# MISSILE DEVELOPMENT AND SPACE SCIENCES

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
*Washington, D.C., Tuesday, February 3, 1959.*

The committee met at 10 a.m., in room 219, Old House Office Building, Hon. Overton Brooks, chairman, presiding.

The CHAIRMAN. The committee will please come to order.

This morning we are going to hear from the Air Force and we have the privilege the first thing this morning, gentlemen of the committee, to hear from the distinguished Chief of Staff of the Air Force, an able witness, a fine gentleman, and a great military leader, who has followed the program that we have under study all the way through. I refer to Gen. Thomas D. White.

General White, I think we have a formal statement to hear from you and if you wish to proceed with this statement we will be glad to have it.

General WHITE. Very good, sir.

The CHAIRMAN. Proceed with your statement, General White.

## STATEMENT OF GEN. THOMAS D. WHITE, CHIEF OF STAFF, U.S. AIR FORCE

General WHITE. Mr. Chairman, members of the committee, I welcome this opportunity to discuss with you the subjects under consideration by this committee today. They are subjects which are not only extremely vital to the Air Force as we advance deeper into aerospace but which are uppermost in all of our minds these days as a matter of utmost national emergency.

The President has stated that we and other nations have a great responsibility to promote the peaceful use of space and to utilize the new knowledge obtainable from space science and technology for the benefit of all mankind. This is the overwhelming desire of all of us. Moreover, it is with this basic premise in mind that the Air Force appears before you today and all witnesses in giving their replies and testimony have the intent to testify within this statement of policy. However, until effective measures to this end are assured, the capability of the free world to operate freely and purposefully in

space will depend upon a strong and capable deterrent aerospace force.

Aerospace is a term which may be unfamiliar to some of you. Since you will hear it several times during the course of our presentations, I would like to define it for the committee at this time. The Air Force has operated throughout its relatively short history in the sensible atmosphere around the earth. Recent developments have allowed us to extend our operations further away from the earth, approaching the environment popularly referred to as space. Since there is no dividing line, no natural barrier separating these two areas, there can be no operational boundary between them. Thus air and space comprise a single continuous operational field in which the Air Force must continue to function. This area is aerospace.

The major military threat which faces our Nation today lies in Soviet aerospace power, even though at the moment this power is expressed in terms of aircraft and ballistic missiles. The primary military deterrent which has contained this threat and which has precluded it from developing into catastrophic reality is U.S. aerospace power. This has been true for the past 10 years with our conventional and early jet fighters and bombers. I am convinced that it will continue to be true as we operate with improved jet aircraft, missiles, and eventually spacecraft and satellites. The decisive weapons of the future will be aerospace weapons. That nation or group of nations which maintains predominance in this area, not only in its military forces, but also in its laboratories, in its industries, and in its technology, will possess the means of survival.

In any new program—and the space efforts of this country are relatively young—it is often difficult to separate basic scientific research from military potential. Never in history has this delineation been more difficult and yet more critical than in this era of limitless scientific expansion. Proper definition of this problem is one of the most imposing responsibilities resting with those who must guide our national space effort to its proper goals. It is our thought in the Air Force that there is at this point in time little, if anything, in the area of basic space research, which may not have some degree of military application. We are interested in the machines to get us into space. We are interested in the problems facing man in space and we must obtain answers to many other related questions before a firm military capability can be established in space.

In the early stages of this program, our scientific and military interests will in many cases be synonymous and simultaneous. This being the case, extreme caution must be exercised in areas wherein basic research might be mistakenly separated from urgent military requirements to the detriment of those military requirements. In these critical days the practical use of space knowledge must be considered

primarily from the standpoint of their application toward the security of this Nation and of the free world—until such time as the use of space for peaceful purposes is assured.

The exploration and exploitation of space is an expensive program in money, resources, and effort. It is also a critical program from the standpoint of time when we consider the threat which faces us. Strong control and tight coordination are needed to acquire the space posture which we must have and at the time we must have it. Our national space program must be comprehensive in scope and must closely coordinate the full potential of our national resources if it is to meet effectively the challenge of world leadership in this field. The policies and programs of the Air Force reflect these national objectives.

