what is holding us back, that we don't know enough to build a larger engine? Why should we have a contract now for a million and a half pound thrust when we know we are going to have to have about 10 million pounds at least?

Dr. YORK. I think you are going to have to have a 10 for space exploration, but it is a NASA program and basically also a NASA requirement.

Mr. TEAGUE. It was under you for a long time. Why didn't you——

Dr. YORK. No, it was not. The Nova engine was—the Air Force had it for some time, but it was a study program and that was one of the earliest things transferred. I am not sure I remember when, but probably at the very beginning. At the very creation of NASA, that was one of the programs sent over.

Mr. TEAGUE. What is the estimated size engine for a reconnaissance satellite?

Dr. YORK. That we plan to do with the Atlas booster, with considerable leeway.

The CHAIRMAN. Thank you.

Mr. Bass?

Mr. BASS. No questions.

The CHAIRMAN. Mr. Anfuso?

Mr. ANFUSO. Doctor, are you satisfied with the progress that we are making in trying to catch up with the Russians?

Dr. YORK. What program are you referring to?

Mr. ANFUSO. The programs that you are working on, the programs that NASA is working on. All these programs which have a connection with space. Do you think that we are doing enough or that we could do more?

Dr. YORK. As far as the Department of Defense is concerned, we are working on our programs because we need the results which they will produce and we would be working on them whether there was a Russian program or not.

Programs in space flight per se, and space exploration, are NASA programs.

Mr. ANFUSO. Can't you give me a "Yes" or "No" answer whether or not we are doing enough?

Dr. YORK. Their program is accelerating, but you would have to ask them whether they are doing enough.

Mr. ANFUSO. You feel that the scientists could do more, don't you?

Dr. YORK. It is always possible to do some more.

Mr. ANFUSO. Now, if the Russians 3 years from now have a tremendous advantage on the ICBM's—let us say they have 1,000 ICBM's compared to a possible 300 that we may have, wouldn't that permit them to almost wipe out any important installation that we have in the United States, as well as devastating a great number of our population?

Dr. YORK. Well, there would be enormous devastation with that number of rockets. This is again not really a research and engineering problem, which is what I am responsible for, and there has been a lot of testimony from other people whose responsibility it is. The Secretary, the Chiefs of Staff and so on.

They have pointed out this balance depends on a great many different things, such as the total number of weapons systems involved, the total amount of warning.

The reason we are so interested in the Midas program is because of the importance of warnings, for example. This can make a big difference with respect to how important any particular numbers in balance may be.

Mr. ANFUSO. Dr. York, I am asking you as a scientist, if the Russians should have that kind of an advantage, wouldn't the prospects for peace be minimized?

Dr. YORK. If they thought—it depends on what they think about it. I mean if they think they have got a good chance, then it minimizes the possibilities of peace, but it depends on their point of view of the total balance and what we would have left.

Mr. ANFUSO. Do you still have reservations as to the Nike-Zeus?

Dr. YORK. As to whether we should go ahead with production on Zeus, yes.

Mr. ANFUSO. When do you think that these reservations of yours will be resolved?

Dr. YORK. I really don't know. The decision to not go into production I hasten to add, is not based entirely on my reservations, at all. A production program is a matter where my responsibility is one of making recommendations to the Secretary. The Joint Chiefs make their own and then it is the Secretary's problem to see what to do.

Now, it happens that my recommendations and those of the Chiefs are the same.

Mr. ANFUSO. Do you agree with what General Taylor says in his book, that Secretary of Defense McElroy appointed a committee headed by Dr. Hector R. Skifter, which recommended the operation of the Nike-Zeus?

Dr. YORK. Yes, I agree with that. We discussed that last year at this same time.

Mr. ANFUSO. Do you agree with the report?

Dr. YORK. I agree that it happened. I thought you asked me if I agreed——

Mr. ANFUSO. Do you agree with the report of the committee?

Dr. YORK. No.

Mr. ANFUSO. Again I am going to ask you as a scientist, Dr. York, this question: We could have commenced work on a larger booster as far back as 1953. At least that was the testimony of Secretary of Defense Gates yesterday.

Dr. YORK. Yes. We would have commenced even earlier than that.

Mr. ANFUSO. If we did, we would be that much further ahead.

We have lost 7 years, haven't we?

Dr. YORK. We would be further ahead if we had commenced both a larger booster and boosters of the present size. If we had started only a larger booster, we would be further ahead on space, but not as far ahead with respect to missiles.

Mr. ANFUSO. We have wasted 7 valuable years, haven't we?

Dr. YORK. 1953 is kind of arbitrary. It could have been started before or it could have been started any time.

Mr. ANFUSO. All of the experts say we could have started in 1953.

Dr. YORK. That is true. We could have started in 1950.

Mr. ANFUSO. It is your knowledge on that that all the experts said we could have started in 1953——

Dr. YORK. We could have started at any time after World War II.

Mr. ANFUSO. We had the capability of starting in 1952.

Mr. BASS. Or 1946.

Dr. YORK. We had it at any time.

Mr. ANFUSO. I don't know about 1946. I do know about 1953.

Dr. YORK. Only because it is one of the years in that span.

Mr. ANFUSO. Dr. York, I am interested in this and I think the American public is interested in this: Do we have any scientists connected with the Bureau of the Budget, besides mathematicians?

Dr. YORK. There are some people with technical backgrounds.

Mr. ANFUSO. There are some people?

Well, isn't it a fact, Dr. York, that the Bureau of the Budget has steadily recommended a lower appropriation for space exploration? These figures were reported not so long ago. For instance, for fiscal year 1959, they recommended $440 million. For fiscal year 1960, they recommended $454 million, and for fiscal year 1961, they recommended $407 million.

That is why I asked you whether we have some scientists there, or are they all mathematicians with a pencil trying to balance the budget?

Dr. YORK. I am not aware of that figure. Within the Department of Defense, we balance our own programs.

Mr. ANFUSO. Well, do you think that these are the figures? They were reported in the New York Times not so long ago.

Dr. YORK. I really don't know.

Mr. ANFUSO. If they are the figures, Dr. York——

Dr. YORK. They could be.

Mr. ANFUSO. There is something wrong with the Bureau of the Budget, insofar as the defense of our country is concerned?

Dr. YORK. The Bureau of the Budget is not responsible for going ahead with space and so on. They are responsible for the budget.

Mr. ANFUSO. The President of the United States is taking their recommendations.

Dr. YORK. The Department furnishes their own figures.

Mr. ANFUSO. The President of the United States has placed balancing the budget as being far more important than protecting the lives of our citizens.

Dr. YORK. He gets recommendations from many sources.

Mr. ANFUSO. That is all.

Mr. FULTON. Just because there is no negation of some of these statements, I hope the record doesn't show the rest of us agree.

The CHAIRMAN. Mr. Riehlman.

Mr. RIEHLMAN. Dr. York, of course, I take an entirely different position than my colleague from New York, because we are not here to try to establish whether or not the President has put pressure on the departments to balance the budget, in respect to the safety of this country.

I do not agree with it and I am sure the gentleman from New York has more respect for the President than to say he would jeopardize the safety of our Nation just for the sake of balancing the budget.

Mr. ANFUSO. I don't say he has done it intentionally, but the figures speak for themselves.

Mr. RIEHLMAN. Well, I am not going to agree with the figures, either. But the thing I think we are vitally interested in, Dr. York, is whether or not in your own position, you personally feel that we are doing everything we can, constructively and realistically with the

money we have allotted to these programs for the defense of our country and for future exploration of space?

Dr. YORK. Well, I am not involved with future exploration of space.

Mr. RIEHLMAN. Well, you certainly have had some interest in it, and you do have, I am sure. It is definitely tied in with our defense program.

Mr. YORK. We are considering all the things we have got to do and the people and other resources we have to do them with. We are going ahead as best we can.

Mr. RIEHLMAN. Well, if we had additional millions or billions allotted to your own assignment, have we the people and the wherewithal to constructively spend this money?

Mr. YORK. Well, we are getting into diminishing returns. There is a shortage of really first-rate people to spend any more. You could get more results with more, but the fractional increase in the results would be less than any fractional increase in money.

Mr. RIEHLMAN. That is all I have, Mr. Chairman.

The CHAIRMAN. Mr. Sisk.

Mr. SISK. Mr. Chairman, I have one or two questions.

Dr. York, with reference to the recommendation for the transfer of ABMA to NASA, would you comment as to your position on that?

Dr. YORK. I am for it. The point here is that—one of the major points here is that without this transfer, we have, to say the least, a difficult organizational problem, because the way it has been, there are two large projects in the very big booster field. There is the Nova project, and there is the Saturn project.

Prior to this arrangement for transfer, there were three management or administrative level agencies, executive agencies, involved in these two programs. This transfer accomplishes an objective of having one executive agency in charge of the two.

What I mean is that prior to this, we had the NASA as the executive for the Nova program. We had ARPA as the executive for the Saturn program, and we have the Army, the Department of the Army, as the executive for the agency that was doing the Saturn program, so there were three executive agencies involved with just two programs. That didn't seem like a particularly neat organization and this puts all of the big booster efforts in one place.

Mr. SISK. In other words, you actually recommended this transfer, did you, Dr. York? Or were you asked for your recommendation?

Dr. YORK. Yes; I did have to do with it.

The primary objective was to get this organization and these two programs in one place. Consistent with the Space Act of 1958, the place seemed to be NASA, but I think it was essential to get these two programs in one organization, under one executive, and that is the primary motivation as far as I am concerned.

Mr. SISK. Well, let me say that I agree with you, and I am not being critical. I simply wanted to know specifically what your own personal thinking was.

Now, I have introduced a resolution calling for the immediate turnover without waiting for the March 14 date, which under law would otherwise be required. Would you support an immediate turnover?

Dr. YORK. Yes. Now, that is without personal knowledge of every detail with regard to how NASA and the Army, where they stand with

respect to who is going to run the water system. I don't know exactly where they are, but barring any funny administrative problems like that; yes.

Mr. SISK. Well, the purpose, of course, that I had in mind was to expedite the transfer of ABMA to NASA, to have it done as expeditiously as possible. By the resolution, of course, we would simply free the Department to go ahead and work out these details as quickly as possible. I assume they are already working on the details.

Dr. YORK. They are working on the details. On Saturn, we made arrangements immediately after the President's decision whereby the Saturn program has been under the control of NASA now for several months.

Mr. SISK. Would you feel that because of the difficulty in working out these details there might be some delay in the project?

Dr. YORK. No; there shouldn't be. There is no reason for it.

Mr. SISK. I would hope there would not be. I know that has been one of the only reasons why there may have been some opposition to the transfer. Now, there may be other opposition. I know there is opposition, of course, to the transfer but some of it has been predicated on the idea that this will tend to slow down ABMA operations.

In your opinion, you do not think the transfer will tend to slow down ABMA? Do I understand you to say that?

Dr. YORK. That is right.

Mr. SISK. That is all, Mr. Chairman.

