

REVIEW OF THE SPACE PROGRAM

WEDNESDAY, FEBRUARY 17, 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 the order. Now, this morning I want to read a letter to the members of the committee from Mr. McCormack that will explain the situation very well. It is addressed to me, as chairman.

The leadership on both sides feels that it is highly advisable, if possible, for the Congress to complete its business before the national conventions of both parties meet. If we do not, it means that Congress will adjourn the early part of July and come back in August, and if this happens it is anyone's guess as to when the Congress will finally adjourn. It is my frank opinion that it would be a hard task to accomplish adjournment before July 11, but it can be done. In order to do this it will require intense work by all the committees and subcommittees and the members thereof because there are some ways that this can be accomplished:

1. Committees giving first consideration to bills that should be or must be acted upon at this session.

And that is the authorization bill to which we must give consideration.

2. Whenever possible, afternoon meetings and even some evening meetings, particularly in the case of committees under pressure. For example, where a large number of bills require hearings have been referred to them or in case of bill with protracted hearings, or in case a very important bill requires hearings in subcommittees.

3. Committees or subcommittees confronted with the above situation meeting early in the morning, say at 9 to 9:30.

Now, there is a nice thought for you subcommittee chairmen—that evening meeting. [Laughter.]

I am respectfully submitting to you, it is in the hope of both parties that we can finish our business and adjourn, sine die, before the national committees meet.

The rest of the letter does not pertain to the present work of the committee.

Signed, John McCormack.

John is not here, but he wants the committee to know about it. He will be here later. I think that speaks for itself. Now, we have these hearings this morning, we have hearings this afternoon especially to collate the work of the subcommittees on the NASA bill, and I am very anxious for the chairmen of the subcommittees to be present. And tomorrow morning—and that will just about finish up these posture hearings. After that we thought a week—I think the full com-

mittee can handle the bill in a week and I think the subcommittees can do it easily in a week. So if we can get that bill back to the full committee by Thursday week, that is tomorrow week, we can go over it in the full committee and get it in shape to be introduced and disposed of, that is as far as bringing it to the House is concerned, by Monday of the following week. Then it would be up to us to get it through the House. I want to commend the Republicans for having excellent attendance here recently, and I want to commend the Democrats, well down on the committee list, for their fine attendance. A little higher up—

Mr. FULTON. Let's not have it low and high. Let's have it new and newer.

The CHAIRMAN. I want to commend the newer members of the committee for their fine attendance. Now, if we will bear up these next 2 days, let's see how your attendance shows—

Mr. TEAGUE. If you can figure out a way to be in three places at the same time, I will be in every meeting every second.

The CHAIRMAN. Olin has a hard job there. I called him this morning—one thing about Mr. Teague, when you call on him to do a job, he will do it.

Mr. TEAGUE. Our committee's work is fascinating and interesting to me, but I have a meeting every day this week on the Veterans' Committee on a \$900 million hospital building program.

The CHAIRMAN. Now, as chairman of the full committee I am not going to interfere with the subcommittees. I want them to do their own job. If a subcommittee chairman gets in trouble I will be glad to pinch hit and help him. Furthermore, I probably will arrange to sit with one subcommittee and then another subcommittee, just looking in, with the subcommittees doing the job. I am ex officio member of all the subcommittees, but I want the committees to do the work and I will sit in with them and help if they need any assistance. But I don't anticipate that.

Mr. FULTON. Mr. Chairman, I have two suggestions.

The CHAIRMAN. Sure.

Mr. FULTON. I would have two suggestions: One is that we check and see on our scheduling of our authorization bill how it fits in with what the House Appropriations Committee already is doing.

The CHAIRMAN. I can tell you that.

Mr. FULTON. Will you tell us that?

The CHAIRMAN. They have already had the hearings on NASA. They have completed the hearings on the supplemental appropriation bill but not on fiscal 1961. They have not completed the hearings on the other features of the independent offices bill.

Mr. FULTON. When will that be coming out of the committee?

The CHAIRMAN. They don't know exactly, but since they have completed some hearings on NASA we are under pressure—

Mr. FULTON. That is what I am trying to get at.

The CHAIRMAN (continuing). To get the matter out. I am going to talk to the leadership today and tell them when we hope to get the bill out and ask them to—if they can—to make arrangements to take it up right away as soon as we get it back from the subcommittees and approved by the full committee.

Mr. FULTON. Now, the second suggestion, that if we are going to finish these posture hearings, which I hope you do, and then go into the hearings on the authorization bill for this current year for our committee, there are those of us serving on other committees—for example, I am on the House Foreign Affairs Committee and I must keep those duties up, too. I have a suggestion I am going to make. It then makes a limit on time and in Pennsylvania our primaries begin on February 23, the campaigns. So that we run through until April 26 with that in addition. Now, we have had other things on this committee that have been smaller in importance, but nevertheless time consuming to date. I don't complain about that. But I would make a strong suggestion that those things now be put aside because I understand that there is a proposed report on the Glennan hearings. Now, I must give notice of filing a minority report, if such a report is being prepared for the committee, and it will take much time for me to do that. My suggestion is that those—

The CHAIRMAN. The gentleman tells me he gets up, gets started at 4 in the morning.

Mr. FULTON. I do.

The CHAIRMAN. So that part doesn't worry me, the time you need.

Mr. FULTON. Not for the record.

(Discussion off the record.)

The CHAIRMAN. What chance does space have under those circumstances?

Mr. FULTON. I think you will find my attendance record is only second to the chairman on this committee.

Mr. HECHLER. Fulton for Vice President.

The CHAIRMAN. Well, that—

Mr. FULTON. You see, I don't want these other things coming up. I want that Glennan thing put off for awhile, or put off, period, because it is going to take time.

The CHAIRMAN. We are going to try to work with you fellows on both sides here, we are going to try to work it out.

Mr. FULTON. Do you have a calendar on that particular matter?

The CHAIRMAN. We don't have a calendar yet, but we will and we will give you some dates on it.

Mr. FULTON. I really feel it is an imposition to have us give our full attention here on this bill and to have these other things and then have things that may have a—I don't know—a political slant, likewise, that are on the side on hearings—

The CHAIRMAN. Mr. Fulton, this is a four-ring circus. You have been to Barnum & Bailey Circus. We can handle it in different rings. You go ahead. You will have time to work on a report. We don't want it too good, anyway. [Laughter.]

One more thing, that I think I could mention here in open session: I am working on a letter asking for the release of this \$137 million that has been set aside there for the Zeus project. I am just going to ask that it be released to the agency that needs the money.

Mr. BASS. Mr. Chairman, is this your action or are you acting for the committee?

The CHAIRMAN. No; it is not at this time for approval of the committee. I just wanted the committee to know. I am trying to be frank and aboveboard.

Mr. FULTON. Shouldn't we have committee action on that?

The CHAIRMAN. It will be all right. Let me write my letter first and get that out of the way and then we will have some committee action. My thought is we will probably finish up 3 or 4 minutes early and then go into executive session. I have one matter I want to mention to the committee.

Now, this morning we have two distinguished witnesses with us and we are very happy to have Lt. Gen. Arthur G. Trudeau, Office of Chief of Research and Development, and Maj. Gen. W. W. Dick, Jr., Director of Special Weapons.

Now, in this posture hearings we have sworn all of the witnesses. So, do you, and each of you, solemnly swear the testimony you will 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?

General TRUDEAU. I do.

General DICK. I do.

The CHAIRMAN. Have a seat. We welcome both of you to the committee. We know the fine work both of you have done and we know you are sincere and earnest and are willing and ready to help our committee.

Now, General Trudeau, you have got a statement and so does General Dick, but we will take yours up first, sir. If you will proceed, we will appreciate it.

STATEMENT OF LT. GEN. ARTHUR G. TRUDEAU, CHIEF, RESEARCH AND DEVELOPMENT, DEPARTMENT OF THE ARMY

General TRUDEAU. Thank you Mr. Chairman.

Members of the committee, I am Lt. Gen. Arthur G. Trudeau, Chief of Research and Development, Department of the Army. I want to express my appreciation to the committee in view of the pressure of time that has just been explained to this gathering for giving us time to present our side of the case this morning. I should like to report to you on the Army's research and development program and its contribution to the national space effort.

Secretary Brucker has reviewed for you the military potential of space and the Army's accomplishments in space. General Lemnitzer has outlined the Army's role and interest in space and the utilization of space to assist the Army in accomplishing its missions. My purpose today is to explain the philosophy of the Army research and development program and relate these to the national military space program as an extension of our experience, capabilities, and resources.

Now, I believe that it is essential to state that the research and development program is based on the Army's assigned combat functions, the assigned role in air defense, and the necessary supporting functions, such as worldwide logistics. From these missions we compute the research and development requirements which are influenced by three major factors: The future threat to the national security; the scope, nature, and shape of tactical organizations; and the sum of the advances in science and technology which can be made available. Over the past 185 years your Army has constructed a solid foundation of competence, resources, and capabilities that have steadily expanded and matured as the demands of warfare have progressed

from muskets and mules to rockets and missiles, and now to space technology. This research and development base is operated by the seven Army technical services: The Chemical Corps, the Corps of Engineers, the Ordnance Corps, the Medical Service, the Quartermaster Corps, the Signal Corps, and the Transportation Corps—all under the direction of my office for the Chief of Staff.

There is perhaps little apparent relation between the development of a semiautomatic rifle and the launching of the first U.S. satellite, or between the solving of the Panama Canal malaria problem and the successful transport of primates through space. But, however diverse these accomplishments may be in point of time and purpose, they are nonetheless the product of a single, timeless Army mission: to provide the U.S. Army with whatever support is required in its sphere of interest.

Let me mention a few specific examples of this technological capability. The Army presently owns and operates approximately \$1 billion worth of research and development facilities. The research and development resources of the Army include approximately 40,000 personnel, with a high percentage of scientific and engineering talent capable of conducting and controlling the most advanced efforts in research and development. These personnel and facilities represent an annual operating expense of over \$400 million, and are supported by an approximate three-fourths-billion-dollar effort from industry and private institutions.

Gentlemen, I reviewed a few of the aspects of this technological foundation or base for you because it serves to emphasize the resources with which we pursue our program. Our objective is to provide, on a continuing basis and as far as budgetary limitations permit, the most effective weapons systems and materiel for our Army, the other services as required, and for our allies.

The research and development program proceeds in two broad areas: The first is basic or fundamental research into the scientific disciplines; the second is applied research and development that results in hardware for the troops in the field.

Basic research looks into the future for a period of about 12 to 20 years, toward the battlefield of 1975, as an example. The Army is particularly aware of the essentiality of basic research because we believe it to be so crucial for significant future developments. We shall continue to stress it. Today we have almost 2,600 research tasks that cut across 16 major scientific disciplines and 74 subfields. This work is conducted at 52 Army installations, at 21 other Government agencies, and by over 550 colleges, universities, scientific research institutions, and private industrial contractors. Part of this program is conducted in 14 countries in Europe, and in Japan.