At this stage of our growth in space technology, requirements and their implementing developments must move at an extremely rapid pace if we are to meet the urgent military and scientific threats which face us today and which we know will face us tomorrow. We must remain fully sensitive at all times to the impact that space technology's swift advance will have upon aerospace systems and operations and we must be able to move with speed, purpose, and directness to exploit these advances. There is no question in my mind that we have the ability to attain our goals in space nor that we will attain them provided that we keep clearly in sight and remain constantly aware of the dangerous detours through which duplication, indecision, and diffusion can lead us.

In closing, I would like to emphasize that our defense posture must be measured at all times against our entire aerospace capability and it must be computed against its capacity to accomplish the mission assigned to it. Total aerospace power includes manned and unmanned air-breathing vehicles, spacecraft, and satellites and ballistic missiles. Each weapons system supplies a definite and unique contribution to our overall defense capability and each is judged by its performance in relation to the whole. The value of one cannot be properly computed except in context and in conjunction with the contributions of the others.

We have prepared detailed presentations for you concerning the space program as it affects the Air Force mission. First, Lieutenant General Anderson, commander of the Air Research and Development Command, will discuss the organization of the Air Force as it particularly pertains to our space effort. He will be followed by Major General Schriever, commander of the Air Force Ballistic Missile Division, who will brief you on the intercontinental ballistic missile program.

Following their presentations, we will be happy to answer your questions on this portion of the overall briefing. I will then turn the briefing over to Brigadier General Boushey, the Director of Advanced Technology, in Headquarters U.S. Air Force, who will carry on with a detailed discussion of Air Force space projects and capabilities.

Our presentations today will be divided into two sections, the first being unclassified, followed by classified sections of the briefings. I would now like to present Lieutenant General Anderson.

The CHAIRMAN. The classified sections of the briefing will be at the end?

General WHITE. That is correct.

The CHAIRMAN. So everybody can remain for the open session. I want to ask you one question before you present General Anderson, if I may: In your mind, in your position as Chief of Staff of the Air Force, how vital do you feel that the successful prosecution of this program of aerospace is to the security and preservation of the United States of America? It is a general question which a great many of our people ask us.

General WHITE. Well, it is my personal and considered view that the move forward into space is perhaps even more important than in 1903 when the aircraft first came on the horizon. None of us dreamt what aviation was going to do to civilization, and I think the same on an expanded scale can be said about space, perhaps in proportion as the one exists to the other relative to the size of space.

The CHAIRMAN. Now you being a military man or an airman, with your feet on the ground, and realizing what is fundamental to the defense of the Nation, would you say that this program of conquering the aerospace is one that we appreciate the importance of, as a people, and as a military organization that we are determined to pursue?

General WHITE. I think that the public imagination is being caught by this. I am not sure that they are fully educated. I think that is a matter of time. I thought it was years before the public was educated to the potentialities of aviation. I think the same thing will occur in space. I think that the military aspects of this thing are being thought through. It must be recognized that there is a great deal that we do not know. But we are trying to keep abreast of it. I think that we are today.

The CHAIRMAN. One more question: Are you satisfied with the effort that we are putting behind this program from a security viewpoint at this time?

General WHITE. Well, we in the Air Force, and I think all of the military services, always want to see technology move faster because we realize that it is from the area of new developments that our lifeblood stems. On that basis alone I would say that I would always like to see things move faster. There are limitations, technological facilitieswise, which have a bearing; but I think we are well on our way.

The CHAIRMAN. Thank you, General.

Now my thought this morning, in order to get through the witnesses, because we were not able to finish yesterday, would be to recognize Mr. McCormack, majority leader, and Mr. Fulton, minority leader on the committee, and then throw the thing open to any urgent questions and then proceed with the next witness, if that is satisfactory with the committee. If it is, I will recognize Mr. McCormack.

Mr. MCCORMACK. General, on the light side still, the matter that I would like to get information about, because the word "aerospace" is something new to me and I know that has significance from the Air Force angle, where was that coined?

General WHITE. Within the last year and by the Air Force, I am willing to add. I would like to explain it if you wish.

Mr. MCCORMACK. I appreciate that it was coined by the Air Force. I imagine within that space that any of these conflicts between the Air Force and the Army and the Navy in outer space would be very easily adjusted from the Air Force angle because everything then will come under "Aerospace."