Mr. FULTON. Would you yield to me, Mr. Sisk?

Mr. SISK. Yes; I yield.

Mr. FULTON. We might put in the record that we feel the transfer in no way reflects on the Army Ballistic Missile team and that General Medaris and Dr. von Braun and their staff have done excellent work. I have been very much impressed with it.

Mr. SISK. May I conclude by saying that I have been one of the greatest supporters of General Medaris and the Von Braun team and I believe one of the greatest mistakes you and others have made is not unleashing that team and letting them go a long time ago.

I am very critical of that. In my opinion, this transfer is a decision that has been made more or less by the Executive, and I think what we should do now is face up to that situation and try to put it under a single head and move as rapidly as we can.

I agree completely with the gentleman from Pennsylvania.

The CHAIRMAN. Let me agree, too, with what the gentleman has to say. We might have been ahead of the Russians today had we given them more latitude with reference to their teamwork.

Mr. Quigley?

Mr. QUIGLEY. Dr. York, in your colloquy with my colleague, Mr. Anfuso, you made the statement that within the Department, itself, you try to present a balanced program. Now, this was in your discussion over the influence of the Budget Bureau on these decisions.

I am interested in your use of the words, "balanced programing." How were you using those words?

Dr. YORK. We have a great many programs we have to sell. We have the missile programs as distinct from the space programs. We have small-range missiles for air defense, for surface-to-surface use. We have antisubmarine warfare. We have communications. We

have intelligence within—I am talking now just about research, development, test, and evaluation—we have basic research, applied research, and so on. And within these we have a great many objectives we have to achieve and we cannot allow a single objective to let us forget others.

Also, something like the early warning satellite, as I have said several times, we judge that on the basis of how it competes with other ways of doing early warning and not according to what environment it operates in.

Mr. QUIGLEY. What I am trying to get at is, which comes first, the chicken or the egg? Do you know what you are going to have to spend, or do you know what you are going to have to do?

Dr. YORK. We know what ball park we are going to be in and we also have a pretty good idea of what we have to do. There is no date before which we know nothing and then suddenly we find out one of these.

Mr. QUIGLEY. When you say you know what ball park you are in, are you telling us now that you know how many dollars you are going to be allowed?

Dr. YORK. I am telling you that I know now within 5 or 10 percent, and I know that for 1962 as well as 1961. As a working hypothesis, I have to make some kind of an estimate about what the resources are going to be. I know that it was clear that 1961 was going to be about the same as 1960, certainly within 5 or 10 percent, and it doesn't matter whether it is precisely or whether it is 5 or 10 percent different. Unless something major occurred, a great increase in the threat or a decrease, or some other military activity, under which circumstances, any extra money would have gone for things that wouldn't ever be anticipated anyway—so as a practical, working hypothesis for planning, I assumed the money was going to be about the same for 1961 as for 1960, within a couple of billion dollars on the total.

And I think that is going to turn out to have been a really good guess.

Mr. QUIGLEY. I have no criticism of your ability to guess, but I am critical and, in fact, I am frightened by the whole system which, in effect, corrals and puts within a little fence the defense and the security effort of this country.

It seems to me the defense of the country, the security of the country, has to come first and the amount of dollars has to follow this. If necessary, this Congress and the administration have to get these dollars. I think you are doing it just the opposite, and I think Mr. Anfuso's comments come pretty close to the truth. The budgetary considerations are taking a priority over this country's security.

Dr. YORK. They certainly play a role.

Mr. QUIGLEY. They certainly play a role, but they could play a very decisive and a very fatal role.

Now, without being partisan, I think this committee, I think the Members of this Congress, and I think the American people are ready to spend what we have to spend to protect and keep this country secure, and to make us tops in every field, including outer space.

Doctor, in answer to Mr. Teague's question, you made a statement which also bothers me and frightens me. You said the military, or

the Department of Defense is interested in seeing a bigger booster and your words were "come along."

Now, how is it going to come along unless you make it?

Dr. YORK. The big booster programs are NASA programs. Whether it comes along or not depends on whether you support their program. And I gather from everything I have heard, you are going to.

Mr. QUIGLEY. Well, is this the easy answer, is this the convenient answer, that this is the responsibility of NASA?

Dr. YORK. There is a National Space Act of 1958 and a number of actions that have been taken consistent with that. To duplicate another booster within the Department of Defense would be in the interests of nobody. It would simply dissipate resources and be a diversion.

Mr. QUIGLEY. But if the Department of Defense is interested in seeing a bigger missile come along, don't they have the responsibility, either within their own Department, or within the administration, through NASA or someone else, to take positive, consistent actions to see that it happened?

Dr. YORK. We have taken quite a few actions to see that it happens. In connection with arranging for the early discussions concerning the transfer, we made our position entirely clear to those who were responsible, that we believed the country must have a big booster and that, although we had no specific requirement for one, we could not foreclose on one.

So that, in connection with the transfer we made it clear to all involved that, to the extent one can do this, that we were trying to make a stipulation that these big boosters would go ahead as a result of this transfer.

Second, in connection with all of these booster programs—and furthermore, in Mr. Gates' statement, my own, and any further questions you ask me on the subject, I will say we support vigorously this program before the Congress.

We provide most of the facilities that are going to be needed for their booster program.

Now, these boosters, for example, will be launched from military missile ranges. The equipment at these ranges is equipment that was installed in very large part for military missile programs. Some of it subsequently for space programs.

They are using contractors that acquired their know-how through participation in military programs and so on.

I think we are doing everything that can be done by an agency that is not directly responsible and that does not directly receive the authorization, the appropriation for the program.

Whenever there are discussions between ourselves and NASA, or between NASA, ourselves, and someone else, be it the Bureau of the Budget—the same as the Congress, we strongly support this program.

The CHAIRMAN. Mr. Karth?

Mr. KARTH. Doctor, in the name of security yesterday we were not given the answer as to how many destructive missiles we think the Russians have. Obviously not for the purpose of telling the Russians, because they know, so it must have been because we don't want the American people to know, but that isn't my question today.

Dr. YORK. That is quite right, but if that is not your question, I won't answer.

Mr. KARTH. It is not because we don't want the Russians to know?

Dr. YORK. Because we don't want the Russians to know what we know and how we find it out.

Mr. KARTH. I see.

My question today, Doctor, is—and I understand your reservations about the Zeus system, which is an early warning system.

Dr. YORK. It is an interception system.

Mr. KARTH. Last week the commander of the U.S. Strategic Air Command, Gen. Thomas Power, said—and in his speech that was quoted in italic apparently for the purpose of designating importance, it was that the Soviets could virtually wipe out our entire nuclear strike capability within a span of 30 minutes with only some 300 ballistic missiles. Not all ICBM's, he said, a part of each.

That leads me to a very important question—at least I think it is important: How long do we have to wait, at your earliest possible estimate, for a dependable warning system so that our whole retaliatory power may not be destroyed on the ground without having fired a shot, so to speak?

What is your earliest possible estimate of a warning system?

Dr. YORK. We have a warning system going in now. I don't want to discuss in open session the dates on the warning system, but there is a warning system being installed now, for missiles.

Now, there are warning systems existing that are suitable for giving warning to one place when another place is struck earlier. You see in General Power's statement he talked about half an hour. If he means that there was a salvo that landed all within zero time, that is one thing. If he means it was spread out over a half an hour, then you have a warning system just by getting the word around from one place to another.

Any nonsimultaneity in attack constitutes a warning. Now, that capability already exists.

In addition, there are warning systems being installed now.

Mr. KARTH. Now, my next question—and maybe we can get at this in closed session—What kind of an antimissile missile programing do we have that could be effective, if you could discuss that in open session?

Dr. YORK. That would be effective—you have to also say when. And, of course, also against what?

Mr. KARTH. Against ICBM's.

Dr. YORK. Yes, but it depends upon what kind and what time scale you are talking about then, too.

We don't have any that would be effective now. It is an easy answer for this year. None.

Mr. KARTH. Would you care to discuss the possibilities of when you think we might have one?

Dr. YORK. The earliest system that has been taken at all seriously is Zeus and that is quite a few years off.

Mr. KARTH. That is all, Mr. Chairman.

Mr. ANFUSO. Will you yield for one question?

Mr. KARTH. Yes, I yield for a question.

Mr. ANFUSO. Dr. York, I don't want you to take any criticism that may have been made here this morning as directed against you person-

ally, because I for one, have the greatest respect for your ability and we don't want you to be going off and resigning like some other people and joining private industry.

Dr. YORK. I won't.

Mr. ANFUSO. We want you to stay in Government and continue to do the job that you are doing under the limitations which have been placed upon you.

Dr. YORK. No limitations have been placed on me that keep me from doing my job.

The CHAIRMAN. Mr. Hechler?

Mr. HECHLER. Dr. York, do you believe we are in a missile and space race with the Russians?

Dr. YORK. Yes.

Mr. HECHLER. I was a little disturbed by what you said earlier, that you would be doing all these things without any reference to what the Russians were doing.

Dr. YORK. That is correct, with respect to those programs which are fully within the responsibility of the Department of Defense; early warnings, reconnaissance, and so forth. If the Russians had never launched a satellite, we would still be—I hope we would still be doing those.

Mr. HECHLER. Would it be correct to say that programs under your direction are more or less cut to fit the size of the budget cloth?

Dr. YORK. That depends on how generally you are willing to take that. In the sense that they are cut to fit a budget of the order of $41 billion or somewhere between 39 and 43, or 45, or what have you, one does have to consider all the things that have to be done and how to fit them together.

Mr. HECHLER. At the bottom of page 4 you give some figures on increased amounts for funding of space-related programs for fiscal 1959, fiscal 1960, and fiscal 1961, which would seem to give the impression——

Dr. YORK. These are for defense program.

Mr. HECHLER. I beg your pardon?

Dr. YORK. These are for defense program, only.

Mr. HECHLER. Which seems to give the impression of a steadily increasing funding.

As I understand it, funding could be interpreted as paying out for past programs and I wonder if you could give us, perhaps, more significant figures which would be figures for new obligational authority?

Dr. YORK. This is direct obligations. I mean there are those three. This is very closely the new obligational authority. I don't have it, but the new obligational authority is very close to these. These are not expenditures. These are the planned obligations to be made in the future and that have been made in the past and they are very nearly the same as the new obligational authority requested. Expenditures are growing faster than this.

Mr. HECHLER. If you could give those specific figures for the record, I would appreciate it.

Dr. YORK. Yes. Expenditures, of course, are much harder to estimate when you are talking about the future than obligations. They would show a somewhat faster expansion.

(The information requested is as follows:)

DOD space related programs (new obligational authority)

[In millions]

	Fiscal year 1960	Fiscal year 1961
Navy: Military astronautics		1.3
Air Force:		
Dyna Soar	35.0	58.0
Samos, Midas, Discoverer	275.2	333.1
Other military astronautics	3.7	5.8
	313.9	396.9
ARPA	104.7	67.0
Grand total	418.6	465.2

Mr. HECHLER. I would like to ask you the question which the Secretary of Defense started to pass to you yesterday and I didn't give him an opportunity to, because I wanted to get his own answer.