Applied research and development is concerned with the classic military fields of mobility, communications, firepower, support, and the soldier—or man—himself. And here we must take a shorter look into the future—say 5 to 8 years—and seek to fashion the machines of war necessary to combat the potential enemy of that time frame.

What we are developing and testing now is, of course, based on the fundamental discoveries and investigations of the last decade. I shall not choose to run down any extensive list of prospective new equipment except to mention a few of the outstanding examples.

These include aerial vehicles which utilize ducted fans on movable mountings, more versatile tanks, radios that are smaller but with more operating frequencies, a new family of missiles to replace or supplement conventional cannon, more compact and faster transportation of supplies and better protection for the soldier in the hostile environment of the nuclear battlefield. Of course, a major task, still, is the implementation of the innumerable improvements in weapons and equipment necessary to modernize the Army in every respect.

These are some of the challenging facets of the Army research and development program. I have given you a broad outline of our activities and some personal reflections about this effort, and I want to assure you that we will continue to pursue our program in a bold and aggressive manner with the backing of an understanding Congress and an enthusiastic Army, convinced of the importance of its mission for national defense.

ARMY CONTRIBUTIONS TO THE SPACE PROGRAM

I should like to outline for you the Army's participation, to date, in the national space program. The research and development program in the fields of Army interest that I have mentioned have provided an unusual amount of experience for conducting investigations, experiments, and in some cases for designing operational systems that utilize the medium of space, while contributing to our land combat mission. Rockets advanced from artillery, and missiles from rockets; data and computing techniques from the science of ballistics, the abacus, and the adding machine; precise electronic systems from Edison's light bulb and communications developments, and biological experiments; from the medical laboratory, the surgeon's scalpel, and basic research. This experience combined with high motivation and a unique capability insures an interesting, rich, and vital program for the future of America.

Let me emphasize what I mean by real experience in the missile and space field. First, any space effort, explorations, or space systems are based on rocket technology. Second, it is obvious today what can be done with a 5-year lead time in the missile business. Despite claims to the contrary, it has been the Army that vigorously pioneered rocket-missile technology for 10 crucial years after World War II. We used rockets in the Mexican War and in World War II, also. I would like to mention here that in 1942 the first rockets used by the Army were used at my instigation and they were Navy rockets and they were used by the Army over considerable objections at that time on the part of certain Army establishments.

The CHAIRMAN. You mean the Navy didn't want you to use them?

General TRUDEAU. No, sir, the Navy was very glad to give them to us. The resistance came from certain places in the Army.

We fired our first test ballistic missile in December of 1944 and 10 years later we had two guided missile systems in production and on station ready for employment by Army soldiers.

The next year, a Redstone inertially guided ballistic missile was successfully fired. These milestones are meaningful because, as additional accomplishments were accumulated by the Jupiter IRBM, the launching of Sputnik in October of 1957 created the emergency that

could be overcome only by a similar event. There was no rocket or missile capability in existence in the United States at that time that could launch an earth satellite except that of the Army. Consequently, at the first opportunity, after we were able to secure the authority, we did the job and were able to repeat it many times thereafter.

Just last year NASA programed five Moon probes; one of the Army's two probes passed relatively close to the Moon and is now in solar orbit, the first and only U.S. space probe to go into a solar orbit, to date.

These examples lend substance to the manner in which experience culminates in success. From the vantage point of foresight and real accomplishments, it is high on the credit side of the record that Army research, development, and organization have made major contributions to our national space effort to date. We only have to look to the future and Saturn to note this continuing major contribution.

I believe that it is important to realize that space must not be considered the property or province of any single national agency. Further, it will take the best efforts of all—scientific and technological institutions, industry, government, and the military services—to gain needed ascendancy in this realm of national endeavor. All have several and often common interests in space. As a matter of fact, just recently it has been discovered that water vapor and certain types of atmospheres do surround some of the planets, and I would assume that there can be little argument about the fact that there may be plenty of real estate to explore and perhaps develop within our solar system and the universe as a new millennium approaches.

In addition, the planning that goes toward real and significant exploration of space, of the vast reaches of space, should closely resemble a national strategy, much like the conduct of international diplomacy, economic aid, or military security. We may find rewards in space that transcend those from the bowels of the earth.

As you well know, the Army since 1958 has conducted all of its space efforts under the National Aeronautics and Space Administration or the Advanced Research Projects Agency. Current projects were assigned and funded by these agencies and the resulting tasks were then integrated by the Department of Army and technical services into the overall research and development operations. Since the larger rocket boosters for the programs which require space flight are now the responsibility of the Air Force or NASA, the Army is concerned primarily with the payloads at present. These are the payoff of satellite or space programs, of course, and some of them that are presently programed may become an integral part of an assigned Army mission, like geodesy or communications. Consequently, we are vitally concerned with such means to assist our land combat responsibilities, and to the national effort, especially when we recognize that orbiting platforms often give us the best, and may provide the only opportunity to insure adequate measures for national security.

Let me describe the NASA and ARPA programs that the Army has been assigned.

The Army has supported NASA in several fields of endeavor since the latter's inception to include space probes, satellites, large thrust boosters such as Saturn, biological experiments, and support of the

Mercury program. In fiscal year 1959, NASA placed \$28.5 million of requests and purchase orders with the Army, but in fiscal year 1960 to date only \$10 million.

On January 31, we passed the second anniversary of the launching of Explorer I which is still up there and is estimated to have made more than 9,000 trips around the Earth for a total of over 280 million miles. Since that original effort, the Army has done considerable work for NASA on satellite and space probe launchings and the development of payloads. This includes the Pioneer IV lunar probe which passed the Moon and went into orbit around the Sun and the Explorer VII Earth satellite placed into orbit last October which has added to our knowledge of the radiation fields around the earth. NASA has requested the Army Ordnance Corps to launch five more scientific satellites this year. This task calls for the provision of the payloads as well as the launching of them. Another NASA sponsored satellite program is the payload for the Tiros meteorological satellite. The Army Signal Corps is working on the payloads with the assistance of the Radio Corporation of America.

A program much in the public eye these days is project Mercury. Eight Redstone missiles are being provided for launching capsules into ballistic trajectories commencing this spring. Besides the booster hardware and launching, the White Sands Missile Range in New Mexico is to man three tracking stations in this program and the Army Ordnance Corps is to provide for the participation of its down-range measurements ship.

Incidentally you probably saw that pictured in the Star last night. The American Mariner is the down-range ship and is equipped with new radar equipment that will be used in the South Atlantic in furtherance of tests like those in the short film that you saw yesterday.

NASA has also requested Army support in the form of a number of special studies. These have included such matters as lunar soft landings, aspects of celestial mechanics, reentry problems, and properties of materials. The Army Ordnance Corps was also requested to include limited biological experiments in rocket flights, and the Army Surgeon General to provide for biomedical experiments.

At this point I would like to mention briefly the Saturn program, although strictly speaking it is not yet a NASA program. Saturn, as you know, represents our earliest hope for a booster to match the Soviet capabilities. It was first proposed by the Army Ballistic Missile Agency almost 3 years ago and we are pleased to see that its value has been recognized today.

With respect to the programs with ARPA, the Army supported over \$83 million in projects in fiscal year 1959 and over \$90 million in fiscal year 1960, to date. Although many of these projects are classified, I should like to mention the general program areas. First, there is the Notus family of communications satellites. There is a critical need for faster and more reliable communications to relieve overloaded circuits. And this will have perhaps as much value for our commerce and industry as in future military operations. The Army is working on several satellite payloads and ground stations to solve this situation and to expand the global communications networks. The importance of the Army Courier communication satellite has already been mentioned to you by Dr. York and the first launching is

scheduled for May of this year. Space surveillance is another important area and several projects are being pursued toward satellite tracking capabilities for both known and unknown satellites under Project Shepherd. Space vehicle and missile defense systems seeking something more advanced than the Nike-Zeus system are being investigated under Defender. These systems are studies only at this time but they serve as a basic input into future weapon concepts needed for the decades ahead. This is, perhaps, the broadest project area that the Army is investigating for ARPA.

The last two areas, Principia and Pontus, are tasks in the field of solid propellant research and materials research. Both are important to the future advancement of rocket technology.

It is obvious, then, that the Army has ably supported the space programs of NASA and ARPA in as extensive a manner as authorized, and in doing so has had a very important, if not always well publicized, role in the Nation's space activities. A wide variety of Army organizations and associated civilian agencies have participated in this effort and a tremendous amount of experience has been gained in these scientific and technological fields. What is more important, our technological base has reached the most extensive proportions in history, such that even after the ABMA transfer of its Development Operations Division is completed, the Army will still retain a considerable space capability in the technical services and allied civilian organizations.

In summary, the Army's research and development program has a broad and comprehensive scope to produce the kind of weapons and materiel that land combat forces of the future will need to enforce our national policies and protect our national interests. With such a diversified program we have contributed substantially, and can continue to do so, to any national space program. Although it is difficult to lose any part of an efficient and dynamic organization, we do not intend to allow the transfer of the Development Operations Division of ABMA to hinder the accomplishment of new defense programs. In addition, we stand ready confidently to accept responsibility for additional tasks in the challenging space field because we realize that the immediate future cannot help but uncover new discoveries, benefits, and military advantages in this new and challenging dimension of our civilization. Our basic mission is still to maintain ascendancy in land combat; in any area that man can operate, anything in any medium that will further this task is of immediate and continuing concern. The utilization of space is definitely included in this category.

It took the Army 5 years to obtain initial recognition of the military potential of the airplane, more than 50 years ago. We have sensed the military potential of space since before we first put Explorer I into orbit. We think that in less than 5 years we will have been proven right. May I suggest that we determine this for ourselves now and not wait until we are under greater duress than exists today.

Gentlemen, I appreciate the privilege of appearing before this committee and the Army stands ready with all of its personnel and resources to keep you fully informed at all times. We will gladly try to answer any questions that you may have. Thank you very much.

The CHAIRMAN. General Trudeau, a magnificent statement there.

General TRUDEAU. Thank you, sir.

The CHAIRMAN. It does present the record of the Army and no one should be ashamed of that fine record. As a matter of fact, I am so impressed with your statement that I am going to place it in the Congressional Record, this morning.

General TRUDEAU. Thank you, sir.

The CHAIRMAN. Now, Gen. William W. Dick, Jr., Director of Special Weapons. We would like to have your statement next and we will ask for questions.

STATEMENT OF MAJ. GEN. WILLIAM W. DICK, JR., DIRECTOR OF SPECIAL WEAPONS, OFFICE OF THE CHIEF OF RESEARCH AND DEVELOPMENT, DEPARTMENT OF THE ARMY

General DICK. Mr. Chairman and members of the committee, I am Maj. Gen. William W. Dick, Jr., Director of Special Weapons, Office of the Chief of Research and Development, Department of the Army. My purpose today is to report to you on the status of Nike-Zeus. My comments will be made on an unclassified basis and so my opening statement will be necessarily brief.