General WHITE. Well, I do not think the conflicts are as serious as some people would like to make them, Mr. McCormack.

Mr. MCCORMACK. I noticed you stressed the word throughout your whole statement, so I assumed this morning there was some significance in this wording. Why not call it "space-aero"?

General WHITE. That is a little more euphonious, perhaps.

Mr. MCCORMACK. You notice I say "on the light side." I can see where it developed, however. We will see what the future holds as to the term "aerospace" and the claim for its jurisdiction. Of course, General, we hear an awful lot about the overall military strength of our country and that word "overall" is what most people overlook, but which interests me every time I hear any of our military leaders speak and also those in high positions in the Defense Department. I always find that word "overall" in there. That could be changed very quickly, could it not? In other words, suppose the Soviet Union perfected a military satellite that could be an effective military instrument before we did. That would change the whole overall picture, would it not?

General WHITE. It certainly would point to that area as something new which had very great potential and very great danger.

Mr. MCCORMACK. Is it fair to say our main retaliatory power—I do not say exclusive, I say main—is SAC?

General WHITE. There is no question about it. About 95 percent of the U.S. retaliatory power is in SAC.

Mr. MCCORMACK. Could you give me something that is not classified—all I know is what I read in the newspapers—as to how far the Soviet Union has advanced in perfecting the intercontinental ballistic missile, its reentry and so forth.

General WHITE. I am afraid there is not very much I can say on that subject in an open session.

Mr. MCCORMACK. We read a lot in the papers that they are a year an a half ahead of us, or something.

General WHITE. That is one of the difficulties but also one of the virtues of our free press. There are many speculations and I still think that those who have the official classified information should neither confirm nor deny it in an open session.

Mr. MCCORMACK. In any event, is it fair to assume that the American people in their thinking, and also for us legislators in our thinking, to assume that military power is relative, that the strength of our power is in relation to the military strength of a potential enemy?

General WHITE. If you limit it to military strength, that is true. Of course, national strength is more than the military side of it.

Mr. ANFUSO. In reference to what you have just said, Mr. McCormack, I should like to advise General White and the committee that Mr. Khrushchev has this day made a public statement, which I think should have a public response on our part. He has said that all of

the weapons we have, and he included those available to SAC, are all outdated. He says that they have enough rocket weapons to wipe out our entire coastline, as well as the coastline of our allies, and that we could never land in Soviet Russia. Now that is a very frightening statement made to the American public and I should like to hear something from you from which the public can get some reassurance.

General WHITE. Well, I have not seen the statement, sir. I believe you said it was made today. The only statement I would like to make is that we are in the midst of a cold war and that history teaches us while we must give some credence to what the Soviet leaders say, very frequently what they say is not entirely the truth.

Mr. MCCORMACK. On military matters?

General WHITE. I think on military matters as well as others.

Mr. ANFUSO. Do you think that our public will take that answer or be satisfied with that answer?

General WHITE. I would not think so entirely; no, sir.

Mr. MCCORMACK. Coming back to what I spoke of—I will use your phrase, the Air Force phrase, I know it will please you on this occasion, "aerospace"—there is nothing in the foreseeable future from a military angle that could be used in aerospace with effectiveness, so me have to rely pretty much on the weapons we have today and the improvement of them.

General WHITE. There is no question about that, sir.

Mr. MCCORMACK. And our retaliatory power is SAC?

General WHITE. About 95 percent lies in SAC?

Mr. MCCORMACK. Our military strength is conceived on massive retaliation.

General WHITE. That is correct.

Mr. MCCORMACK. You spoke of our overall strength, and our economic strength, but if we are defeated militarily our economic strength is conquered, is it not?

General WHITE. That is correct.

Mr. MCCORMACK. So we have to be very realistic and realize that our military strength is of vital importance in this period of the world's history.

General WHITE. There is no question about that, sir, and it is given grave consideration.

Mr. MCCORMACK. Those charged with the responsibility of government, whether they be military or executive, if they are going to err in judgment, it is better to err on the side of strength than on the side of weakness?

General WHITE. I think that is generally a good rule to follow; yes, sir.