Do you think that the status of the educational system in our country has any relation to our future progress in missile and space programs?

Dr. YORK. Yes, I do, because we can—I would very much like to see right now more very good people in these and all of our other research and engineering programs. And the people we have are the product of the educational system.

Mr. HECHLER. I am glad to hear you answer that. I would certainly like to see if some leadership, too, could be provided from the Department of Defense and at the Presidential level to pinpoint the necessity of strengthening our educational system.

This seems to me to be the central point of our whole national defense, which we are neglecting.

Dr. YORK. The central point of our future.

Mr. HECHLER. Well, aren't we all living for the future?

Dr. YORK. Yes. Yes, I agree with you, Mr. Hechler.

Mr. HECHLER. Would you be willing to consider that possibly it would be advantageous to take away some of the appropriations for the Department of Defense to divert them to strengthening our educational system?

Dr. YORK. I would make an alternative suggestion of making an effort to finding some other source. I am not eager to have any taken away from the Department of Defense.

Mr. HECHLER. In other words, you feel what you are spending on research, hardware, and development is more important than education?

Dr. YORK. No, I don't think it is more important, but we are not the only source of funds available in the United States.

Mr. HECHLER. I just wish I could get the people in the Defense Department interested in education enough to——

Dr. YORK. A great many are, but not perhaps to the point of being inspired to suggest a decrease in our own programs.

Mr. HECHLER. Well, I just feel, myself, that I am not going to vote for any more defense appropriations until we get an aid-to-education bill. So far as I am concerned, education is the most important thing for the future defense of our country.

Dr. YORK. I agree it is very important, but the immediate problem of survival is also very important.

Mr. HECHLER. Thank you, Doctor.

The CHAIRMAN. Mr. Daddario?

Mr. DADDARIO. You have said, Dr. York, with reference to the Nike-Zeus system, that your recommendations were the same as those of the Joint Chiefs of Staff. Now, what were those recommendations?

Dr. YORK. That we should not at this time go into production of a $15 billion system, or whatever it might be, but that we should continue the research and development program into 1961 and further.

Mr. DADDARIO. Well, was your recommendation then based on the $15 billion estimate which you have made, or was it on the scientific basis of something wrong with the system?

Dr. YORK. As far as my part of the recommendation was concerned, it was on technical grounds.

Mr. DADDARIO. What are those technical grounds?

Dr. YORK. I don't think we should discuss this at too great length, here, but they have to do with the question of what the probability of Zeus working is in the face of a probable attack. There are sufficient numbers of unsolved technical problems so that this probability seems quite low, as of today.

Mr. DADDARIO. In reference to that, do you mean it would not be 100 percent successful? That it would be zero effective, or that it would have some effectiveness somewhere along the line, between the zero and the 100 percent figure?

Dr. YORK. It would be somewhere between zero and 100 percent, but if the things we are at the present time dubious about were true, it would be much closer to zero than a hundred. In other words, we are not quibbling about the difference between 98 and 100, Mr. Daddario.

Mr. DADDARIO. If you look toward the date when Nike-Zeus might have become effective, taking into consideration the deficiencies you feel it apparently has, are there other programs in mind, either theoretical or those that you have some great faith in, which might be developed to the point where they might be effective at the same date Nike-Zeus might have been produced and put into the field?

Dr. YORK. Probably none of these could be effective at the same date Nike-Zeus might have been effective. But there are others that we are somewhat hopeful about and that we are trying to explore further.

Mr. DADDARIO. Then we can look forward, as I understand it, to a gap between the time when our potential to attack with ICBM's, and the Communist's potential to attack us becomes effective, to a period when there will not be a screen against that attack.

Dr. YORK. Yes; but that has nothing to do with administrative decisions. This is based on facts and nature.

Mr. DADDARIO. I am not basing my question on the administrative decisions; I am basing it on the scientific knowledge available to us and this apparently is the scientific position at the moment.

Dr. YORK. Yes. If I understood your question correctly; yes. They have already got ballistic missiles and we don't have any antiballistic missiles.

Mr. DADDARIO. And it seems that the answer to preventing an attack by ICBM's is somewhere in the distant future.

Dr. YORK. No; the answer to intercepting an attack. The answer to preventing it lies in ballistic missiles, not in antiballistic missiles.

Mr. DADDARIO. You are talking about retaliation?

Dr. YORK. We are talking about deterrents.

Mr. DADDARIO. That is sort of a continuation of a balance of terror between ourselves and the Communist world.

Dr. YORK. Yes.

Mr. DADDARIO. And can there be something done in reference to that? Is there anything within the Department of Defense to take care of the gap by minimizing the blows that might be followed through some sort of buildup in our civil defense system.

Dr. YORK. Well, the civil defense system is not in the Department of Defense. As far as what is in the Department of Defense is concerned, we do a great deal along that line because the direct military problem is one of how to make the retaliatory force survive a first blow. And we have taken every route that has been suggested to us, every technical route, hardening, dispersal, concealment, mobility, and so on.

Mr. DADDARIO. When you say hardening, concealment, and mobility, you are talking about the Defense Establishment alone?

Dr. YORK. Talking about the survival of the retaliatory power.

Mr. DADDARIO. How about the millions of Americans who don't have the same ability to be mobile, to conceal themselves, or to put themselves under some hardening device to prevent themselves from being killed in the event of an attack? Isn't that part of our defensive capacity, for the civilian population to survive the blow?

Dr. YORK. It is not, as the Department of Defense's responsibilities have been defined, a part of the Department of Defense program. If you use defense in the broad term, then it is part, but insofar as the Department of Defense's programs are concerned, it is not a part. It is OCDM.

Mr. DADDARIO. Then, as I understand you, we can look toward a period of time when we have no intercepting device and the protection of the people of this country will depend more upon the protection of the Defense Department and not the entire population of the country?

Dr. YORK. The protection of the deterrent is the responsibility and we don't have to look forward to it; we are already there.

Mr. DADDARIO. That is all.

The CHAIRMAN. Mr. King.

Mr. KING. Dr. York, I have just one question. The question has been asked at least five times this morning, but I guess each Congressman reserves the right to ask it again in his own words and in his own context. It is, I would imagine, the most important question that faces us in this decade.

By way of background, Mr. George Allen, Director of the USIA, this week, testifying before our committee, stated that—we all knew it, but he stated it authoritatively—that our reputation abroad had suffered very seriously because of the spectacular progress made by the Russians, that they were outpacing us and that in the minds of

many of the people in the world, progress in rocketry was equated with progress in all fields of science. Many, many peoples in the world were now concluding that Russia had outdistanced us in the general field of science, which conclusion is incorrect; but it is a fact, nevertheless, that they so interpret it.

So, with that background, let us assume hypothetically that the United States has established a national policy of trying to overtake and surpass the Russians in the field of rocketry, in the field of exploration of outer space, and in the field of rocketry for defense purposes.

Assuming hypothetically that that is our national policy, my question is: Are we now doing everything that is reasonably possible to achieve that policy?

Dr. YORK. It depends on what action is finally taken with respect to the NASA budget. With the question of support for NASA, because these programs that have the big psychological effect, that have done and are doing what you have described—which all of us in Defense agree with, incidentally—are the NASA programs. These are the ones that have the psychological and prestige associated with them.

Mr. KING. Dr. York, are you saying that if the Congress of the United States approves the NASA budget, which is now before it, as submitted by the administration; if it does, then the answer to my question would be: "Yes, we are doing everything that is reasonably possible"?

Dr. YORK. I can't quite say that. You can always do a little more. I don't know what NASA's plans are with respect to requests to Congress. I think you will have to ask the NASA people about the NASA program.

Mr. KING. You can only answer insofar as my question refers to the Defense aspects of this, the military aspects?

Dr. YORK. Well, you mentioned that the prestige of the United States and so on is greatly affected by what the public sees about our progress in space. What the public sees are the space programs related to man in space, the lunar activities and so on. These are not in the Department of Defense.

Mr. KING. Then you are disqualifying yourself from aswering that portion of my question, which applies to the NASA, and that is all right.

Dr. YORK. I guess that is right.

I do want to say that we do agree that this is a very important matter because the basic facts about a deterrent has two sides to it. One thing is how good it really is, and how good the other fellow thinks it is, and how good the other fellow thinks it is depends on what he thinks the Russians and we are doing, independently of what we really are.

Mr. KING. You have knowledge of what NASA is doing, of course, working so closely with them. You have knowledge of their budget. Just based on your observation, would you think that the budget is adequate to accomplish this national policy which I stated?

Dr. YORK. It is an expanding budget and you would have to get from them what their plans are for further expansion.

Mr. KING. Let me direct my question to a place where you are an expert: Assuming it is our national policy and I am sure it is—this is not purely hypothetical—for us to overtake the Russians and to pass the Russians in the matter of the use of rocketry in its broadest sense for defensive military purposes, are we doing everything that is reasonably possible to achieve that national policy?

Dr. YORK. In research and development, I think we are probably doing so near to everything, that we are doing what we ought to be doing.

We have improvement programs going on our missiles, we have very large programs for the finishing of the development of the Atlas and Titan, for moving them beyond their present capabilities as required, for developing the Minuteman, for developing the Polaris, for eventually moving on with the development of the Polaris to a better Polaris, working in other strategic systems.

It is always possible to do some more, but this involves judgment and it seems to us we are doing about the right thing as well as we can make the judgment with regard to the development of strategic systems, principally missiles.

Mr. KING. Let me ask this: Would the appropriation of more money—shall we say another billion dollars, to take an arbitrary figure—add significantly to the progress that you are making?

Dr. YORK. Yes, you could go faster with more money, but again—and this is especially true with the military missile programs—you wouldn't go very much faster. With a lot more money, you would go a little bit faster.

The CHAIRMAN. Mr. Roush?

Mr. ROUSH. Dr. York, the reason we are behind Russia today is because of decisions which were made in the past few years which did not prove to be good decisions, isn't that correct?

Dr. YORK. It is based on a history that goes back to the end of World War II.

Mr. ROUSH. The reason we are behind Russia in the eyes of the rest of the world is because we made the wrong decision in giving, say, Project Vanguard emphasis instead of the Army project, and as a result, the Russians beat us with their sputnik, when we could have put a satellite in orbit before them, is that correct?

Dr. YORK. We bet on the wrong horse, there, with respect to getting a satellite in orbit first.

Mr. ROUSH. Dr. York, on this matter of a large thrust vehicle, we also bet on the wrong horse there, didn't we?

Dr. YORK. I don't think that is as well understood as it might be. As of the present time, there are two distinctions between the boosters we have used in space and the ones they have. First of all, our biggest booster is only half as big as theirs and, second—and this has had a much greater influence on how we have been compared in the last several years—our big booster was behind theirs in time.