The Nike-Zeus is designed to defend against the ballistic missile threat—to include both the intercontinental ballistic missile and the shorter range, intermediate and submarine-launched ballistic missiles. It is the only weapons system of its type under active development. The same experienced Army-contractor team, which has successfully developed other Army air defense weapon systems, is being utilized on the Nike-Zeus.

The German V-2's in World War II provided a preview of the ballistic missile threat. Subsequently, the Stillwell Board in 1946 recognized the magnitude of the threat posed by the ballistic missile married to a nuclear warhead and recommended development of a defensive system to combat it.

It was not until 1955, however, when the Army initiated feasibility studies at the Bell Telephone Laboratories followed in 1956 by component development and experimental work, that active effort began on Nike-Zeus.

Since that time the development of Nike-Zeus has been conducted in accord with a logical and orderly plan, consistent with the urgency and priority assigned to the program. This plan calls for an early system test to be conducted at White Sands Missile Range and later a full systems test at Kwajalein Island against actual IRBM and ICBM targets.

The development program milestones necessary to fulfill this test plan have been achieved on the scheduled set some 2 years ago. Construction of the prototype installation at White Sands is nearing completion. Hardware has been built and is being tested. Early missile performance flight tests are underway and several test missiles have been fired to date. Construction of the Kwajalein site is also underway.

Subsequent to my last appearance before this committee, it has been possible to demonstrate the growth potential which is inherent in the design of Zeus by incorporating changes in the system which improve

significantly the design performance without the necessity to slip the program schedules. These changes include higher power and more sensitive radars of greater range and an improved missile. Research to increase further the Zeus capabilities and effectiveness is being conducted.

The Zeus is the pioneer defensive weapon development project of the ballistic missile age—a pioneer of qualified heritage and background, our previous Nike family experience. It has no immediate competitors.

At this point I would like to explain more explicitly what I mean by that last statement. There are two principal means of defense against any weapon system: passive and active. Passive defense denotes the measures taken for protection against a weapon system. In the case of ballistic missile defense, this would mean underground shelters, organization for civilian defense, and protection against the effects of a nuclear explosion.

On the other hand, active defense means the measures taken to defeat a weapon system. This would be the means employed to destroy a ballistic missile before it reaches a target.

At the present time there are several programs and projects designed to contribute toward an effective ballistic missile defense. These consist of warning networks, tracking systems, an active defense, antiballistic missile weapon systems, and many study programs for advanced ballistic missile and space vehicle defense.

For instance, the BMEWS radar warning network and the Midas detection satellite will furnish valuable information, in the future, so that we can prepare ourselves for a possible missile attack.

These systems are not now in operation but it is anticipated that they will be part of a vast warning network in the years to come. These systems contribute no active defense against an ICBM. In other words, they will only give the alarm.

The only active defense system that the Nation has under development now is Nike-Zeus. There are many studies, concepts, and proposals but no other means of attacking an ICBM in flight on the way to a target in the United States is under development. That is why the Army is so vitally interested in pursuing what we believe to be the only active antimissile defense system which could give us a reasonably early capability to meet the recognized Soviet ICBM threat.

Progress made in the program to date gives me no reason to doubt the successful development of the system and has reaffirmed the Army's confidence in Nike-Zeus. The Army believes that the Zeus has the capability of advancing with the ballistic missile threat. This growth potential is made possible by the use of a flexible design capable of ready modification to accept new data or new techniques as furnished from the research program.

Gentlemen, it has been a privilege to appear here before you again. I shall be happy to answer any questions, as I am able to, on an unclassified basis. Thank you very much.

The CHAIRMAN. Thank you very much, General Dick, for an excellent statement.

Now, this committee operates under the 5-minute rule. We will invoke it this morning. We are going to absolutely run it on a 5-minute rule, including the chairman.

I want to ask you, General Trudeau and General Dick, both of you: The \$137 million which was approved by Congress for the fiscal year 1960 is being withheld. Who is withholding that money?

General TRUDEAU. The \$137 million appropriated by the Congress for the current fiscal year was for preproduction engineering which is a different item than research and development, itself, and was to permit the construction of certain equipment that would expedite production of the missile if it was so authorized.

These funds are being withheld, as far as we are concerned, by the Department of Defense. Whether it goes higher than that or not is not known to me.

The CHAIRMAN. The Department of Defense has the money now, though?

General TRUDEAU. That is correct.

The CHAIRMAN. Now, if that money is released, the natural result would be your preengineering plans; that is correct, isn't it?

General TRUDEAU. That is correct.

The CHAIRMAN. And if the Zeus continues to program in research and development, as it has in the past, you would want to go ahead with that at once; is that correct?

General TRUDEAU. We feel that way. There are others who don't agree with us, but we have that confidence in the system; yes sir.

The CHAIRMAN. Well, we have nothing else to pin our hopes to but the development of the Zeus program to bring down missiles; isn't that right?

General TRUDEAU. That is correct. It is the only thing in the foreseeable future, say to 1970, that can possibly do this job.

The CHAIRMAN. Dr. York testified before this committee a year ago, a year and a half ago, that the Zeus system might cost around \$15 billion.

General TRUDEAU. I think that figure has been reduced to about 9 to 10, now.

General DICK. Seven and one-half.

General TRUDEAU. Seven and one-half billion is the figure.

The CHAIRMAN. Seven and one-half. If we continue to work on it, it might come down even lower than that, maybe, but $7\frac{1}{2}$ billion is your present figure?

General TRUDEAU. That is conceivable. But if it is needed for this country and if we are going to stand out with the Russians in a nuclear hailstorm, then the fellow that can have an umbrella over his head is going to have quite an advantage.

The CHAIRMAN. Now, the withholding of \$137 million now is having what effect on the program?

General TRUDEAU. You might say on the research and development program it is not having any effect, but if the research and development program progresses to a point where they say "go into production," then there will be time lost if we are not able to conduct some, and preferably as much as possible, of this preproduction engineering.

To give you an example, I have in my hand here a model of transistors, resistors, and other very small electronic parts which I would like to pass around.

Would you pass one down either side? They are the little items that you see in there. In this one you will note flecks of metal that are

about six-thousandths of an inch square and a thousandth of an inch thick.

Each of these little items do the same job as a large radio tube with which you have been familiar, and it takes millions of them in the Zeus system. To prefabricate these items now, individuals—to a large extent women—work under microscopes because the work is so intense and the particles are so minute, at a cost of perhaps \$20 to \$50 apiece.

Now, in the numbers we are getting into, it is necessary that we develop the equipment for automated lines with a high degree of reliability for its product. It is for doing this work and advancing this field and cutting this terrific leadtime with which we are faced that we are trying to get a substantial portion of the \$137 million, for instance.

The CHAIRMAN. If you got the \$137 million released to you today, how much time would it save in the overall program of developing and engineering this Zeus missile?

General TRUDEAU. What have we used? Six to nine months is the statement of General Dick, if you go into production. Now, I might say with respect to all of these new electronic components—and we have had tremendous advancements in this field as the field continues to accelerate in the technological breakthroughs we are getting—that these will also have a real application in all space efforts, no matter who does it.

This is not just for Zeus. This is a breakthrough and a development for which we have got to have automated machinery in this country, no matter whether Zeus ever is built or not.

The CHAIRMAN. So that the 137 million if spent for engineering, the results would be available for the whole space program and would be usable; is that what you are saying?

General TRUDEAU. I would say that for a substantial portion of it, this would be true. There is some of it that goes into more advanced work that does involve some brick and mortar in connection with pilot lines and new plants. But not all of it. If some of it probably did go into Zeus production, you can say it would be lost or used in the interest of trying to develop this automation and save time for development.

The CHAIRMAN. What percentage would you say?

General TRUDEAU. Dr. Morse, in consultation here, just mentioned that a letter has gone to the Director of Research and Engineering, Dr. York, in the Department of Defense, requesting especially the release of \$25 million to get into the pilot lines and the pilot equipment for producing this very intricate electronic equipment.

The CHAIRMAN. I hope you get it, General.

General TRUDEAU. Thank you, sir.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. Very glad to have you here and I think both of your statements are excellent. The question, of course, is one of what is the cutoff point? What is the cutoff point on the research and development program of the Nike-Zeus? Some of us that had experience on the aircraft scheduling unit in World War II always had the problem of when you cut it off and put it into production.

General TRUDEAU. That is right; that is always a problem.

Mr. FULTON. What generation it is and how competent it is. Now nobody at this particular stage says that the Nike-Zeus will be 100

percent foolproof, nor are we sure, in operation, that it will defend us, maybe, on these three proposed installations, more than an arc of maybe 60 percent around the country. It doesn't even go 60 percent.

Under those circumstances, it is then a judgment that is not political but one of engineering and it has been adequately handled, to me, by Dr. York, the Director of Research and Engineering, Department of Defense, as well as with your research and development program.

So I would like to compliment both you and Dr. York on your research and development on the Nike-Zeus, because it is given the highest priority on Government programs by the administration and by the Defense Department as well as the Army.

Already you have saved, and you corroborate this, within about 15 to 18 months that this has been under discussion, by going ahead with the research and development program, the original estimates for the cost of the Nike-Zeus have come down from \$15 to \$7½ billion, is that not right?

General TRUDEAU. No, it is not right, sir. If I may add to that, there is probably a billion and a half dollars that is going into research. So if you talk about the whole thing as a program, the figure would be around \$9 billion.

Mr. FULTON. I think you are correct. But you have through your efforts, as well as with Dr. York's direction, saved approximately then \$6 billion through going ahead with the research and development program?

General TRUDEAU. I would like to qualify that again, if I may, Mr. Fulton, because a part of this savings appears in the interest of getting something for the country, a system that would meet minimum requirements at least. We have considerably reduced the number of weapons or batteries on site that was contemplated under the \$15 billion program.

Mr. FULTON. But the problem is there as to coming up with a level of efficiency of Nike-Zeus, that we can be standing under the apple tree with our apron out and maybe catching 29 out of 30 apples and missing the 30th, and it hits us on the head.

Now, therefore, if we are trying—

General TRUDEAU. Well that is not a bad ratio. I'd bet on that.

Mr. FULTON. If we want to step up the ability of Nike-Zeus, maybe you had better go ahead and do more R. & D. Don't you think more research and development work is necessary before it becomes operational?

General TRUDEAU. There is no question about that; we admit that. We would like to proceed at the most rapid pace. I can only say—and I would like to say—that there are several other weapons systems, some of which are or will be obsolete, that have cost more in their entirety to date than is predicted for the Nike-Zeus; and they have been adopted without so many difficulties. If we were to take the philosophy in research and development that we couldn't go ahead until it is proven, then we should eliminate research and development.