Mr. MCCORMACK. Can you give us any idea whether the Soviets are perfecting a defense against SAC?

General WHITE. There is no question about their improvement in their defensive capabilities just as we feel we are countering it with improvement of our penetration capabilities.

Mr. MCCORMACK. Well, until we perfect some more retaliatory power, if they perfect the intercontinental missile before we do, so that it can be pinpointed, under the factor of ironing out the bugs, and so forth, and they perfect a good defense against SAC where the attrition will be too high, we would be in a bad position, would we not?

General WHITE. I am sure that is so.

Mr. MCCORMACK. Is that an improbability?

General WHITE. I consider it an improbability.

Mr. MILLER. Will the gentleman yield?

Mr. MCCORMACK. Yes.

Mr. MILLER. I may say for the gentleman's information, that the statement Mr. Anfuso used, at least in its translation read in the press by me this morning, Mr. Khrushchev used the word with his intercontinental ballistic missile that he could "pinpoint."

Mr. MCCORMACK. He said that the other day, too.

Mr. MILLER. Do you think that is significant or do you think he is just whistling in the dark to keep his courage up?

General WHITE. I think there is some of both there. I think they have some capability or are rapidly getting it, but I question, from what we know, that it is anywhere near as effective as he says it is. However, the fact that he makes this statement, which appears as something new to me, probably has some significance that we must weigh very carefully.

Mr. MILLER. But he has been known in the past to use words to keep up the enthusiasm and confidence of his own people where they have not quite met up—where time has not been able to prove that.

General WHITE. We have been having a great debate on our own defenses here. I imagine some of it trickles through to the Soviet people and your thought may very well be a valid one, that he is speaking for home consumption, though I doubt if home consumption means very much in that country under their form of government.

The CHAIRMAN. He has been known to exaggerate, though, has he not?

General WHITE. He certainly has.

Mr. MILLER. Do you think recently in Quemoy, where we armed the Chinese Nationalists with some Sidewinders, that the Chinese Communist Air Force is finding very good reason to exaggerate after they met Sidewinders being launched from planes that were supposed to be less efficient than theirs.

General WHITE. I think the Chinese Communists and perhaps the Russians themselves received a considerable shock with the rapidity with which we reacted and with the efficiency of our forces that were there—and by "our forces" I am including the Chinese Nationalists.

Mr. MILLER. Of course their first reaction was that this was a dirty trick, that this was not clean pool, to use the Sidewinders—going beyond the real realm of war.

General WHITE. I think it is also fair to state, sir, that the Chinese Nationalists had a considerable margin of air victory without the Sidewinders. However, the Sidewinders were one of the most spectacular victories in air history. It was not only the Sidewinders that showed the Chinese Nationalists were superior to the Chinese Communist Air Force in that particular area.

The CHAIRMAN. The Chair wants to say this: He wants to proceed in the regular order which would be to recognize Mr. Fulton and then afterward we will throw open the meeting for general questions. The general is here for general questions and we want to proceed with the other witnesses; however, after recognizing Mr. Fulton, the Chair will throw the meeting open to general questions from any members of the committee.

Mr. FULTON. We want to welcome you, General, and we feel that you, as well as the Air Force, are doing an excellent and spectacular job in your field. We in America appreciate your good work.

General WHITE. Thank you, sir.

Mr. FULTON. I would like to yield at this time to Mr. Walter Riehlman of New York, who is in his second term of seniority in the House, who will handle the questions on this side.

The CHAIRMAN. Wait a minute, the Chair is going to have to recognize the members who question in a regular order. I don't think you can take away from the Chair the right to recognize the members who will question. The gentleman can yield for a question. That is all right. Mr. McCormack did. But as far as recognizing him, the Chair will have to proceed along that line.

Mr. FULTON. In this case I am requesting the Chair to recognize the Republicans in reverse order of seniority, starting with Mr. Riehlman.

The CHAIRMAN. Well, we have no objection at all. We will proceed.

Mr. FULTON. The questioning will start with Mr. Riehlman.

The CHAIRMAN. That will make for confusion.

Mr. FULTON. I have listed them in order for you here, one, two, three, four.