We have not yet in our space programs, not in any important way—even used our big booster. All of our space programs up to the present time have been based on smaller boosters, smaller, both in thrust and in the other factors, the total impulse that goes to make up the kind of velocity increment they can get.

In other words, the ratio between the size of the American satellites and Soviet satellites has been 100 to 1. I mean various numbers.

The primary reason for this large factor is not that our biggest booster is only half as big as theirs, it is because we haven't even used the biggest booster for these space programs.

Mr. ROUSH. What is our biggest booster?

Dr. YORK. The biggest in terms of thrust is the Atlas, but in performance, Atlas and Titan are about the same.

Mr. ROUSH. It was the wrong decision, wasn't it, Doctor?

Dr. YORK. The "wrongest" thing, if you want to put it that way, was not starting several years earlier.

The big difference that we now see—there would still be a small difference, but it wouldn't be the difference that we have been living with for the last 2 years.

Mr. ROUSH. Dr. York, not very long ago I saw you on a television program and thought you conducted yourself very well, but in discussing this Atlas vehicle of which you just spoke, as being our largest, you stated that we deliberately made the choice to cut the size in half.

Dr. YORK. Yes.

Mr. ROUSH. And at that time, we were capable and there was on the drawing boards and plans presented, of an Atlas which would have had a thrust of about 650,000 pounds, is that correct?

Dr. YORK. Yes. It wouldn't have been here today. I mean had we made that choice, we wouldn't have had an ICBM today.

Mr. ROUSH. Why not?

Dr. YORK. Because it is enough more complicated, it would have taken enough longer to do, that we wouldn't have had it today.

Mr. ROUSH. Apparently the Russians were able to create such a vehicle.

Dr. YORK. Yes, but that is this timing matter, now. They simply started their bigger program sooner. They both enter into it, but the timing is more important than the decision on size.

Mr. ROUSH. Speaking of time, Dr. York, when was this 650,000-pound Atlas booster first presented by Convair?

Dr. YORK. I don't know, but it was carried really as a study program with some experimental work until 1954.

Mr. ROUSH. But it started back in the 1940's, didn't it?

Dr. YORK. On paper, yes.

Mr. ROUSH. When was it Project Saturn was first considered?

Dr. YORK. About a year and a half ago. Going on 21 months.

Mr. ROUSH. What date would that put it at?

Dr. YORK. That would put it in the fall of 1958.

Mr. ROUSH. In the fall of 1958. We knew, didn't we, Dr. York, when the Russians launched Sputnik I, October 4, 1957, that our great need was a big booster?

Dr. YORK. From the first few sputniks that were launched, it is not obvious that the booster was as big as we now know it to be. The first sputnik was 180 pounds, as I remember it.

Mr. ROUSH. When was the second one launched and how much did it weigh?

Dr. YORK. The second one was 1,100 pounds, and it was launched about 3 months later.

Mr. ROUSH. Yes, but it took us all this time to decide that we needed a bigger booster?

Dr. YORK. You see, for those sizes you don't need a bigger booster. You need an Atlas-size booster, but at that time the only thing you could say from these weights is that we were behind in having a big booster available. You couldn't say—it is not obvious from 1,100 pounds that their booster is as big as it is. It is not until you get much farther down the road, and furthermore, to add ancillary information which is available since, that it is obvious their booster is as big as it is.

It was not obvious the Russian booster is as big as it is, back in late 1957 and early 1958.

Mr. ROUSH. The reason I ask these questions is not because I just like to look behind and be critical, but it seems to me occasionally we have to be critical in order to forge ahead and it seems to me that the decision to develop this huge booster was late in coming and that wrong decisions were made.

I am very pleased that we are going ahead and I wish we could go ahead faster, because this is the one key, the one thing that will take us to a position equal to that of Russia. Every time we have had testimony here, we have heard people say that the reason we are behind is because we don't have a booster. We are only behind in the area of thrust.

Time and time again that has been stated here before this committee and I wonder if we are placing enough emphasis on this program, and I am convinced that we have not placed enough on it in the past.

That is all, Mr. Chairman.

The CHAIRMAN. Thank you, Mr. Roush.

Doctor, let me ask you a question or two, now. You refer repeatedly to our balanced program. I suppose you mean both missiles and space, because it is hard for me to distinguish between missiles and space.

Now, will our balanced program bring us to the point where we will overtake Russia in its development and if so, when will we overtake Russia?

Dr. YORK. The Department of Defense program is not designed to overtake Russia. The programs—in terms of these space programs that you are primarily interested in. It is the NASA programs that are designed to, as Mr. Roush has said, to produce a booster that will in terms of payload size, overtake the Russians.

The CHAIRMAN. Now, why shouldn't the Department of——

Dr. YORK. I wasn't speaking of that in my remarks.

The CHAIRMAN. Why shouldn't the Department of Defense programs be designed to overtake Russia?

Dr. YORK. Because the responsibility for space flight and space exploration, which is what it is that requires these big boosters, is the NASA program and if we were to start another program in that size, this would result in nothing but diversion and dissipation in resources. It wouldn't be correct for us to start another big booster.

The CHAIRMAN. You don't refer to the ICBM in space, then?

Dr. YORK. We do have a second generation coming along, but it is smaller because we believe that is the direction of progress on ballistic missiles. Such as the Minuteman.

The CHAIRMAN. Referring to your program envisioned for the ICBM, under the military; will it overtake the Russian programs?

Dr. YORK. I am not sure I entirely understand the question. As far as development is concerned, the important things now—both the Russians and ourselves have a missile that will work—that will go the required distance. It will go there with reasonably good accuracy and with a big explosion. From here on out, the problems are related to matters like survivability, reliability, improving the accuracy further, improving the effectiveness of the weapon, enabling you to make it mobile and things of that sort. There isn't any nice, simple thing like payload to define who is ahead and who is behind in development here. That is good for the space program, but not for the missile programs.

The CHAIRMAN. The reason I ask you is that you refer to the programs one after another which are——

Dr. YORK. These are not parts of overtaking. These are legitimate ends in themselves.

The CHAIRMAN. I know; but will they overtake the Russian programs?

Dr. YORK. So far as I know, Russia doesn't even have an early warning satellite, so I guess it will. I don't know whether they have a reconnaissance satellite with the kind of resolution we are talking about, so I suppose it will. I don't know if they have a communications satellite. They show no evidence of it. I am sure we will overtake them in these objectives.

They are not designed to be big boosters. They are designed to be early warning programs, reconnaissance programs, navigations programs, and communications programs.

The CHAIRMAN. Don't you need the big booster for those programs? The man in space program, you said, was very important to the military.

Dr. YORK. That is because of the possibility of unforeseen requirements arising, we feel that we must have the—we feel that this country must have for that reason, as well as for prestige reasons, a big booster program, a going, an impressive big booster program.

The CHAIRMAN. Well let me put it another way then: Dr. Glennan made the statement, as I recall, that we could not hope to catch up with Russia, where Russia is at the present time, under 5 years.

Dr. YORK. Yes, I agree with that.

The CHAIRMAN. Do you agree with him on that?

Dr. YORK. That is right. That is especially as measured in payload. But the Department of Defense's programs—the Department of Defense is very interested in that because of its influence on our prestige and the status of our deterrent and so on. But the Department of Defense's programs are for objectives which are legitimate ends in themselves and don't have to do with this particular race.

We think this is very important but our programs are not designed as entrants.

The CHAIRMAN. With reference to the interest of the Department of Defense in the program, in your opinion, it is not intended to overtake Russia?

Dr. YORK. The Department of Defense's programs which I outlined here are without—are intrinsically not a part of a race in space. The

Department of Defense is interested in the question of payload and the question of catching up in the terms of payload, which is what this 5-year item refers to. And we regard these as very important objectives and strongly support them. But in our programs, in the programs we are running, these are not part of the objectives.

The CHAIRMAN. They are needed for our defense, are they not?

Dr. YORK. They are important for defense.

The CHAIRMAN. And yet, you agree with Dr. Glennan that we will not catch up with Russia for 5 years?

Dr. YORK. In terms of payload, that is correct, and that is the most convenient measure.

The CHAIRMAN. As I read his statement he said in 5 years we will be where Russia is today.

Dr. YORK. I don't think that is what he meant.

The CHAIRMAN. But you think we are——

Dr. YORK. If that is what he meant, I don't agree with it, that it would take 5 years to be, in terms of payload, where they are today. To catch up with them, it is certainly a matter of at least 5 years.

The CHAIRMAN. And then it is questionable, depending on the pace that Russia makes——

Dr. YORK. It depends on what they do.

The CHAIRMAN. That is right, and what I want to know is this: I don't disagree so much with the spending. Where I disagree is in the priority given these projects.

Now, can you say that all of the projects you have referred to today have had the topmost priority in the award of funds?

Dr. YORK. Within Defense, no, they have not.

The CHAIRMAN. Which ones don't have the top priority?

Dr. YORK. The navigational satellite and the communications satellite.

The Samos program has highest national priority. The other three do not have highest national priority. By highest national priority, I mean a specific priority system set up by the President that relates to all programs. It includes these; I believe it includes Saturn, it includes Mercury and includes Samos as far as space is concerned. It includes Atlas, Titan, Minuteman and so on.

The CHAIRMAN. Now, let us be frank about this: Don't you think that the navigation project, for instance, ought to have top priority?

Dr. YORK. No. No navigation project that I know of has highest national priority. If no navigational project does, there is no particular reason why the navigational satellite should. The fact that it uses space environment is not a measure of priority. Its priority has to do with how important navigation is.

The CHAIRMAN. What would you say about the Samos project?

Dr. YORK. It does have the highest national priority.

The CHAIRMAN. How about the early warning?

Dr. YORK. That is under discussion right now. It will probably end up in that category.

The CHAIRMAN. Do you think it should have highest priority?

Dr. YORK. I think that is how we will come out when we go over it.

The CHAIRMAN. But thus far it doesn't have?

Dr. YORK. It is pretty close, but not quite.

The CHAIRMAN. I hope you will stick with that idea and help it.

Dr. YORK. There is not much difference between where it is and highest national priority, so-called.

The CHAIRMAN. How about the communications project. That is Notus.

Dr. YORK. Well, Notus does not.

The CHAIRMAN. Shouldn't it have highest priority?

Dr. YORK. You can't have everything have highest national priority and have the word mean anything.

The CHAIRMAN. You might take a little bit away from foreign aid there, and put it all in this project.

Dr. YORK. I am talking about a formal system of priorities and so far as I know, foreign aid is not in it, that has to do with development programs. This started out with Atlas and Titan and it has kind of gotten longer ever since. You wonder what highest national priority means after a while.

The CHAIRMAN. Well, of course, it means preserving the integrity of the United States of America. That is really what it means to me.

Dr. YORK. Communications just is not, in our judgment, as important as either missiles or early warning. That is what it amounts to. Communications is very important, but not everything can be of equal importance.

The CHAIRMAN. Does your vehicle development program have highest priority?