Mr. FULTON. Yes, but when you have a weapons program with 50 different projects in it—

General TRUDEAU. And no potential before 1970.

Mr. FULTON. Well the so-called—I am not allowed to say that.

The CHAIRMAN. The gentleman's time expired.

Mr. FULTON. Not quite, sir. I looked; it was 16½ minutes when I started.

Mr. SISK. Point of order. I think the chairman is determining the time here and we are going to have to depend on the chairman.

The CHAIRMAN. I am doing the best I can. The gentleman's time has expired.

Mr. TEAGUE. Mr. Chairman, can I yield the gentleman 1 minute?

The CHAIRMAN. No; you can't.

Mr. FULTON. Would you yield for a comment?

Mr. TEAGUE. If possible.

The CHAIRMAN. Well, you can yield for a question.

Mr. FULTON. I am always appreciative of the various services claiming the "firsts" in the ballistic missile field and in the use of science on these programs, but I would like to point out to you that the first use of ballistic missiles was in the Third Macedonian War, ballistae were used by Perseus to very great strategic advantage, and likewise the Moon was used as a satellite—

The CHAIRMAN. The gentleman's time—Mr. Teague's time is now about to expire. [Laughter.]

Mr. TEAGUE. I ask unanimous consent that he be able to extend his remarks in the record.

Mr. FULTON. Thank you. [Laughter.]

Mr. TEAGUE. General, what is your opinion of the efficiency of our Government in using the capabilities of our country? I ask you that because we go around these companies and visit them, and invariably they come around to saying that it takes almost as long to get a contract going as it does to get them to complete the job, that they want us to do.

General TRUDEAU. Well, our system is complicated, I will say that. I think we do a fair job of operating under the system. One of our great problems in this country is the leadtime where it takes us from zero up to 10 years to bring anything from concept to production. The Russians are able to do it in half the time.

This is due to the safeguards inherent in our system, the same as the congressional hearings which you go through here, which may be time consuming but are necessary safeguards.

I don't want to criticize the system, but I think there are improvements that can be made. I think the American system has to learn to do things faster between concept and delivery, if you will.

Mr. TEAGUE. We get the criticism that it is necessary to rotate your people: you send a new man in and it takes him a year to get acquainted with what is going on.

General TRUDEAU. That is true; there is some degree of rotation. On the other hand, it is desirable to bring fresh brains in on these problems, as we have found there is nothing worse than an old line outfit which hasn't had a change in management for 20 years.

Mr. TEAGUE. That is all.

The CHAIRMAN. Mr. Bass?

Mr. BASS. You indicated that you disagree with other authorities and believe that this \$137 million should be released and that you should be allowed to spend it, I believe you say, on preproduction engineering?

General TRUDEAU. I don't think I have stated it quite that way. I have definitely stated that we do believe that at least \$25 million initially should be released right now to progress in these fields that I pointed out. We do say that, if the rest were released, it would result in a savings of time between now and the time we get to overall production.

We can recognize the fact that perhaps scientific brains better than ours have serious doubts about this and are justified in withholding it. We accept this. This is part of the system.

We don't have to be happy about it, but we accept it just like a lot of other things.

Mr. BASS. Do you think it should or shouldn't be released?

General TRUDEAU. I think it should be released; yes. I think we should go full blast, personally. This represents my confidence in the program which isn't shared in full by Dr. York and some of his associates.

Mr. BASS. Yet, as I understand it, this Nike-Zeus system has not been fully proved out; is that correct?

General TRUDEAU. This is perfectly true, but if we had taken this same premise, there are lots of other systems that would never have gotten off the ground; and it might have been better if some of them hadn't, I will admit. [Laughter.]

Mr. BASS. Mr. Chairman, I would hope that before this committee makes any statement or recommendation on this Nike-Zeus system that we at least give those who disagree with General Trudeau an opportunity to present their case before this committee.

As I understand it, Dr. York does not agree and I assume also Secretary Gates and General Twining, because they have—

The CHAIRMAN. Will the gentleman yield? But the Congress has felt like it should be spent there, and we put up the money after it has been proven to us.

Mr. BASS. Well, just speaking for myself, I don't necessarily go along with that. I would like to hear both sides of the case, and I think it is a hasty and ill-advised action to go ahead on this, just having heard one side of the case. That is all I have to say.

The CHAIRMAN. Any further questions. If not, Mr. Anfuso.

Mr. ANFUSO. General, first of all, I want to congratulate you for your sincerity and your fighting spirit. I think that is just what we need in these times.

General TRUDEAU. Well, you pay a price for it, sometimes.

Mr. ANFUSO. Well, I am sure you are willing to pay that price.

General TRUDEAU. That is right.

Mr. ANFUSO. I was very much interested in this umbrella that you spoke about.

Now, if we had this umbrella, wouldn't we automatically bring about a reduction in armaments, particularly in the manufacture of ICBM's and IRBM's? In other words, if we had this protection, both sides would realize: Well, what is the purpose, what is the sense of manufacturing more ICBM's or IRBM's, they can't penetrate anyway?

General TRUDEAU. That could conceivably be true, but what causes even more concern in my mind is what position it puts the other fellow in with respect to blackmail, threats—pick your own word for it—if

he has this umbrella and felt confident that he could block the majority of our retaliatory effort against him, and we were naked.

Mr. ANFUSO. That is right. If we had this umbrella we certainly would greatly discourage the enemy from going ahead full blast on this threat of bombing us out, and Khrushchev has said that many times that he could ruin this country.

General TRUDEAU. I think there are many psychopolitical aspects to it.

Mr. ANFUSO. Now, you said that 3 years ago you proposed—rather the Army proposed going ahead with the Saturn. What stopped you?

General TRUDEAU. Well, there was no funding or no approval for it at the time.

Mr. ANFUSO. Although funding was requested?

General TRUDEAU. Well, yes; the project was submitted with a view to having funds made available for it. It is a natural breakout from our Jupiter engine. It is merely a cluster of engines to give us something that would be the equivalent of anything Russia has used today as a booster.

Mr. ANFUSO. Now, if you had this money to go ahead with this engineering project which you say is absolutely essential, of course, you would want to continue research just the same, research and development would continue, isn't that right?

General TRUDEAU. They are related.

Mr. ANFUSO. They are related.

General TRUDEAU. They are related projects. One of the things we do in most of our systems, particularly where we feel any confidence in them at all, is to do what you call the preproduction engineering: the tooling up or development of the equipment as early in the program as possible to cut down this terrible time between the concept of an idea and the production of the finished equipment. It is really too great, much too great, today.

Mr. ANFUSO. With an ICBM going at the rate of 4 miles per second, it would take only 15 minutes to travel 3,400 miles, which would be sufficient to bomb out New York City, in which I am vitally concerned. We heard here about a 15-minute warning.

I don't think we would even have that with an ICBM, would we?

General TRUDEAU. If BMEWS is operating, you would have it; but whether you had the full 15 minutes or not, we believe there is the capability being built into Zeus to operate in much less time.

Mr. ANFUSO. There is nothing you could do about it in 10 or even 15 minutes.

General TRUDEAU. Yes; there is, with Zeus.

Mr. ANFUSO. With Zeus?

General TRUDEAU. Yes.

Mr. ANFUSO. I am just talking about the warning system. There is nothing we have without Zeus—

General TRUDEAU. Even if you had the warning, what would you do? You would have no passive defense, and you would have no active defense.

Mr. ANFUSO. One final question: Yesterday afternoon I attended a symposium on this subject, and I was very much impressed with the testimony of yesterday on the Nike-Zeus and I asked some questions

and somebody said: "Well, perhaps the objection to that is that when it is perfected, 4 or 5 years from now"—1970, did you say?

General TRUDEAU. Oh, no; much before that, if we get the full go-ahead.

Mr. ANFUSO (continuing). "It might be outdated." Do you foresee that?

General TRUDEAU. No; I don't foresee that. As a matter of fact, we think it has the added capability of an antisatellite missile.

Mr. ANFUSO. Congress is very much concerned, as the chairman has said, about this project, and I think we all are. Would you be willing to sit down with your dissenters before a secret session of this committee and have it out and then finally we would—if we see fit, we would make the recommendation to the American people and to the Congress?

General TRUDEAU. I am always available to give the best and most honest information I have to the Congress.

Mr. ANFUSO. That is all.

The CHAIRMAN. Mr. Riehlman?

Mr. RIEHLMAN. General, did I read into your statement here this morning that you had any opposition to the transferring of the Von Braun team to NASA?

General TRUDEAU. Well, I would be frank to say, since you have asked my personal opinion on it, that I was not in favor of the transfer. Since it was decided by higher authority, we are endeavoring to do it in the most effective manner, as far as the national interest is concerned, and to minimize any delay or setbacks in our program in the meantime.

Mr. RIEHLMAN. Well, could you tell us briefly why you were opposing it? On what basis?

General TRUDEAU. Because we feel that there are real military problems, military potential in space; and we felt—at least I felt—I should speak for myself here—that there should be a coordinated effort, an agency within the Department of Defense that would do most of this work.

Actually, the development of the airplane in this country, both in World War I and World War II and for commercial use, was headed up by the efforts of the Army and the Army Air Corps under it. This combination succeeded in winning two wars and in building a great industry; and I sometimes ask myself whether this would have been the case with industry if NACA had had the primary interest and the military interests had been subjugated.

Mr. RIEHLMAN. Well, at the present time the development of Saturn is still under the direction of the Army, is it not?

General TRUDEAU. It is an ARPA program. It is funded by ARPA, but we are doing it under the Von Braun team. This is right, sir.

Mr. RIEHLMAN. And you will continue until the transfer is made—

General TRUDEAU. It will physically move over with Dr. von Braun's team to NASA.

Mr. RIEHLMAN. Do you have any fears that when it moves over, this program is going to be stymied in any respect, it isn't going to advance as well as it had under the direction of the Army?

General TRUDEAU. We are not going to let it, because it will be during a transition period and the full facilities of the Army, country-wide, are going to be behind this effort.

Mr. RIEHLMAN. Have you had any indication at all from NASA that you aren't going to have that type of cooperation?

General TRUDEAU. Well, the cooperation is going to be on our part. We are giving it to them.

Mr. RIEHLMAN. I mean after it is transferred? It certainly isn't going to be completed by July 1.

General TRUDEAU. The cooperation is on our part.

Mr. RIEHLMAN. I see, because you are handling the program under the direction of NASA?

General TRUDEAU. Yes; but let me make my point. After July 1 it will be a NASA program. If there is any cooperating to be done, it will be the Army that will be doing it, and we intend to do it.

Mr. RIEHLMAN. All right; you intend to give them full cooperation?

General TRUDEAU. Absolutely, no question about that. We must have Saturn as early as possible.