The CHAIRMAN. But if you start the Democrats at the top and the Republicans at the bottom, I think that is a type of discrimination. I do not like discrimination.

Mr. RIEHLMAN. Will the chairman recognize me for just a statement?

The CHAIRMAN. How is that?

Mr. RIEHLMAN. Will you recognize me for a statement.

The CHAIRMAN. We will throw the meeting open for a question. I will recognize the gentleman for a question.

Mr. RIEHLMAN. May I say to our distinguished chairman, this is not something that I have requested. I am sure Mr. Fulton would know that I, as a junior member just coming on the committee, would not request the opportunity to take over the minority side in questioning a witness this morning because I do not feel I am entirely qualified to do that. I think it is out of the goodness of his heart, because the members at this end are the last ones to have an opportunity to ask a question. This is only in the way of explanation.

The CHAIRMAN. If I may say to the gentleman: We had only one witness and he was on all day yesterday. If the members did not have an opportunity to ask questions of this witness, I do not know of any way to arrange it because he was on until after 4 o'clock yesterday afternoon.

Mr. RIEHLMAN. May I say to the distinguished chairman, that I had an opportunity to ask questions and I had no argument as to that.

The CHAIRMAN. It would be my purpose later on when we get into these hearings to rotate. If the committee wants to start in reverse order it is all right with me and the Chair will take the last place to ask questions, but I do think, after 1 day of hearings and practically only one witness, it is a little bit early to complain about the delay in permitting some of the members to ask questions.

Mr. RIEHLMAN. Would the chairman permit—I hope that you understood my statement, I was not complaining in the least. I just

said that that might have been in the mind of Mr. Fulton when he suggested that the men at the lower end have an opportunity to ask questions.

The CHAIRMAN. Mr. Fulton is a grand man, we will get along with him.

Mr. RIEHLMAN. Well, I would like to say to General White that I think he has made a very interesting and outstanding statement before this committee. You have outlined the interest that we as Americans and the Department of Defense have in this new field. You have alluded to one thing in which I am very much interested, on page 4 where you say there is no question in your mind that we have the ability to attain our goals in space nor that we will attain them provided we keep clearly in sight and remain constantly aware of the dangers and detours through which duplication, indecision, and diffusion can lead us. Now my question is this, General: Do you have any knowledge of where there is duplication and indecision and diffusion at this time with respect to this program?

General WHITE. I am not making reference there to any specific thing. I am pointing up that this is expensive business, not only in terms of dollars, but in terms of scientific talent and that we simply cannot afford to go down blind alleys knowingly or to have duplication or to drag our feet on this.

Mr. RIEHLMAN. I am sure that is what this committee would be primarily interested in. We want to wipe away any indecision, duplication or diffusion in this great field of activity. We want to see it move forward. I was interested in your reaction to that sentence, whether you could pinpoint any instances where there might be indecision, duplication, and diffusion.

General WHITE. No, sir; it is a new business and I just want to make sure we are on the right track and I point up those possibilities.

Mr. RIEHLMAN. I do not have any other questions.

The CHAIRMAN. Any further questions from either side?

Mr. MILLER. Mr. Chairman.

The CHAIRMAN. Mr. Miller.

Mr. MILLER. I would like to follow up the colloquy that you just had with my distinguished friend, Mr. Riehlman, in this matter of duplication, indecision, and diffusion. I think the money is important, the spending of money for duplications wrong, but to me the big thing is the waste of manpower, the waste of scientific know-how. We only have a limited amount of it, as much as we would like to think it is unlimited. Do you agree with that statement?

General WHITE. I certainly do, sir.

Mr. MILLER. Now then, has there been minor friction between the Air Force, the Army, and NASA, or is there a chance of that developing?

General WHITE. Well, I cannot cite any examples of minor friction.

Mr. MILLER. Well, major friction?

General WHITE. There are always differences of opinion on matters. Here again I am not citing any specific examples. To rule out the possibility of friction in the future would not be in accordance with human nature, but I feel that with the goals clearly set forth, with intelligent people exercising commonsense in furtherance of a really important and vital program, those things will be worked out.

I am confident we have the people who will manage this thing in the most efficient manner possible.