Dr. YORK. It depends on whether it is necessary for something else which does and thus far, the principal parts of it have been related to Samos and since Samos has highest national priority, so do those parts of the vehicle development program that relate to it.

The CHAIRMAN. The other parts don't have the highest priority?

Dr. YORK. No.

The CHAIRMAN. Is that the reason some of them have lost funds—because they don't have the highest priority?

Dr. YORK. Which funds are you speaking of? I know of no vehicle programs that have lost funds?

The CHAIRMAN. I don't mean the vehicles, but I mean all of these programs. Some of them have lost funds over the recommendations, I understand.

Dr. YORK. But as Mr. Gates described yesterday and as I think everyone knows, the initial request for funds is vastly more than what we finally end up with. If you judge that as being loss of funds, we lose funds for everything. But in no case has a going program been reduced.

The CHAIRMAN. Mr. Anfuso.

Mr. ANFUSO. The intelligence from CIA is made available to you, is it not, Dr. York?

Dr. YORK. By and large, yes.

Mr. ANFUSO. Could you this afternoon in executive session, tell us what our intelligence is with respect to the warning systems that we know about that the Russians have against the Polaris and against our ICBM's?

Dr. YORK. I will see what I can do.

The CHAIRMAN. Now, one question from Mr. Hechler.

Mr. HECHLER. Dr. York, don't you feel someone should have central leadership and direction over the whole space and missile pro-

gram, to give highest urgency to this, so the American people would know precisely where we stood?

Dr. YORK. Centralizing direction of the space and missile programs, I think would be a mistake.

What we have now done is that those programs needed for the big booster programs, the programs in space flight is an end in itself, programs in space exploration are all centralized in NASA. The programs remaining in the Department of Defense are those which have end objectives which are specifically for defense purposes and which we regard as essential or we wouldn't be doing them. These are not programs in rocketry primarily, these are programs in electronic components, both spaceborne and groundborne, and to disassociate them from the using service, or from the people who have the—to disassociate the rocket part from the part that has to do with the data handling which is in most cases the bigger part, would do nothing but lengthen the programs and confuse matters beyond all recognition.

Mr. HECHLER. I submit they are not getting central leadership and direction at the present time.

The CHAIRMAN. Now, I will say at this point there that the Doctor has some testimony he hasn't given us which he wants to give in executive session and also in executive session, I would like to take up one matter with the committee.

My thought is this, that we recess until 2:30 this afternoon and we will resume the questioning and will recognize Mr. Fulton.

Is there any objection to that? If not, we will adjourn until 2:30

(Whereupon, at 12:05 p.m., the committee adjourned to reconvene at 2:30 p.m. of the same day.)

AFTERNOON SESSION

The CHAIRMAN. The committee will come to order.

Now, at the time we recessed for lunch, Dr. York was testifying and the Chair agreed to recognize Mr. Fulton. I now recognize Mr. Fulton of Pennsylvania.

Mr. FULTON. I am glad to have you gentlemen here. I hope we can keep this on a nonpolitical level, because it seemed to me this morning that this was the first time a Presidential campaign had been started in space instead of throwing the hat into the ordinary atmosphere.

I do realize there have been some comments made by some so-called advisory committees of scientists that were released very peculiarly on Monday, January 25, just at the time this committee starts in action on these particular space hearings. So we do have running along with us possibly, a political group looking over the shoulder. I might say that some of the questions this morning looked to me a little bit as if they might have received some suggestions from those questions.

Now, I want to clarify the history a little bit of our missiles progress because the year 1953 has been mentioned with a certain remarkable regularity as a turning point in the development programs of our missiles.

Actually the U.S. missile program did not begin in 1953, but began clear back with the forerunner of the Atlas. That was in 1946, and

the Atlas program went along until the year 1949 when it was cut out in the defense cutbacks. Then it progressed on a private basis—the Atlas was on a private basis under research and development for 2 years. Then it was revived in 1951 and only as a low-level national effort.

That means that the Russians during this period from 1946, on through, have emphasized their long range ballistic missiles, where, as a matter of fact, we have started and stopped in the United States and then started again. It has only been since 1953 that we have emphasized the operational feasibility of these long range ballistic missiles.

I want to ask the good Doctor, Dr. York, if that isn't the case? It has been a matter of decision, not on party lines, but a matter of decision over a period of years, really involving both parties?

Dr. YORK. There is a long history to this matter, involving not just ballistic missiles, but also air-breathing missiles, matters involving what appeared to be the best idea at the time that might look different in hindsight, but which was not such a bad—but looked good at that time, and so on.

Mr. FULTON. Actually, of the ballistic missile programs that are now in process and that we are working on, there is only one, the Atlas, that began before 1953. Our whole missile spread, really, has been the development in these last 7 to 8 years, is that not correct?

Dr. YORK. In the big ballistic missiles; yes.

Mr. FULTON. Then I would like to read the statement of Dr. Teller, to the Senate Preparedness Subcommittee. He said:

> In 1946 right after the end of the war, we could have said, "Let us develop ballistic missiles." Well, we did go into the development of ballistic missiles, but at an exceedingly slow and small rate. Years later, we determined to start a very vigorous program on the guided missile and on the ballistic missile. It has been an excellent and excellently managed program, but it came too late. The Russians had started on their ballistic missile program from all we know, right after the war and they kept at it.

Do you agree with that statement, Dr. York?

Dr. YORK. That is what I understand to be the case; yes.

Mr. FULTON. Then let me read you another statement of Dr. Wernher von Braun when he was asked, on November 10, 1957, the question of where we stood in our ballistic missile programs in the United States, vis-a-vis Russia.

Dr. von Braun said:

> The main reason is that the United States had no ballistic missile program worth mentioning between 1945 and 1951. These 6 years during which the Russians obviously laid the groundwork for their large rocket program, are irretrievably lost. The United States went into a serious ballistic missile program only in 1951, with the decisions to weaponize the Army's J.P.L. rocket developed at Redstone. Our present dilemma is not due to the fact that we are not working half hard enough now, but we did not work hard enough during the first 6 to 10 years after the war.

Do you agree with Dr. von Braun's statement as to the early developments as I have just read them to you?

Dr. YORK. Yes.

Mr. FULTON. There is another matter that we should look into, and that is the emphasis on the various programs. You were certainly correct this morning when you said that every program cannot be made a program of first national priority because it destroys the priority system. That must be kept fairly exclusive or, I would say

for myself, it becomes another OPA and the system goes backward. We don't have the materials or the personnel or the administrative guidance to carry them on at the level of priority that has been assigned to them.

Would you comment further on the necessity for these national priorities in your missile programs?

Dr. YORK. They are used actually primarily in connection with priorities with regard to materials and matters of that sort. They have proved very useful in getting ahead with the programs that have had this highest priority.

Mr. FULTON. Now, I had referred to the so-called Scientific Advisory Committee of 17 scientists that on Monday, January 25, 1960, and in the Washington Post, had made certain statements.

These scientists contended, says the Post, the Mercury-manned satellite project had "little military or scientific justification." They charged it was being pushed too fast, with insufficient funds to be safe and sound. A quick but risky way of achieving a first. They also likened the Mercury program to the ill-fated Vanguard project.

They said the Mercury program should be put in its "logical place," and suggested the target date be delayed 3 to 5 years.

In my book it is necessary that we go ahead at once with the Mercury or the man-in-space program because there is a clear military necessity that we can see at this point. If we don't have quick action, the United States will be outflanked strategically in this very important region.

Would you please comment on that?

Dr. YORK. Well, the Department of Defense and NASA and the administration as a whole, have all agreed that the Mercury program should be pursued vigorously and it has the highest national priority. It is a necessary precursor to any application of man in space, and, of course, it also has interesting psychological and prestige factors associated with it. For whatever purpose you may use men in space, you need to find out about their reaction and that is what this program is mainly for, from a technical point of view.

Mr. FULTON. You disagree then with the statement that the Mercury manned satellite project has little of military or scientific justification?

Dr. YORK. This particular program, Mercury, is more scientific than military, except that again it is one of these things where the programs take so long that if there is going to be a military use for man in space, that is one of these things we are in favor of getting at now, so we will have the information when we need it.

Mr. FULTON. You, therefore, specifically oppose the recommendation the Mercury program should be put in its "logical place," and the target date be delayed 3 to 5 years?

Dr. YORK. Yes. We in Defense have always felt that this should be done as soon as possible, as soon as reasonably safe—as soon as possible with due regard to safety, and so forth, and NASA feels the same way.

Mr. FULTON. This committee has said this:

A stepup and realinement of the entire space program with more emphasis on projects that will pay off in immediate and military scientific benefits and less emphasis on man-in-space projects.

I disagree with that statement, because I think we must emphasize both and keep the front of progress moving on all these fields and not

move back one step by lowering the priority. What do you think?

Dr. YORK. I agree with the way you put it, Mr. Fulton.

Mr. FULTON. Do you feel that your Department of Defense understands the depth of the Russian challenge to our U.S. security and our defense of this country?

Dr. YORK. Yes, I think so. That would require being able to peer inside of people's heads to answer thoroughly.

Mr. FULTON. Well this committee says that you don't and I wondered whether you did.

The CHAIRMAN. What was that committee?

Mr. HECHLER. What are you attributing to the committee, if the gentleman will allow me——

Mr. FULTON. The committee feels that the Defense Establishment does not understand the problem of the Russian threat. I wonder if you do in the Department of Defense and in the administration, understand the depth of the Russian threat to the security of the United States and the defense of this country?

Dr. YORK. I think we do.

Mr. FULTON. Now, should we have another military-civilian type liaison group set up in order to handle or resolve priority conflicts that might occur between military and civilian projects, space projects and to take care of the gray area where there may be overlapping in type of projects?

Dr. YORK. Well, we do not need not "a body," but bodies of that sort and we do have them.

Mr. FULTON. And they are operating now, according to your statement, on a day-to-day basis, very satisfactorily in this realm of the melting, or the meeting of the need, so that we get projects that are worked out without disputes between military and space?

Dr. YORK. In my opinion, yes, and I think that Dr. Glennan would say the same thing.

Mr. FULTON. Would you comment on the amount of the budget which you are now receiving and also will receive for the coming fiscal year as programed? Tell us whether you feel that you can operate well within that budget, tell us if there is any area where it pinches you, and thirdly, tell us if that budget in any way endangers the security of the United States through pennypinching?

Dr. YORK. That is a series of questions.

I am sure that if we take the funds we have got for this year and the next year and spend them right that doing so and using these amounts would not endanger the security of the United States, and I am, of course, speaking about—I like to limit myself to my own responsibility, which is research and engineering.

Mr. FULTON. When we were developing missiles clear back in 1946 we started out with the air-breathing type. I believe two of them would be the Snark and the Navajo, and we made considerable progress with those missiles, did we not? They have formed a position in our strategic posture which has been very worthwhile, would you not say?

Dr. YORK. Doing those programs has contributed a great deal of information that was invaluable in carrying out the ballistic missile programs later.