Mr. RIEHLMAN. That is all I have.

The CHAIRMAN. Mr. Sisk?

Mr. SISK. Thank you, Mr. Chairman.

General Trudeau, I am very much impressed with your statement; particularly, I think your answers to my colleague, Mr. Riehlman, were rather significant.

The Army has been seemingly one of the only branches that have for over a period of time really recognized the real need for super-booster vehicles and for some application of space as a military vehicle or for military usage.

Would you agree with that statement?

General TRUDEAU. Well——

Mr. SISK. I am not trying to start an interservice argument here. I am merely, as I say, I have been much impressed with this.

General TRUDEAU. I wouldn't go so far as to say the recognition of our talents are unique. But I do say what we have done speaks for itself.

Mr. SISK. I think you have done an outstanding job.

General TRUDEAU. Thank you very much.

Mr. SISK. I, for one, am appreciative of it. I want to get back to seemingly the No. 1 question, of course, that is being discussed, Nike-Zeus. I have been interested along with many others in this because I think nothing could be more valuable than a defense against a ballistic missile if it could be developed.

Now, on this engineering production money which, as I understand, we are talking primarily about the \$137 million, I would like your frank comments on the status, for example, of a couple of other programs which I understand engineering production has been permitted.

That is on Polaris and Titan. Now, having some general knowledge of the background of Nike-Zeus and the length of time that you have worked on it, in the research and development program, I would like to have you comment on what you feel to be the relative status of research and development of these two weapons systems, Titan and Polaris, as compared to Nike-Zeus.

Here again, I am not trying to attempt to create any interservice rivalry, but I have a feeling that the Zeus in many instances was well ahead of some of the things on the Titan, for example. Yet they have been given the money, chances are being taken, the gamble is being made in these instances and yet apparently there is a hesitancy to take the gamble on Nike-Zeus.

General TRUDEAU. I have to say this in all honesty, that we have not brought a Zeus missile to the point where it is as complete or as near the finished product as is either Polaris or Titan. They have fired full-scale, according to my belief. I am not extremely knowledgeable about Polaris, but they have fired their full-scale missiles.

The results are another problem here. We have not fired a full-scale Zeus. We have had our fourth firing and it has been eminently successful, proving out everything that we wanted to prove. But each of these test firings, and they will number up into 30, 50, I don't know how many, adds some other new component that is being checked out to be sure that the whole and final package works properly. We are still a year to 18 months away from that, at least.

Mr. SISK. Of course, I am a staunch supporter of the Polaris program. I want to see them push ahead on that because I think it offers a real defensive weapon for us in the sense it is a good offensive program, but at the same time, I know they have been given the go-ahead so far as production is concerned.

In view of the progress that has been made in Nike-Zeus, of course, I for one, have been vigorously supporting the release of these funds to you people to boom ahead full speed, and I have some really serious regrets that that has not been done. Let me ask you if after listening to this for several days, isn't actually what we are confronted with now is the necessity of a decision?

Isn't actually a decision awaiting to be made somewhere as to the direction you are going?

I realize you still have some research and development going on.

General TRUDEAU. A lot of it.

Mr. SISK. But if we are going to boom ahead full-speed on Nike-Zeus, isn't a decision desperately needed and needed shortly on what we are going to do in the production field?

General TRUDEAU. This is correct, and the reason it is not forthcoming is because there are these differences in scientific opinion between other scientists and our scientists. I do not profess to be one of the great scientists, myself.

Mr. SISK. I certainly am not, either, and I hesitate to question any of the scientists, yet it seems to me that somewhere a decision is desperately needed when, so far as I know, all the testimony indicates that this is the only possible defense we have in the mill against the ballistic missile.

General TRUDEAU. I can only say that I know no other weapons system to which there have been as many strenuous objections. I have seen a lot of them that have gone forward when there were probably more scientific objections that could have been made to them than is the case in Nike-Zeus.

The CHAIRMAN. The gentleman's time has expired.

Mr. Mitchell?

Mr. MITCHELL. General Trudeau and General Dick, let me say this to you, that every member of the committee is intimately familiar with the pros and cons about Nike-Zeus.

General TRUDEAU. Yes, sir.

Mr. MITCHELL. I can say for myself that I have a very definite opinion as to what we should do and I am in full accord with both of you as to what should be done about Nike-Zeus.

Now let me ask each of you: Do you think that we can at this stage afford to gamble on Nike-Zeus in that we will not go as you term it, full blast?

General TRUDEAU. Well, I will put it this way: I think an active defense, if it is possible—and we think it is possible with Zeus—that will create a greatly added deterrent as far as Russian attack is concerned, and a very considerable but never complete ability to stop such an attack, if it were launched, is so important that we can't afford not to develop it.

Mr. MITCHELL. I agree with you wholeheartedly. Are those your sentiments, General Dick?

General DICK. I would say, Mr. Mitchell, in my personal opinion, the gamble is too large to take.

General TRUDEAU. To what?

General DICK. Not to go into production.

The CHAIRMAN. Not to go ahead, he means.

General TRUDEAU. Not to go ahead. [Laughter.]

General DICK. We have to have a little excitement here this morning, somewhere.

Mr. MITCHELL. Let the record show that emphatically, Mr. Chairman. [Laughter.]

General Trudeau, you mentioned something about the controversy between scientists as being the cause of the withholding of funds. Well, I submit that it goes beyond that and I think it is a prime example, the withholding of funds for the Zeus system is a prime example of the fact that we have not determined to make the maximum defense effort and that we are putting budgetary considerations above defense, itself.

General TRUDEAU. Well, I wouldn't want to impugn the motives of anyone, of course.

Mr. MITCHELL. That was my statement, General. I didn't ask for an answer. [Laughter.]

General TRUDEAU. OK.

Mr. MITCHELL. Let us turn now to Saturn. Do you think the transfer of Saturn to NASA will speed up the development of the project?

General TRUDEAU. No.

Mr. MITCHELL. Do you think——

General TRUDEAU. Unless they can put a lot more money behind it than has been made available.

Mr. MITCHELL. I am talking about funding as it was.

General TRUDEAU. From a technical standpoint; no.

Mr. MITCHELL. Do you think by virtue of the transfer that the cost of the project would be reduced or will it cost us more money?

General TRUDEAU. It is the same team. I wouldn't know. I don't see how it can be reduced.

Mr. MITCHELL. Do you think it possibly may cost more money?

General TRUDEAU. It could conceivably, because they are going to have to set up an administrative and logistics setup, which we have nationwide, to do all the servicing that is necessary. In the meantime, the Army is going to do this for them because we can't permit any slack. But it isn't just a question of acquiring the Von Braun team, because they are scientists and they shouldn't be diverted to have to go out and buy the hardware that is needed. We have done that in other parts. Von Braun has never had to worry about anything except concentrating on his scientific effort. The Army, through the Ordnance, the Engineers, and the Signal Corps has done all of the work to see that he has had what he wanted, when he wanted it, and where he wanted it.

Now, I don't know if the NASA establishment, countrywide, is set up to do this, but they are going to have to in time.

Mr. MITCHELL. Can you see any good coming at this particular time from the transfer of Saturn to NASA?

General TRUDEAU. Well, my answer, frankly, is, from a technical standpoint, no.

Mr. MITCHELL. From a practical standpoint?

General TRUDEAU. Well, you get into a lot of other points about the—

Mr. MITCHELL. Funding—

General TRUDEAU. Diplomatic status, diplomatic approaches, the psychopolitical values of where this should be or that should be, which I am not really qualified to discuss.

Mr. MITCHELL. Thank you, General.

The CHAIRMAN. Mr. Karth?

Mr. KARTH. Has Mr. Riehlman had his?

The CHAIRMAN. Yes.

Mr. KARTH. General, I want to compliment you on one of the fightingest presentations we have had before this committee and for the courage to express your own convictions upon being interrogated by the committee. I think a little more of this would probably help the committee make up their minds as to what they should do. I want to congratulate you on it.

General TRUDEAU. Thank you, sir.

Mr. KARTH. What does the transfer of the Von Braun team really mean to the Army in the R. & D. field? Will this have any serious effects on an overall basis to your R. & D. program, General? That is my question.

General TRUDEAU. We will still have a considerable competency in space and, of course, we will have less use for it with all of these various items and projects being taken away and being given to other services. The main thing we wanted was to be sure that the Von Braun team would not be dissipated, because we do consider it the greatest national asset we have with respect to space. I will not back away on that, no matter what other service or other agency is involved. The Army's one effort was to see that this great national asset was not dissipated. So we much preferred to see it go to any other service or agency than to see it disbanded. I wouldn't be truthful if I didn't tell you that after having built it and utilized it for 15 years, it was not a happy moment when we surrendered it.

Mr. KARTH. General, would you recommend a Manhattan-type project for the space program?

General TRUDEAU. Well, when you say a Manhattan-type project in that case you gave the Army complete authority to go ahead and get done what the country thought needed to be done. If the powers that be thought that there were certain things in this connection with respect to our defense, with respect to our exploration of space, which needed to be done, in the most effective manner and in the shortest possible time, the concept of a Manhattan project would have great value.

The CHAIRMAN. Any further questions?

Mr. KARTH. Just one other, Mr. Chairman. I would like to have the general, if he would, in regard to a statement on page 9 where he said space vehicle and missile defense systems more advanced than the Nike-Zeus system are being investigated under Defender. If you will elaborate on that—

General TRUDEAU. I can't say much in open session here. But there are research funds in which we are cooperating with ARPA in which different approaches are being sought. Now, these might involve propulsion of our own missiles or detection of the other missile or different "kill" means, or any or all of those three things. This is about as far as I can go. I assure you they are in the very initial stages and we see nothing there that would give us any promise of being in action within 5 years at least from the time that Zeus could be on station.

Mr. KARTH. Thank you, sir.

The CHAIRMAN. Mr. Hechler?

Mr. HECHLER. General Trudeau, you used on a couple of occasions the word "psychopolitical," which I think is a wonderful word. Can you give me about a 30-second thumbnail sketch of what you mean on page 11 of your statement that, "We determine this for ourselves now and not wait until we are under greater duress than exists today"? What do you mean by "duress today"?

General TRUDEAU. Pressure from the Kremlin.

Mr. HECHLER. I see.

Mr. ANFUSO. That is less than 30 seconds.

Mr. HECHLER. Now going back to page 6 of your statement you mention it will take the best efforts of all—scientific and technological institutions, industry, Government, and military services—to gain needed ascendancy in this realm of national endeavor.

Would you add, also, aside from those factors an understanding and a sense of urgency on the part of the American people? Do you think that would help any?