Mr. FULTON. So really you got from the Navajo launcher the liquid propellent booster fluid, didn't you?

Dr. YORK. Yes. Also the development of the guidance system for that was an essential starting off point for the development of guidance systems for ballistic missiles.

Mr. FULTON. So these particular programs, while they have been discontinued, are nevertheless, programs on which we could say the Atlas, the Thor, the Jupiter and the Redstone, as well as maybe the Navy Viking, have obtained a lot of the groundwork upon which these later programs have advanced, such as the Polaris and so on in the Navy?

Dr. YORK. That is right.

Mr. FULTON. Is there any area in programing that the Joint Chiefs have overridden you and that would in any way effect the security of the United States adversely which we on this committee should know about in order that we can give you the money to correct it?

If so, I would like to have it specifically stated.

Dr. YORK. Not to this point.

Mr. FULTON. And you are then satisfied with the treatment you have gotten from the Joint Chiefs of Staff, as well as from the Congress on the amount of money you have received for your programs?

Dr. YORK. Yes.

Mr. FULTON. The Strategic Missile Evaluation Committee. Would you comment on what they said on February 10, 1954? I believe they were the ones who talked of the significant breakthrough on the warhead size, were they not?

Dr. YORK. I don't remember about the particular date, sir, so I may not——

Mr. FULTON. Well, that is the date and it was a recommendation for early availability of ICBM's.

Dr. YORK. What the Von Neumann committee pointed out—and I was a member, myself, at that time, so I have some personal recollections involved, was that you could get—taking into account progress in nuclear weapons which we were certain would obtain, taking into account guidance that we were certain would obtain, taking into account progress, or the possibilities of developing a proper reentry method, which again we were quite confident about by and large, that putting all of this together meant that an ICBM could be produced that would be a very useful weapon from the strategic point of view and the best way to do this, considering everything: The state of the art, the programs that were then in progress, the surest way to do it was the Atlas route, which was a 1½-stage missile with 250,000-pound engines which were to be based on the 135,000 pound engines then under development and that a second way that wasn't quite so sure, but that—I am not quite sure about the dates, because there were a lot of meetings—but a second way wasn't quite so sure, but in principle, would be better, would be to build a true, two-stage rocket. That was the Titan program.

Mr. FULTON. This took place in 1954, approximately, and actually as a result of your Von Neumann committee recommendations, a Gillette group was set up, wasn't it, to accelerate the ICBM program?

Dr. YORK. I think the considerations of the Gillette group were made just prior to my joining the committee and I am not sure about that.

Mr. FULTON. And before the Von Neumann committee we had the Joint Resources Command set up.

Dr. YORK. The Joint Ballistics Commission was set up at that same time and the Von Neumann committee addressed itself to a streamlined setup for this program on the grounds that was a serious program and needed unusual organizational attention and special organizational setup to push it as rapidly as possible, breaking across the usual lines of authority in coordinating control and so on.

Mr. FULTON. As a result of both the Von Neumann committee recommendations and the Gillette group, the Secretary of the Air Force then assigned an extremely high priority to the ICBM projects, and that was clear back in 1954?

Dr. YORK. That is right. And set up a special organizational system. The Air Force Ballistic Missiles Division, the Air Force Ballistic Missile Committee, and the then Assistant Secretary of the Air Force, Trever Gardner, played a major role in all of this and was given special authority with respect to these programs, too.

General Schriever was the BMD commander in those days.

Mr. FULTON. So full authority, responsibility and accountability for the project was given to General Schriever and the Atlas then became the basic mission of the Western Development Division of the ARDC, with Schriever commanding, is that not correct?

Dr. YORK. Yes. He was given unusual authority in comparison with the normal way of doing even other high priority programs.

Mr. FULTON. And then you were there, too, through the remainder of 1954 when the ARDC with its contractors made an extensive technical review of the Atlas program and focused further attention on the acceleration of these ICBM programs; is that not right?

Dr. YORK. Yes, that was a continual subject of discussion in those days. How much—what was the maximum amount that could be used in these programs.

Mr. FULTON. And then in February 1955, it was the Killian committee which recommended, concurrently with this ICBM effort that was already installed that we were talking about, that there be an equivalent IRBM effort to be carried on at the same time, is that not right?

Dr. YORK. That is right.

Mr. FULTON. And I might say to you that by the spring of 1955, that meant the Atlas program was expanding rapidly and further, that a $3 million program for the Atlas in 1953 had gone to $14 million in fiscal 1954 and it was $161 million in fiscal 1955. That would show quite a strenuous effort to push the Atlas ICBM programs and the research and development work along these lines; would it not?

Dr. YORK. Yes.

Mr. FULTON. Now, on the ICBM research, the question then had come up earlier, when the highest national priority was given to the Air Force ICBM work. That occurred when the President, in September of 1955, approved the assignment of the highest priority to the ICBM research and development program, is that not right?

Dr. YORK. Yes, but the Air Force had already given its high priority about the year prior.

Mr. FULTON. But the President then gave it the highest national priority by assigning it in September 1955, as well; is that not right?

Dr. YORK. That is as I remember it.

Mr. FULTON. And then likewise, the Titan ICBM project was established, so it ran along at the same time on a high priority?

Dr. YORK. Yes, it was started a little bit later. It was felt that we should start one that we were sure of, get going on that, and then start what we thought would be better, but were just not so certain on.

Mr. FULTON. And then just finishing this, to show that there has been ample administrative effort and attention given to these ICBM programs during this period, it was on November 8, 1955, that Secretary of Defense approved the formation of the Defense Ballistic Missile Committee and ordered organizational changes in order to handle better the ICBM and the IRBM programs, is that not right?

Dr. YORK. Yes. That was for the purpose of again taking this program out of the regular channels and setting up special streamlined channels for this purpose.

Mr. FULTON. And likewise, in that particular period, it was in November of 1955 that the Navy set up a sea-based projects division for the IRBM. They created, I think it was on November 7, the Office of Special Projects.

Dr. YORK. Yes.

Mr. FULTON. And on the outcome of those seaborne missiles we have had the development of the famous Polaris project.

The question is: Have we changed the standards? As I recall, there has been not one change in the size of the Polaris ever since the original supervising committee of the Navy set the project up, isn't that correct?

Dr. YORK. Well, there was a study for quite some time, using a liquid fuel missile, but all this time the progress in thermonuclear weapons was still going forward and we came to another point similar to that we arrived at in 1953, when it turned out—it became evident that we could do considerably better in the way of yield-to-weight ratio than we had predicted in 1953.

So the program was reoriented with a much smaller warhead as far as weight is concerned, but a size that permitted the use of solid fuels—which always have a somewhat lower performance—and permitted a generally smaller and more compact rocket so that you could get a lot of them on a single submarine.

Now, since the basic decision to go to solids and to the light weight warhead was made, there have been no important changes in standards as we went along.

Mr. FULTON. So, there was no avenue down which the DOD had gone which later had to be abandoned and we were still following pretty much the same conformity.

Dr. YORK. Still following the basic designs set down when we first changed over to solid propellant systems.

Mr. FULTON. I have just one more question and I am through.

The CHAIRMAN. Make it an even 3 o'clock.

Mr. FULTON. The Von Neumann Committee actually did not really go out of existence. It became the Scientific Advisory Committee, didn't it, and was transferred from the Air Force to the Office of the Secretary of Defense, and is still in existence.

Dr. YORK. Still in existence and reports to the Secretary through me, now under the chairmanship of Dr. Millikin who succeeded Dr. von Neumann, following Dr. von Neumann's death.

Mr. FULTON. Thank you, and you have made a very good witness. I appreciate very much the statement you have made.

The CHAIRMAN. Mr. Hechler.

Mr. HECHLER. I would like to commend the chairman for the nonpartisan approach that he has taken and has insisted that this committee take because I think therein lies the strength and prestige of this committee. Without taking the time of the committee, I would like to put some comments into the record.

The CHAIRMAN. Are there any objections to the comments in the record?

If not, it is so ordered.

(The comments referred to are as follows:)

Mr. HECHLER. In his remarks at the outset of this afternoon's session, my friend and colleague, Mr. Fulton, referred to "some comments made by some so-called advisory committees of scientists that are released very peculiarly on Monday, January 25, just at the time this committee starts in action on these particular space hearings." Mr. Fulton characterizes these comments by scientists as made by a "political group."

Mr. Fulton prefaced his remarks by stating that "I hope we can keep this on a nonpolitical level." I am delighted that Mr. Fulton has contributed so richly to our nonpolitical literature in his searching, "nonpolitical" questions and observations.

The January 25 report to which Mr. Fulton refers, and to which he has attributed direct quotations, is simple to identify. The story is clearly told in the February 5, 1960, issue of the magazine Science, published by the American Association for the Advancement of Science, at page 340:

"The Democratic committee of 17 scientists was organized last spring under the chairmanship of Ernest C. Pollard, head of the department of biophysics at Yale University. Since that time it has analyzed a number of critical areas in which it believes scientific advice is important to national objectives. In addition to the peace agency proposal, the committee has issued a statement describing the relation of science and technology to our foreign and military policy, a statement on nuclear test suspension, and a statement on science and politics.

"At present the committee is working on an evaluation of the space program and its objectives. In this connection, there was a meeting on January 24 at Democratic Advisory Council headquarters in Washington. A midday press conference opened vigorously because a 25-page committee working paper that was sharply critical of the U.S. space efforts had somehow reached the Baltimore Sun. The Sun article conveyed the mistaken impression that the committee was suggesting that the Government delay Project Mercury, the NASA man-in-space program.

"Pollard said emphatically that the report quoted in the Sun contained 'anything but' the final thinking of the committee. He explained that committee working papers are prepared by only a few members and that they are especially designed to be challenging and therefore contain as many points of controversy as possible, including statements that are deliberate 'jabs' to stimulate the committee members and keep them alert."

Thus what Mr. Fulton has done is to quote from a "working paper" which has absolutely no official standing within the committee, which certainly does not represent the conclusions of the full committee, and which was not officially released to the press. Obviously, therefore, the committee of 17 scientists, contrary to Mr. Fulton's allegation, made no release whatsoever which was timed to coincide with the opening of the hearings of the House Committee on Science and Astronautics.

So far as Project Mercury itself is concerned, I cannot speak for the committee of scientists which will make its official report in due time. As of February 25, 1960, the committee had not made its official report. I feel constrained to say, however, that those scientists on the committee with whom I have talked fully recognize the fact that the United States is publicly committed to Project Mercury, and that it is useless to argue about the wisdom of that decision. Accepting that decision, this group feels that NASA and Project Mercury itself should be adequately funded to speed the successful attempt to put the first man into space and to insure that if we should happen to be second we have an adequate backup of scientifically, technically and militarily valuable experiments. In this way, the United States can regain prestige and at the same time obtain data of value to tomorrow's science and technology.

The CHAIRMAN. Are there any further questions?