General TRUDEAU. I certainly would like to add that. I would like to say, as I happened to mention on the west coast the other day, that while I recognize the importance of the question—this is one I am not capable of getting into—the question of the missile gap, that I think we ought to also be concerned with the muscle gap which is your Army's capabilities—the hard core for sustained fighting—and also the mental gap. I think the mental gap needs a lot of attention in this country. I think we have gotten to a point where we can't differentiate between our standard of living and our way of life, and we are going to lose both unless we wake up.

Mr. HECHLER. Now, on page 5 I would like to most respectfully differ with a statement that you made here concerning the effect of a

launching of Sputnik. You said, "The launching of Sputnik in October of 1957 created the emergency that could be overcome only by a similar event." I would like to challenge that statement because the President himself said, immediately after the launching of Sputnik, "So far as the satellite itself is concerned that does not raise my apprehensions, not one iota."

Now, wouldn't your own job be much easier if the American people were awakened to the fact that we are facing really the gravest crisis in American history and it is necessary for the people to devote every ounce of heart, and mind, and muscle in order to meet that crisis? Wouldn't that make your own job much easier?

General TRUDEAU. It certainly would. I might say that when Sputnik was launched, I was the American commander of the I Corps in Korea and I had no knowledge that I was coming back to the country at that time. I got some consolation out of the fact that Sputnik had finally gone up, since I was pretty sure it was going up. Somebody was going to get up there soon and I felt sure it would awaken the American people, and it did. I was still in Korea when Explorer I went up on the 31st of January 1958 and I came back shortly thereafter. I thought surely I would find an awakened America to what the real problem was, long range, vis-a-vis the threat of world communism. I got back and at first I was impressed in talking with people that there had been some awakening. But only a little time had gone by when they were completely complacent and when the country club and corner drugstore seemed to solve most of their problems.

Mr. HECHLER. I must confess I agree with you. I want to shift quickly to General Dick, on the question of Nike-Zeus. I am very much impressed with your discussion of the fine family background of Nike-Zeus. I am sort of a nut on genealogy, too. I suppose you could say that unlike the Army mule that Nike-Zeus has both pride of ancestry and hope of progeny?

General DICK. I think that is very apt, Mr. Hechler. [Laughter.]

The CHAIRMAN. Mr. Daddario?

Mr. DADDARIO. If the Nike-Zeus system were completely operative today and there was a missile attack launched on, let's say New York City—

General TRUDEAU. And there was?

Mr. DADDARIO. There was.

General TRUDEAU. Yes.

Mr. DADDARIO. Under what conditions would the Nike-Zeus pick up the attack, and under what conditions would it destroy the oncoming missile?

General TRUDEAU. I would have to answer that in closed session, Mr. Daddario.

Mr. DADDARIO. Well, the reason I ask the question is that over the weekend you took very good care of New York, you were quoted as saying that it would be better to have an explosion 100 miles over Hartford, Conn., which I represent [laughter]—

General TRUDEAU. I would love to respond to that.

Mr. DADDARIO. Than a large explosion in New York City.

General TRUDEAU. I would like to respond to that. But I said a small explosion over Hartford, didn't I?

Mr. DADDARIO. Yes; I quoted that.

General TRUDEAU. First, I had regrets that I had named places, but later I was very glad that I did because I would like to drive the point home.

Mr. DADDARIO. It is insurance for New York City—

General TRUDEAU. What I am trying to tell you is this: that the very small warhead in a Nike-Zeus will destroy the big incoming warhead without a nuclear explosion; that the small atomic warhead is the only thing that explodes up there, and that there will be no damage to people 100 miles below it, unless the individual was specifically looking at that point at that time. This is very important.

Mr. DADDARIO. That, of course, is the purpose—

General TRUDEAU. As against losing New York City and 10 million people.

Mr. DADDARIO. That, of course, is the purpose of my question.

General TRUDEAU. I am very glad to have this opportunity to clarify it, because I felt it might be misunderstood.

Mr. DADDARIO. I think it is extremely important. It is my understanding that that would be the circumstances under which the destruction would occur and that it would be destroyed without that kind of tremendous explosion over Hartford or any other city.

General TRUDEAU. That is correct, sir.

Mr. DADDARIO. This was the basis, and this is a further basis to support the Nike-Zeus program.

General TRUDEAU. It is in our opinion.

Mr. DADDARIO. And I share, too, with many of my colleagues on this committee your opinion and that which was propounded yesterday by General Lemnitzer that we do need this kind of an active defense. I further go along with the need of a stronger passive defensive system. That is all, Mr. Chairman.

The CHAIRMAN. Mr. Moeller?

Mr. MOELLER. General Trudeau, could you tell us the cost ratio between a Nike-Zeus and, let us say, a Polaris and a Titan.

General TRUDEAU. Now, we are getting into systems cost. I don't know, this would be difficult.

Mr. MOELLER. In generalities it would serve my purpose. Is it less costly, let's say, than a Polaris?

General TRUDEAU. One-fourth.

Mr. MOELLER. One-fourth the cost of a Polaris, and certainly much more less than the cost of a Titan?

General TRUDEAU. About one-quarter the cost of a Titan, I am told. The missile cost is about a quarter of Titan.

Mr. BASS. Would you yield?

Mr. MOELLER. All right.

Mr. BASS. You have just said that the Nike-Zeus program will cost about \$9 billion and that is one-quarter of what the Titan costs, so it would be \$36 billion—

Mr. MOELLER. I am talking about one missile.

General TRUDEAU. The physical cost of a Zeus missile is not over one-quarter of the cost of a Titan missile. But you have systems and a lot of angles here that make it very difficult to even discuss the problem.

Mr. MOELLER. If we had many Nike-Zeus, this would, of course, be defensive, but it could also be looked upon as offensive?

General TRUDEAU. Very definitely, very definitely.

Mr. MOELLER. In other words, we could actually get more for our money if it were spent on the Nike-Zeus program than possible either on Polaris or Titan?

General TRUDEAU. Well, I won't say that in that way. But I will say, I think I would be saying what General Lemnitzer said in effect, that we need some mix between the offensive and defensive. Naturally, as military people we believe in the offensive, we don't think you can sit on your duff and win anything. But on the other hand, we think a proper mix of our offensive capability with some defensive capability is necessary. If we are going to maintain our capability, the most important thing is to maintain our determination as a people so we can meet this challenge. You can't do it completely naked and exposed over a long period of time.

Mr. MOELLER. That is all.

The CHAIRMAN. Mr. King.

Mr. KING. General, I just wanted to express curiosity as to what those two exhibits were there in front of you, if they have some bearing on your discussion of this morning.

General TRUDEAU. Not particularly. This is our new solar furnace. In the interest of science and space I didn't know how broad the questions would be you asked here. I brought this example of the first piece of metal that was melted at some three or four thousand degrees temperature at our first solar furnace, which proves, even with due respect to you, Mr. Chairman, that your colleague, Mr. McCormack has some sunshine up in Massachusetts because this is located there.

The CHAIRMAN. Can you give use a demonstration of it now? Our weather today calls for some sunshine. [Laughter.]

General TRUDEAU. This is the pattern of MOBIDIC. This is an all-electronic data computer equipment, it is mobile and is being used in the field Army for the integration of information in a rapid manner, as is necessary today to meet this challenge. They were merely two other samples that I brought down along with these which I knew would interest you very much here. These are the items we are talking about.

Mr. KING. Thank you. When in response to Congressman Moeller's question you agreed that the Nike-Zeus had offensive as well as defensive aspects, you didn't mean to suggest by that that the Russians could interpret the Nike-Zeus system as being an offensive weapon, did you? It has no capacity to actually be launched against a ground target.

General TRUDEAU. No, the impact of Nike-Zeus is that it would vastly increase the Russian requirements as to the number of missiles they need to have available at any time that they thought they dared to launch the attack against us. This is another aspect of the psychological problem.

Mr. MOELLER. Will you yield?

Mr. KING. Yes.

Mr. MOELLER. Of course, we could at the same time reduce our number of offensive missiles.

General TRUDEAU. This is a major question. There is a balance in there. This is for the Joint Chiefs of Staff. I wouldn't touch that one.

The CHAIRMAN. Mr. Roush?

Mr. ROUSH. Mr. Chairman.

General Trudeau, apparently there are people who feel there are very definite limitations on the use of Nike-Zeus?

General TRUDEAU. That is correct.

Mr. ROUSH. Limitations on their capabilities. In the statement you refer to the fact that you are constantly looking forward to discovering these capabilities. How long will it be before the research and development of the system is far enough along for you to determine these capabilities?

General TRUDEAU. We think that the critical time is going to be when we physically knock down an incoming ICBM and IRBM with them, which we are hopeful in doing in something over a year from now.

Mr. ROUSH. You are confident of certain of its capabilities now; is that correct?

General TRUDEAU. We feel confident, based on the best scientific appraisals that can be made of its abilities to do its job. But as I state very clearly the full missile, the complete system has not been tested and it will take time to do that.

Mr. ROUSH. Now, I want to try to clarify a question raised by my colleague, Mr. Fulton, and I believe Mr. Anfuso also followed up on this, but it isn't a matter of stopping research and development once we get into the production phase; that is correct, is it not?

General TRUDEAU. Of course, by the time you get into production phase, the major portion of your research and development should have been completed.

Mr. ROUSH. But you are constantly seeking new improvements and new capabilities of the weapon, are you not?

General TRUDEAU. We have greatly expanded the capabilities of the weapon in several fields over and above where we thought we were even 12 months ago, when we presented this problem to the committee.

Mr. ROUSH. Would you feel with this system as capable of improvement or modification after it is placed in production?

General TRUDEAU. We feel all systems are capable of improvement and we feel this can lead on to the next generation that will give us an antisatellite missile. We feel that with certain modifications it can give us a limited antisatellite capability, in itself.

Mr. ROUSH. The critical phase of present production that you refer to, when you refer to this \$137 million, is a present construction phase; that is important, is it not, in considering its relationship to research and development?

General TRUDEAU. The question is "Yes" and "No." It becomes important in the consideration of the date that you want to have these missiles defending your cities. This is where it becomes important. It is an attempt to take production or present production and research and development up to this point where we finally test it and then start on the other. It is an attempt to telescope and gain 6 to 9 months or up to a year's time by getting into some of this additional work.

Mr. ROUSH. Is the date classified as to when this missile would be capable of defending our cities if we go into immediate production?

General TRUDEAU. This still has to go on the end of research and development. Is that still a classified date?

General DICK. Yes.

General TRUDEAU. It is well this side of 1965, I think we can say that. In fact, I said it, didn't I?

General DICK. You said it.

General TRUDEAU. OK.

Mr. ROUSH. I didn't hear that.

General TRUDEAU. I say this side of 1965.

Mr. ROUSH. When was Nike-Zeus assigned a priority?

General DICK. January 22, 1958.

Mr. ROUSH. And prior to that had a priority been requested and denied?

General DICK. I frankly don't know. I can find out for you.

Mr. ROUSH. Would you please?

(The information requested is as follows:)

The assignment of the priority on January 22, 1958, resulted from the Army's first request for assignment of priority dated September 5, 1957.

Mr. ROUSH. Now, this year, referring to the fiscal year 1961, have you been assured of all of the funds you requested for research and development of Nike-Zeus?

General DICK. Are you asking me?

Mr. ROUSH. General Trudeau, or whichever one can best answer it.

General DICK. Prior to 1961, the program has been essentially fully funded.

Mr. ROUSH. All right, the question I asked was with reference to 1961.

General DICK. The budget as it presently stands today provides full funds to test the system.

Mr. ROUSH. Was it the same amount of funds you requested?

General DICK. It was less than the funds we requested.

Mr. ROUSH. How much did you request?

General DICK. \$323 million were requested. The budget carries \$287 million. The difference lies in those moneys which would be requested to carry along training devices and documentation, maintenance provisions, and so on, which would accompany a decision to produce Zeus and put it in the field. If you are not going to put it in the field, you are not going to turn it over to troops, then you didn't need those extra moneys. So I say the \$287 million is fully funding the system to demonstrate a capability.

Mr. ROUSH. Is this difference important to the Nike-Zeus?

General DICK. The difference is not an adverse factor at this time since there is no decision to produce.

Mr. ROUSH. Will the difference delay Nike-Zeus?

General DICK. No, not in research and development.

Mr. ROUSH. Thank you. I have just one other question: Is there any present military need for a superbooster engine?

General TRUDEAU. Such as Saturn?

Mr. ROUSH. Yes, sir, such as Saturn.

General TRUDEAU. Absolutely. Absolutely.

Mr. ROUSH. You disagree with the other services then in making that statement?

General TRUDEAU. No, it stands on its own feet. The communications satellite is going to be fired with a Saturn booster and we have stated the communications satellite is necessary in space.

Mr. ROUSH. Then there is a present need for a superbooster?

General TRUDEAU. I don't see how it can be denied. Do you know of anything else that can fire the communications satellite?

The CHAIRMAN. The gentleman's time has expired.

Mr. ANFUSO. May I just comment that General Trudeau—General Trudeau, has anybody ever told you that you talk like a former president, Harry Truman. [Laughter.]

General TRUDEAU. No, they haven't.

Mr. MOELLER. May we ask, Is he a candidate? [Laughter.]

The CHAIRMAN. Mr. Mitchell?

Mr. MITCHELL. General, let me commend you for not only talking like Harry Truman [laughter] but let me commend both you, General Trudeau, and General Dick for your sincere concern about the defense of the United States and I know it is not necessary but I urge you to continue to fight for the eventual production, early production of the Nike-Zeus system. And I think that with your efforts, that eventually it will have the effect of changing the prevailing philosophy of being penny wise and pound foolish insofar as the defense of America is concerned.

General TRUDEAU. Granting that there may be, and probably are, real and honest differences of opinion, we feel that we would be failing in our job if we didn't state our own conclusions based on the best information we are able to accumulate.

The CHAIRMAN. General, may I ask you this: You have nothing special to give us in executive session, do you?

General TRUDEAU. No, sir.

The CHAIRMAN. We have just a few moments before we go into executive session. I would like to ask General Trudeau one or two questions. On page 2 of your statement you refer to a billion dollars' worth of equipment, space equipment. Where do you have that equipment located?

General TRUDEAU. No, this is the total research and development facilities available to the Army.

The CHAIRMAN. Where are they located?

General TRUDEAU. They are scattered throughout the United States.

The CHAIRMAN. Could you give us a list, if it isn't too much trouble, that we could insert in the record so we will know pretty well where your research and development—

General TRUDEAU. Major research and development installations by technical service. I will be glad to do that.

(The information requested is as follows:)

U.S. ARMY INSTALLATIONS HOUSING RESEARCH AND DEVELOPMENT ACTIVITIES

PART I. ARMYWIDE AND U.S. CONTINENTAL ARMY COMMAND INSTALLATIONS

Fort Benning, Ga.: This installation includes both the Infantry Human Research Unit and the Infantry Board. The Human Research Unit conducts research to develop new techniques of infantry training. The Infantry Board conducts service tests of infantry weapons, ammunition and fire control items, clothing, equipment, and protective devices for the individual, small detachment and individual rations, and field messing equipment.

Fort Bliss, Tex.: The Air Defense Human Research Unit, located at Fort Bliss, conducts research to develop new techniques of electronics training and training of personnel to operate air defense units. The Air Defense Board conducts service tests on antiaircraft and selected field artillery guided missile systems, antiaircraft artillery weapons and fire control equipment, target drones,

and antiaircraft fire direction systems. The Office of Special Weapons Developments at this installation advises and assists the deputy commanding general of the U.S. Continental Army Command with development of requirements for doctrine, equipment, organization, and training as they pertain to the employment of atomic energy by the Army in the field.

Fort Bragg, N.C.: The Airborne and Electronics Board, at Fort Bragg, conducts service tests on communications and electronics equipment which are not a part of weapons systems, tests on infrared devices, and on special airborne and special air support equipment.

Fort Churchill, Manitoba, Canada: Fort Churchill is a Canadian-operated installation wherein the U.S. Army shares facilities with the Canadian Army. This installation provides facilities for engineering testing of development items in the arctic environment. The U.S. Army also operates a rocket research facility for various United States and Canadian agencies.

Fort Greeley, Alaska: The Army Arctic Test Board, at Fort Greeley supports all other U.S. Army boards by conducting arctic and subarctic portions of service tests.

Fort Gulick, Panama Canal Zone: This installation provides a high humidity, high temperature jungle environment for engineer testing of certain Corps of Engineers equipment.

Fort Knox, Ky.: Located at Fort Knox is the Armor Human Research Unit, the Armor Board, and the Army Medical Research Laboratory. The Research Unit conducts studies in armor training problems and the Armor Board conducts service tests on armored vehicles and associated weapons, ammunition and fire control equipment, selected engineer materiel, and radiation detection instruments. The Medical Research Laboratory, working under the Surgeon General, conducts basic and applied research on physiological, biochemical, biophysical, psychological, and psychophysiological problems that have military significance.

Fort Ord, Calif.: The Combat Development Experimental Center at Fort Ord conducts scientific controlled experiments of new concepts, organizations, doctrines, and procedures for future combat.

Fort Rucker, Ala.: The Aviation Human Research Unit and the Aviation Board are both located at Fort Rucker. The Human Research Unit conducts training and research in support of Army aviation, and the Aviation Board conducts service tests of a wide variety on aviation equipment. This equipment includes Army aircraft, communication and navigational aids used in controlling aerial flight, individual protective equipment, flight clothing, parachutes and personal equipment for aviators and crew members, portable hangars or other airfield facilities, airborne camera systems, airborne detectors (including radar, infrared, magnetic, and radiological), optical viewing devices for air observers, and maintenance equipment. This Board also maintains a constant review of aeronautical equipment developed by other services and civilian companies for application to Army aviation requirements.

Fort Sill, Okla.: The Artillery Board located at this installation conducts service tests on field artillery weapons, ammunition, radars, survey, sound and flash ranging equipment, meteorological equipment, and searchlights.

Presidio of Monterey, Calif.: Leadership training and mobilization research is conducted at this installation by the Leadership Human Research Unit. The work of this Unit includes studies to determine factors related to effective combat performance, techniques for training junior officers, leadership training for noncommissioned officers, and means for increasing the motivation of soldiers.

Yuma Test Station, Yuma, Ariz.: The desert climate in the Yuma Test Station permits hot weather and desert environmental testing of development items, both for engineer and service test.

U.S. Army Research and Development Group, Frankfurt, Germany: This agency was established in 1956 to establish and maintain contact with the European Scientific Community and to receive research proposals and to negotiate and administer research and development contracts in Europe.

U.S. Army Far East Research Office, Tokyo, Japan: This agency enables the U.S. Army to exploit the many research capabilities existing in the SEATO nations and to serve as a focal point for contacts between U.S. Army scientists and the scientists of the SEATO nations.

PART II. U.S. ARMY ORDNANCE CORPS INSTALLATIONS

Aberdeen Proving Ground, Aberdeen, Md.: All classes and types of Ordnance materiel, except the guided missile systems, the large caliber rocket systems, and aerial target drones are tested and evaluated at this installation. In addi-

tion, ballistic research and Ordnance weapons system evaluation are also carried out. Finally, those special missions relating to human engineering studies, explosive Ordnance disposal activities, coating, and chemical research are carried out here.

Diamond Ordnance Fuze Laboratories (DOFL), Washington, D.C.: This installation conducts both research and development in the various physical sciences and engineering fields for fuzes and related items.

Office of Ordnance Research, Durham, N.C.: This office is charged with planning, directing, and appraising the conduct of basic research of current and future Ordnance interests. This includes the collection, evaluation, and dissemination of information achieved from research conducted by the Ordnance Corps, by other Department of Defense agencies, and by other governmental, private, and foreign agencies.

U.S. Army Ordnance Missile Command, Huntsville, Ala.: In addition to the responsibility for weapon system management for all missile systems, this installation conducts basic research projects in the fields of missile and rocket development. It executes supporting research projects and conducts developments on ballistic and guided missile weapons systems and on space missiles or vehicles, and it executes space missile or vehicle development.

Rock Island Arsenal, Rock Island, Ill.: The Ordnance Weapons Command, located at the Rock Island Arsenal, controls the Springfield Armory, Springfield, Mass., and the Watertown Arsenal, Watertown, N.Y., in addition to the Rock Island Arsenal, Ill. In addition to the procurement and production functions of these several arsenals, basic research in the fields of metals and other materials as well as development of many Ordnance items is conducted.

Picatinny Arsenal, Dover, N.J.: This installation conducts both basic and supporting research in the fields of plastics, adhesives, and nonmetallic materials, as well as certain development and testing responsibilities with respect to explosives, and certain end items of ammunition.

Ordnance Tank Automotive Command, and its subordinate agency Detroit Arsenal, Detroit, Mich.: Conduct necessary research and development in all tank and automotive vehicles and power systems for vehicles.

Frankford Arsenal, Philadelphia, Pa.: At this installation, development of certain fire control systems and fire control components is conducted.

Watervliet Arsenal, N.Y.: This installation is charged with development of that category of Ordnance materiel classified as cannon.

White Sands Missile Range, White Sands, N. Mex.: This installation provides facilities for the engineering and service testing of the Army's missile systems, and operates range facilities for the other services.

PART III. ARMY SIGNAL CORPS INSTALLATIONS

Signal Research and Development Laboratory, Fort Monmouth, N.J.: This installation conducts continuing research in all fields of physical science leading to the development of new techniques and the design and improvement of communications, radar, electronic countermeasures, electronic data processing, radiological, meteorological, photography, drones, and other surveillance equipment and related components.

U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz.: This installation provides facilities for engineering and service tests of communications and electronic equipment.