Mr. Anfuso.

Mr. ANFUSO. I asked you this morning whether you were able to get some information from the CIA. Were you able to get that information?

Dr. YORK. This information concerned the Soviet Ballistic Missile Early Warning System. We believe we should hold that for executive session.

Mr. ANFUSO. Do you have that information?

Dr. YORK. Yes.

Mr. ANFUSO. I expect to go into it in executive session.

In line with that intelligence, I would like to mention something which will be published. A statement quoting British experts said that Russia is working on a missile with range between 10,000 and 12,000 miles and that this weapon will be available within the next 2 or 3 years.

Have you heard of such a weapon?

DR. YORK. I haven't heard of a weapon with those range figures. In fact, for a ballistic missile, those are fairly difficult ranges because that happens to be just halfway around the earth and it is hard to make—because of the way the trajectories work, that is harder than going more than halfway.

Once you get up to 5,000 miles, it doesn't require much in the way of change to get on to 6,000, 7,000, 8,000 and so forth.

I haven't heard of it, but if they wanted to build one at 10,000 miles, I am sure they could. I would have the same feeling about ourselves.

Mr. ANFUSO. Do you believe that the British have the wrong information or the wrong intelligence?

Dr. YORK. I really don't know. I am not familiar with this particular item. It is a rather odd sounding range, frankly.

Mr. ANFUSO. Of course, you know it has been stated time and time again that the Russians will have three times as many missiles as we have during the next few years. They will have as many as three times what we will have in the next few years.

You have heard that statement?

Dr. YORK. Yes; I have heard it.

Mr. ANFUSO. Do you agree with it?

Dr. YORK. This lies pretty far outside of research and engineering also, Mr. Anfuso.

Insofar as the Department of Defense is concerned, Secretary McElroy said that on the information he had some time ago he believed that they could and that he was making his plans on the basis of what they could do.

Since then there has been testimony from those within the Goverment who are responsible for these matters that they have readjusted this particular outlook.

I don't have anything to add to what has been said either way.

Mr. ANFUSO. Dr. York, with respect to that, General Power, the commander of the Strategic Air Force, upon which we are going to rely a great deal, has recognized the problem. He said, "In this period of time the Soviet Union will be able to virtually wipe out our entire nuclear retaliatory strike capability within a span of 30 minutes."

Dr. YORK. I believe that General Power said that 300 ballistic missiles could do that. I don't believe that he said the Soviets have

these 300. I haven't really read—I have only read excerpts from his statement.

As I understand it, but I am not sure of it, he did not say that they had 300. He said if they had 300 or if they launched 300 simultaneously that they could do this and I presume he was talking about the present.

Mr. ANFUSO. Well, we have no right or at least we should not take the risk of assuming that they won't have that capability, should we?

Dr. YORK. Well, we should and we do take into account that things may be much worse than our mean prediction and we take it into account in many ways. The purpose of developing an on-the-shelf capability for airborne alert is one recognition.

The programs for mobile Minutemen and mobile and concealable Polaris are based on the fact that things may be worse than, again, the average prediction.

Our procedures for hardening and so on are based on assumptions that are not based on our predictions of what they can do, but on a considerably worse set of possibilities.

Mr. ANFUSO. Not taking into consideration the Polaris and the A-bombs—and I am not going to assume the Russians don't have a warning system for the Polaris and I am not going to assume that the Russians are going to allow the Polaris within devastating striking distance—but just taking this very statement made by our commander of the Strategic Air Force, General Power, it is safe to conclude that the Soviet Union would no longer be deterred, since it could knock us out before we could answer back.

Dr. YORK. Excuse me. Just your last sentence——

Mr. ANFUSO. I think if they have that striking capability—300 bombers, and they probably will have 300 of these intercontinental missiles—they will wipe out all of our basic military installations within a span of 30 minutes; they will knock us out before we could answer back.

Dr. YORK. Again I didn't read General Power's statement. I think he said, "if" they had 300 now they could do that.

The testimony of the people in Defense responsible for this particular matter—the Secretary and the Chairman of the Joint Chiefs—has been to the effect that when you take everything into account they couldn't knock it all out.

Now, they are the responsible people in Defense for this matter and that is what they have said.

Mr. ANFUSO. Well, I would like to assume that we have sufficient retaliatory power to make this impossible. But even if we assumed that, isn't it fair for me or anyone else on this committee to draw the conclusion that the chief weakness with our program is that, in the general field of rockets, and the exploration of space, we are not holding our own? We are behind, aren't we?

Dr. YORK. We are, taking all of these things that you mention and adding them all up, I think it is right to say we are behind. That is a fairly broad spectrum to put into all one pot.

Mr. ANFUSO. Isn't it also the truth that if we continue to go at this snail's pace and if they continue to go at this rabbit pace, that they will be even that much further ahead?

Dr. YORK. If they were going at a rabbit pace and we were going at a snail's pace, I guess so, but we are putting $2.9 billion into just

research test and evaluation of missiles and military related space programs alone next year. That is a lot of snails or whatever you want to say.

Mr. ANFUSO. Well, compared to the wealth of the Russian Government and that of the United States, and considering the fact that they are still spending three times more than we are spending, I think we are proceeding at a snaillike pace and they are proceeding at a rabbit rate.

Dr. YORK. I don't know where you get that three times as much. That would be almost their whole defense budget, very nearly.

Mr. ANFUSO. No one has contradicted me in that figure yet and we asked Mr. Dulles for certain figures—I know the figures he gave us. He testified in executive session.

Dr. YORK. For spending in missiles and space?

Mr. ANFUSO. That is very important to me as a Congressman to know if that is true, and if it is not true——

Dr. YORK. Well, you can ask Mr. Dulles. It is not true to my knowledge, but Mr. Dulles is the expert. That they are spending $9 billion on development in this field?

Mr. ANFUSO. I am not giving any information, but I think the American people will want to know whether it is true that this rich country of ours cannot at least spend as much money as the Russians in this effort, at least.

Now, I didn't say that the Russians are spending three times, although I believe they are, but I say at least we should spend as much.

Dr. YORK. Our total expenditure in this field is about $6 billion, and if you multiply it by three, I don't think the Russians are doing that.

Mr. ANFUSO. It would be very important to get those figures, Dr. York.

Dr. YORK. I can only give them to you for us.

Mr. ANFUSO. We shouldn't do as much as the Russians; we should do a lot more if we are going to catch up. We should do three times as much, not that they should do more than we are, we should do three times as much in order to catch up. Don't you think so?

Dr. YORK. If we are going to catch up, we have to do more; that is correct.

Mr. ANFUSO. Three times as much.

The CHAIRMAN. Now, gentlemen of the committee, we have here General Betts, who is also a witness today. My thought is this: We have given General Betts' statement to the press so it is released as though he testified already before us today. It is important for that reason that we do hear him. My thought is, if we hear the general now, then we can ask further questions in an executive session because Dr. York has certain classified information he would like to give us. What is the will of the committee?

Gentlemen, if there is no objection, we will be happy to proceed with the general's statement.

I think everyone has a copy of your bibliography here.

The general is a very distinguished American. I recommend to your attention his record, his promotions and his honors. We are happy to have you here, sir.

If you will proceed with your statement, we will appreciate it.

STATEMENT OF BRIG. GEN. AUSTIN W. BETTS, ADVANCED RESEARCH PROJECTS AGENCY

General BETTS. Thank you, Mr. Chairman. It is, as always, a pleasure to appear before you, this time to report on the activities of the Advanced Research Projects Agency during the past year.

Secretary Gates and Dr. York have reviewed the recent changes in ARPA assignments with you, and Dr. York has outlined the range of advanced research projects currently under ARPA management. I should like to speak more directly to them.

The work begun last year on ballistic missile defense, Project Defender, has been continued in an attempt to discover adequate means to counter operational ballistic missiles in the future. About one-half of the ARPA budget is devoted to this activity. Our thinking is geared beyond the more conventional Nike-Zeus concept which involves, as you know, destruction of a missile toward the terminal phase of its flight.

ARPA is studying missile interception at the early, midcourse, and terminal phases of flight by means extending beyond the current state of technical knowledge. To do this, we must explore all of the phenomena associated with missile flight which might be helpful; that is, we must become intimately familiar with both the natural and disturbed conditions of the upper atmosphere and the space beyond. Such familiarity is practically nonexistent.

Measurement of the properties of the various constituent elements of the atmosphere and space qualifies as a fundamental scientific unknown. The nature of even the undisturbed atmosphere is poorly understood; our problem, of course, goes beyond that to study of the interaction between the atmosphere and solid objects passing through it at high speeds. We seek not only the knowledge itself, but improved methods of obtaining that knowledge.

The study of such things as atomic cross sections, changing molecular relationships and electron densities is involved. We are experimenting with the release of chemicals at high altitudes and the observation of artificial electron clouds and luminescence in order to determine basic data which will enlighten our understanding of the medium in which our weapons systems, and those of the enemy, will have to operate.

We are also examining a variety of techniques which might be helpful in solving the problems of detection, identification, intercept, and kill of ballistic missiles. Further advances in our knowledge of radar, infrared and optical sensing systems are required, as well as the development of a capability to receive, process, communicate, and effectively use the data collected by such sensing elements in a matter of minutes or fractions of minutes.

For example, once a missile or warhead is detected, it may be necessary to determine whether it is fully armed or merely a decoy designed to saturate or confuse our defense. The offense may also employ jamming devices for the same purpose. It is incumbent upon us, then, to consider the development of a capability to discriminate between "duds" and the real weapon and to neutralize jamming techniques. In other words, we are seeking a counter-counter-measure capability.

Once a ballistic missile is detected and identified, a "kill mechanism" must be employed to destroy it or its reentry warhead. Obviously, a warhead traveling at great speeds and built to withstand the tremendous stresses involved in atmospheric reentry will be difficult to bring down.

The data processing system required to structure or order the operation of a complex missile defense system is a crucial factor—consideration of the "judgment" which must be built into the system is a sobering yet exciting challenge. We are giving it close attention.

In the face of these unknowns, there are a few important resources available to us. The U.S. ballistic missile test program presents us with a first-rate laboratory in which we can undertake actual flight measurements. A complex of ground, ship, and airborne instrumentation will be used at the Atlantic and Pacific Missile Ranges to collect this valuable data. Radars, of course, are the basic tool in experimental measurement work of this kind, and we have produced a program of radar development which will hopefully increase the limited range and resolution capabilities of conventional radar equipment. The results achieved thus far in this area have been very encouraging.

Project Principia connotes the ARPA effort to develop more efficient solid propellants for use in missiles and space vehicles. Our objective is a solid propellant with at least 10 percent higher specific impulse than any now under development.

The current plan of attack is twofold: (1) the synthesis of new propellant combinations which have never been made before and testing them in small-scale engines, and (2) accomplishment of the related supporting research required for effective utilization of the new chemicals as they become available.