U.S. Army Combat Surveillance Agency, Arlington, Va.: The Combat Surveillance Agency coordinates all phases of the surveillance activities conducted by the Chief Signal Officer as well as that work done by other technical services of the Department of the Army and of the Navy and Air Force.

The Signal Air Defense Engineering Agency, Fort George G. Meade, Md.: This agency provides research, analysis, development, engineering, installation and test of the Army's Air Defense Environmental Systems, as well as their integral and associated telecommunications and electronics.

Signal Electronic Research Unit, Mountain View, Calif.: This agency serves as a technical representative for the Signal Corps contracts with Sylvania Electric Products, Inc., for operation and maintenance of the development facility known as Electronic Defense Laboratory.

PART IV. U.S. ARMY CHEMICAL CORPS INSTALLATIONS

Army Chemical Center, Md.: The Army Chemical Warfare Laboratories, located near Edgewood, Md., conduct research and development work in the fields

of offensive and defensive toxic chemicals, radiological, smoke and flame warfare, to include lethal and incapacitating agents, munitions, weapons, defensive measures, design and operation of pilot plants, and evaluation of developmental agents and munitions systems.

Fort Detrick, Frederick, Md.: The U.S. Army Biological Warfare Laboratories, located at Fort Detrick, conduct research in the fields of lethal and incapacitating antipersonnel BW agents, research on detection and warning devices for BW attack, as well as many classified projects. In addition, the U.S. Army Medical Unit of the Surgeon General located at this installation determines the risks to the U.S. Armed Forces of biological warfare attacks, and where indicated, develops appropriate biological protective measures.

Dugway Proving Ground, Utah: This installation provides facilities for testing the chemical, biological, and radiological warfare developments from the Army Chemical Center and from Fort Detrick. Because of the extent and location of this facility, large-scale development testing as well as the testing of highly lethal and infective CW, BW, and RW agents are conducted.

PART V. U.S. ARMY CORPS OF ENGINEER INSTALLATIONS

Fort Belvoir, Va.: The Engineer Research and Development Laboratories, located at Fort Belvoir, constitute the principal field agency of the Corps of Engineers for the accomplishment of research and development of Engineer materiel, methods, and techniques required for military operations. Included in the research and development work, conducted at this installation, are such widely varied projects as gasoline, diesel, and steam engines, mobile industrial gas generating, storing and distributing equipment, construction equipment, bridges, equipment for handling POL, map reproduction and terrain modelmaking equipment, infrared and night vision devices, concealment, and camouflage techniques, etc.

Snow, Ice and Permafrost Research Establishment, Evanston, Ill.: This activity conducts research and development in the field of snow, ice, and frozen ground, on and beneath the Earth's surface.

U.S. Army Waterways Experiment Station, Vicksburg, Miss.: This installation undertakes, on a reimbursable basis, experimental studies pertaining to problems in the general field of hydraulics, soils mechanics, flexible pavement, and concrete.

Camp Tutto, Thule, Greenland: The U.S. Army Polar Research and Development Center, at Fort Belvoir, conducts in the Camp Tutto area research in problems associated with the polar environment.

Houghton, Mich: Both the Corps of Engineers and the Transportation Corps perform deep snow research and equipment testing in snow conditions at this installation.

PART VI. U.S. ARMY TRANSPORTATION CORPS INSTALLATIONS

Fort Eustis, Va.: The U.S. Army Transportation Research and Engineering Command, located at Fort Eustis, supervises development programs of Army aircraft, provides work on amphibious vehicles, harbor craft, and associated marine equipment, works on specialized off-road vehicles such as trackless trains and rolling fluid transporters, develops terminal handling equipment such as aerial tramways, and develops specialized military railroad equipment.

Transportation Corps Aviation Field Office, Dayton, Ohio: This field office provides coordination for the Department of the Army with the designated agencies of the Departments of Air Force and Navy in all fields of aviation research.

PART VII. U.S. ARMY QUARTERMASTER CORPS INSTALLATIONS

Natick, Mass.: The Quartermaster Research and Engineering Command, located at Natick, conducts research and development in such Quartermaster items as food, clothing, shelter, petroleum distribution, materials handling, tentage, laundry, shower, heating, and cooking equipment.

Quartermaster Maynard Test Site Maynard, Mass.: Plans and conducts field evaluation for the QM R. & E. Command at Natick.

Quartermaster Food and Container Institute for the Armed Forces, Chicago, Ill.: Under the direction of the Research and Engineering Command, Natick, Mass., this agency designs, develops, evaluates, and improves food and ration

components of all types for the armed services, as well as containers for food and other items.

Fort Lee, Va.: The Quartermaster Research and Engineering Field Evaluation Agency plans and conducts field evaluation tests, studies, observations, and supporting research for the Research and Engineering Command at Natick, Mass.

Quartermaster Radiation Planning Agency, Washington, D.C.: This agency develops all plans necessary for the establishment and operation of the U.S. Army Ionizing Radiation center.

PART VIII. U.S. ARMY MEDICAL SERVICE INSTALLATIONS

Walter Reed Army Institute of Research, Washington, D.C.: This installation plans and conducts research and development in the fields of medicine, dentistry, veterinary medicine, and the allied medical sciences.

Fort Sam Houston, Tex.: A U.S. Army surgical research unit, located at Fort Sam Houston, investigates problems arising in all fields of military surgery, to include problems of mechanical and thermal injury and complications arising from such trauma.

U.S. Army Prosthetics Research Laboratory, Washington, D.C.: This agency conducts fundamental research, applied research, testing, development, and training in the techniques of fitting new devices in the field of prosthetic and orthopedic appliances.

U.S. Army Medical Research and Nutrition Laboratory, Denver, Colo.: This agency determines the nutrient intake of the soldier under various conditions in order to evaluate the adequacy of his diet. In addition, it assesses the health, nutrition, and performance capacity of troops in all environments in order to ascertain whether they are well fed and are as healthy and as fit as is compatible with local danger, disease, and environment.

Fort Totten, N.Y.: The U.S. Army Medical Equipment and Development Laboratory at Fort Totten designs and develops new items of military medical equipment for all three services.

U.S. Army Medical Research Unit, Kuala Lumpur, Malaya: This unit investigates fevers of undetermined origin and other diseases of potential military importance in southeast Asia.

U.S. Army Tropical Research Medical Laboratory, San Juan, P.R.: This medical laboratory conducts tropical medical research which will ultimately prove beneficial to combat troops stationed in similar environmental areas.

U.S. Army Medical Research Unit, Landstuhl, Germany: This unit conducts studies regarding radioactivity in man.

U.S. Army Medical Research Unit, Panama: This unit conducts studies of diseases of military importance in middle America.

The CHAIRMAN. One more thing, through your statement as you went along, you added in some places after you had gotten the authority to go ahead and in other places you changed a word and inserted the word "authority." I think back to the hearings we had in the Armed Services Committee a number of years ago where it was shown that you could have gotten a Jupiter C in orbit before Sputnik No. 1 if you had been given authority. Does that have anything to do with your shifting of the words there in your statement today?

General TRUDEAU. Not particularly. I think this is true. I was not in this particular end of the game at the time, but there are several cases, such as Saturn that I mentioned this morning, where we feel that had authority been forthcoming sooner that the work could have been expedited.

The CHAIRMAN. You could have gotten Jupiter C in orbit before Sputnik, if you had been given the authority to do it?

General TRUDEAU. The answer is "Yes."

Mr. BASS. Mr. Chairman.

The CHAIRMAN. I yield.

Mr. BASS. I just want to clear up one matter, General.

With regard to those individuals who disagree with you on Nike-Zeus, you don't impugn their sincerity and loyalty, do you?

General TRUDEAU. I hope I have made that clear. No, I don't, and there are some very fine brains that don't agree with me or our people.

Mr. BASS. You don't agree with the statement that their decision has been motivated by budgetary reasons or anything like that, do you?

General TRUDEAU. From my viewpoint I wouldn't permit myself to think that.

Mr. BASS. Thank you.

The CHAIRMAN. Now, General, do you need any additional authority, in your opinion, to go ahead, outside, of course, of the release of that \$137 million. Do you need any other additional authority to proceed with the space program in areas which you consider vital to the security of the United States?

General TRUDEAU. Well, I think these are forthcoming. We are looking for clarification at an early date on responsibility for the communication payloads, about which I have spoken briefly. We are making the studies on those, primarily under our Signal Corps now, but we do not have an assignment of the communication payloads officially and in full and complete with funds today.

The CHAIRMAN. And you need that assignment now, do you?

General TRUDEAU. Yes, sir.

The CHAIRMAN. And it would save time if you got the assignment?

General TRUDEAU. Absolutely.

The CHAIRMAN. How much time would you save?

General TRUDEAU. Well, every day saved is just that much time. This is about what it amounts to.

The CHAIRMAN. Mr. Hechler?

Mr. HECHLER. I would just like to concur with my colleagues, Mr. Mitchell and Mr. Anfuso, and say that I think that both you, General Trudeau, and General Dick have made magnificent statements this morning and I hope you will stick to your guns.

General TRUDEAU. Thank, you sir.

The CHAIRMAN. Mr. Moeller?

Mr. MOELLER. General Trudeau, if you would rather not answer this in open session, maybe you could tell us in executive session: Would you give us your honest opinion as to why you think the Von Braun team was transferred from the Army? We hear many reasons about this.

General TRUDEAU. Well, I don't know. It would only be surmise on my part. I think there have been certain jealousies that are bound to have been stimulated by the Army's success in this field. I think there are honest doubts in the minds of many people as to whether the Army should be in space. There are some people who do believe that one service or one agency should have control of everything that has to do with space. There are probably psychological reasons and again psychopolitical—since you like that word, I will use that—as to why we should accent the civilian aspects of this effort and play down the military implications, and those to my mind—and then there can be others which you can evaluate better than I can—that all add up to this problem and the current solution to it.

The CHAIRMAN. Thank you very much, General. Thank both of you, General Trudeau and General Dick, for very fine statements that you have made to us.

Now, tomorrow morning, I will say that we have General Medaris with us. We will probably get some fine statements there, too. [Laughter.]

General TRUDEAU. Since he is no longer on the active rolls of the Army, you should.

The CHAIRMAN. We look forward to hearing his testimony—

Mr. ANFUSO. You heard the comment of the general, General Medaris is no longer on the active roll of the Army.

The CHAIRMAN. These gentlemen—I will say this, whether they are on the active rolls or not, they speak their mind, they say their convictions and it is always pleasant to have witnesses before us who do give us their sincere convictions. Sometimes we don't agree with them, though.

General TRUDEAU. That is all right.

The CHAIRMAN. But we are happy to have you.

The committee will go into executive session.

(Whereupon, at 11:41 a.m., the committee proceeded into executive session.)

(The executive session is classified and will not appear here.)