The great advantages of solid propellants, as compared to liquids, are instant readiness and reliability. Unfortunately, existing chemical and explosives technology has been almost fully exploited. It is our judgment that any further large improvement will require a chemical breakthrough.

During the last year the Agency has also been assigned responsibilities in the field of advanced materials research and more recently in the field of research and development relating to techniques for inspection of a possible nuclear test ban.

The objective of the materials program, Pontus, is the strengthening of the U.S. basic research capability in the field of materials. The chemical and physical properties of materials now available constitute major limiting factors in the development and performance of most weapons systems. The revolution in materials requirements stemming from the accumulative scientific and technological advances of this century, and highlighted by the special case of nuclear energy development, has resulted in a serious national deficiency. The evolution of new weapons systems designed to perform under severe and previously unknown operating conditions has placed a great strain on existing basic materials.

At the present time a considerable amount of materials research is being carried out on an ad hoc or emergency basis as a part of the development of specific weapons systems. The overall effectiveness of DOD research and development could be expected to improve if such materials were readily available.

The ARPA materials program will seek to augment our basic materials research capability by supporting interdisciplinary laboratories for basic research in materials at selected universities. Materials problems are now so complex that various combinations of the knowledge of several disciplines are required to solve them; principally, solid state physics, inorganic and high temperature chemistry, metallurgy, and ceramics. Pontus is viewed as a continuing program designed to build a measure of stability and strength into the basic research foundation which underlies our defense capabilities.

In addition to these primary assignments, you have already been informed that the Agency has retained management responsibility for certain space programs, pending their transfer to the appropriate military department. The communications satellite program, Notus, is an effort to assess the technical feasibility of reliable, efficient, and secure communications satellites for use in global command, control, and support of military forces.

As part of Project Transit, a navigation satellite was launched in September 1959. Orbit was not achieved, but useful systems data was acquired. Three further launches are contemplated for the balance of fiscal year 1960 and 1961. It is hoped that a satellite system can be developed to provide a more precise, worldwide, all-weather navigation capability of considerable value to ships and aircraft.

ARPA is also engaged in a three-phase satellite tracking and data acquisition program based on a need, shared by both the Department of Defense and NASA, to know precisely where satellites and space probes are at any given time.

One element of the program is known as Spasur, a continuation of the east-west satellite detection fence project discussed last year. It is naturally in our interest to develop means to detect, track, and identify unknown or silent satellites.

As a second feature of the program, a central catalog of all satellites is being set up so that new orbiting objects may be identified at once. This activity is called Spacetrack. It will involve the receipt, collation, and analysis of data from a variety of sources such as the detection fence, the NASA minitrack network, and the military missile ranges.

The third project is for installation of tracking and data collection devices overseas. In addition, studies of other approaches to the problems of satellite detection, tracking, and data collection are planned.

This tracking and data acquisition program will support both the military scientific and development program in space and the nonmilitary space program directed by the NASA. The worldwide character of this undertaking requires an extensive investment in stations and equipment, and the DOD and NASA have cooperated in the development of a mutually supporting system.

With this outline of ARPA's programs in mind, I believe the ARPA budget figure becomes more meaningful. A reduction in the specific hardware requirements of the Agency's programs—for example, expensive rocket boosters—has occasioned a reduction in the overall dollar expenditure request contained within our budget presentation. However, of the $215 million requested, a significantly greater portion can now be devoted to the kinds of advanced research leading

hopefully to "breakthrough" technology for which the gency was created.

We look forward to a year of heavy activity and continued progress. The clarification of the Agency's role and mission which has been made possible by the recent decisions of the Secretary will, we are sure, permit us to devote increasing attention to our research and development task and less to the critical, but for ARPA unrelated, areas with which we have been previously concerned.

The Secretary noted in testimony before the Defense Appropriations Subcommittee of the House Appropriations Committee earlier this month that, considering the defense program as a whole, "the rate of adjustment to technological progress has been rapid and remarkable." It is ARPA's intent to contribute to and facilitate this continuing process of adjustment by reducing scientific unknowns to useful and manageable knowledge.

This completes my prepared statement. I shall be happy to answer any questions.

The CHAIRMAN. Thank you very much, General. We are interested in your statement which is different from the others that have been given to us.

Your work is, of course, in defense missiles and defense programs.

You are satisfied with our present position with reference to defense developments in space, are you, General?

General BETTS. I am not in a position to comment on that, Mr. Brooks, in terms of the entire Department of Defense missile and space programs since ARPA is only concerned with certain segments of that program. I am certainly of the opinion that the ARPA budget is adequate to do the jobs we have to do in advanced research and in the tail end of the space efforts with which we are concerned.

The CHAIRMAN. You are with the Defense Department, the Office of Director of Defense Research and Engineering, aren't you?

General BETTS. Yes; I am a part of Dr. York's office; that is right.

The CHAIRMAN. So you work with Dr. York and what Dr. York says pretty well represents your views?

General BETTS. I haven't heard anything from Dr. York today with which I seriously disagree; that is right, sir.

The CHAIRMAN. You have one man who is in accord with you, Dr. York.

Mr. FULTON. Could we strike out the word "today."

General BETTS. Occasionally, we do disagree.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. I would like to thank the general.

May I have your comments on the deterrent and retaliatory capabilities of the United States?

At the present time when we have the Strategic Air Command and we have the Navy and Air Force jet bombers able to deliver nuclear weapons, of course, part of our posture of defense is the power to retaliate in great and massive size by means of IRBM's or ICBM's; is that not correct?

General BETTS. That is correct.

Mr. FULTON. What we are talking about in the development of the ICBM as a weaponry system and the IRBM as a weaponry system is something for the future. It is a matter of judgment on how soon

the conventional methods will be superseded by these long-range missiles—unmanned missiles. Is that not right?

General BETTS. I think I would agree with that.

Mr. FULTON. So actually, at this particular point in our defense history, we are phasing out many of the conventional weapons and phasing in new ones that we have been making research upon?

General BETTS. This is true.

Mr. FULTON. And in that phasing you people are making sure that there is no scientific gap, or intelligence gap, or any capability gap. You are able to defend our United States security and our position, are you not?

General BETTS. We have been working not only on the development of the long-range missile, but also we have been working on the development of the reentry capabilities of such missiles.

Mr. FULTON. Aren't we either equal or ahead of Russia on the capability of reentry? No missile is good unless its payload has the capability to reenter the atmosphere undamaged.

For example, back in 1957 we saw the successful reentry of the nose-cone of the Jupiter-C missile. That certainly established an outstanding lead over any of our other competitors on the ability to complete the trajectory of a missile where it can be effective, is that not the case?

General BETTS. I think I would say only this, Mr. Fulton: I don't have enough knowledge of the Russian's reentry development program to compare it with what I do know of the reentry development within the U.S. program.

I would say that we would be very remiss if at this stage in our situation with respect to the Russians we did not concede that they do have the ability to bring a warhead through the reentry onto target, and I think that is the U.S. position, but I don't have personal, independent knowledge of their capability in this area. This has not been part of my responsibility.

Mr. FULTON. Do you know if there is any gap or lag in our own defense capabilities with regard to the reentry of our missile warheads?

General BETTS. I think our reentry program has been very effective.

The CHAIRMAN. Would the gentleman yield?

Mr. FULTON. I would be glad to yield.

The CHAIRMAN. Would the recent effort of the Russians, in firing that missile across the Pacific and landing it within a limited area, indicate a reentry capability?

General BETTS. It certainly would if we accept the Russian announcement at its face value and I have no basis for either accepting or denying.

Mr. FULTON. I want to compliment you particularly on the second paragraph of your statement, General Betts, where you state, "The work begun last year on ballistic missile defense Project Pounder"—in which I understand you have 50 programs under study now—"has been continued in an attempt to discover adequate means to counter operational ballistic missiles in the future. About one-half of the ARPA budget is devoted to this activity."

General BETTS. This is correct, sir. For the coming fiscal year. This has not been true in the past.

Mr. FULTON. So you are emphasizing the antimissile defense?

General BETTS. We consider the ballistic missile defense one of the most critical problems of the Department of Defense.

Mr. FULTON. Then you state further, "Our thinking is geared beyond the more conventional Nike-Zeus concept which involves, as you know, destruction of a missile for the terminal phase of its flight."

Therefore you are thinking on a much broader basis of the whole trajectory of an ICBM or an IRBM missile.

General BETTS. This is one of the very marked advantages on this kind of a program in an organization like ARPA which does not have the specific problem of getting an operational system into the field in a specific time frame.

Having turned that kind of a program over to the Army, in the Nike-Zeus program, then ARPA is completely free to do the things which we feel must be done technologically to grow in capability in this whole area.

Mr. FULTON. You have study contracts out, 50 programs under Defender——

General BETTS. And we have hardware which may or may not contribute to the Zeus program. We don't know at this stage of the game.

Mr. FULTON. Are you then studying missile interception at the early, midcourse, and terminal phases of flight?

General BETTS. This is correct.

Mr. FULTON. When the statement is made, then, that Nike-Zeus is not put into operation, it does not mean that everything is being held up in the U.S. Department of Defense, or ARPA, on antimissile defense. We are making broad progress, are we not?

General BETTS. We are certainly doing everything we can technologically to get a good, sound solution to this problem.

Mr. FULTON. In your estimation, are the efforts and the money being provided for you adequate, both in this fiscal year and in the proposed fiscal year, beginning June 30, 1960?

General BETTS. Of the things which we see to be done in this area, I think we have adequate funds to carry them ahead at just as fast a pace as they can advance technically.

Mr. FULTON. Thank you. That is all.

The CHAIRMAN. May I suggest to the committee at this point, we have well exhausted this subject and we have some high-powered witnesses coming and a heavy day tomorrow too.

Now, Dr. York has some few matters that he wants to talk to us about in executive session, so if there is no objection, I would say this would be a very good time to go into executive session and close our session today.

Mr. FULTON. Could I just finish with one point on Nike-Zeus?

The CHAIRMAN. You are the only one who has asked any questions in the open session of the General.

Mr. FULTON. At this time, considering the present stage of research and development of the Nike-Zeus we have no defense against a complete smothering by that type equipment. For example, an enemy can drown out or can flood out any power of discrimination of incoming missiles we have at the present time, considering the level of our research and development in this field.

For example, we can't discriminate yet between duds and jamming techniques, as well as live weapons. So that is a real reason why we should not go into the Nike-Zeus production at the present time, is that not right?

General BETTS. Well, I think there is a great deal more to it than just that, Mr. Fulton. All I would say is, in reaching the judgment not to go into production I am sure that the Secretary took note of all of the things which have been done in the ARPA program with respect to discrimination techniques, as well as the progress that has been made within the Army Nike-Zeus program in this general area.

The CHAIRMAN. If the gentleman wants to continue, we will have to stay in open session. You are the only one who has asked any questions of the witness.

Mr. FULTON. That is all.

The CHAIRMAN. If there is no objection, we will go into executive session.

(Whereupon, at 3:25 p.m., the committee proceeded in executive session.)