Mr. MILLER. We do not want to put a muzzle on anybody. That is the last thing we want to do in a scientific program where we have to go into a field as unknown as this. All people concerned with it have to speak out and maintain their position. But is the guideline sufficiently clear that one of the services is not going to go off on its own in the development of what it feels is a missile in its interest, whereas the overall good could be best measured by full cooperation with the other services?

General WHITE. I am perfectly certain, sir, that there will be no individual service interests carried out at the expense of the overall program.

Mr. MILLER. You know, General, some of us have felt from time to time that there has been this encroachment of one service on the other, and that it has not been in the best interests of national defense, but I feel that this program is altogether too big and too important to let that take place. Is the Air Force prepared to make its sacrifices for the good of the whole?

General WHITE. There is no question of that. I think a good example was the reorganization of the National Defense Department which had as one of its chief objectives the objectives you spoke of and I believe the Air Force was not compelled by any service in its support of the reorganization bill.

Mr. MILLER. You would not mind if I said I could get into an argument on that, but we will not bring that up now.

The CHAIRMAN. Any further questions?

Mr. ANFUSO. Will you yield to me for a question?

Mr. MILLER. Yes.

The CHAIRMAN. The Chair recognizes Mr. Anfuso.

Mr. ANFUSO. Following up my distinguished colleague from California, General White, in connection with those research and development matters that represent dual purposes in that they may be developed for peaceful purposes or for military purposes, do you believe these should be financed and managed by NASA jointly with the Defense Department?

General WHITE. Well, the law as presently written, whether the intent of Congress is being fully expressed or not, I can't say, but there is some latitude for interpretation in that matter. I feel that wherever there is a dual interest that people who will be in charge of these programs will be people of integrity and high motivation, and will carry out their duties with commonsense. I think that there will be no conflict. I think that the military where needed will participate in any of the programs where there is a military requirement.

On the other hand, a great many of these programs will be purely civilian, and I have no question that intelligent men with a single good purpose will work these things out smoothly.

Mr. MCCORMACK. I think it is only fair to say, Mr. Chairman, as to any of these witnesses, your high motives are thoroughly appreciated by all of us. You are just as dedicated Americans as anyone else and we respect you and we know that you are giving your life to the service of our country and that goes to you and to all men in the service, so the question of motives is never involved.

Mr. ANFUSO. I might add to what Mr. McCormack has said that I, as I am sure is true of every member of this committee, have the highest confidence in all of our departments and that working together, I sincerely believe, that we will catch up with the Russians. The important question comes up, which did come up yesterday, and that is whether we are planning enough, whether we are doing enough. For example, we are inclined to assume, and I think some of the experts are inclined to assume, that we have enough retaliatory power, that some of the statements which come out of the Russians are whistling in the dark.

I am inclined to go on the assumption that most of the things that they say are true, for security reasons. For example, it is true today that the Russians have a satellite up there which is doing the work which we are planning to put in a satellite in the next 2 years to accomplish, is that not a fact?

General WHITE. On that order.

Mr. ANFUSO. So that is not boastfulness on their part, they are actually doing it. On the question of budget, that question was raised yesterday, and reading some of the newspapers this morning I think that the public is rather alarmed by the statement that there is not anything more that we can do. Do you feel, General, that there is not anything more that we can do? Do you think that we have done all the planning possible? Do you think that we have allocated all of the money necessary to catch up with the Russians?

General WHITE. I have to be guided by what our scientists say be-because I am not a scientist myself.

Mr. ANFUSO. Could I have an answer to that question.

The CHAIRMAN. What was your answer to the question, General?

General WHITE. Well, as to the budgetary resources, I am not qualified to talk on it. That is something that is in NASA and I think I would be out of my field if I commented on it because I do not know what their budget is at the moment.

The CHAIRMAN. Mr. Sisk, do you have a question?

Mr. SISK. General White, just one question:

Do you feel that either moneywise, budgetwise, organizationalwise or any other way that we are overemphasizing the peaceful application and use of space as compared to its military value today?

General WHITE. I think that our national aim to dedicate space to peaceful purposes is a very fine one. I also believe, as with many other things, such as disarmament, there are practical difficulties to doing that.

Mr. SISK. Well, the practical side of it is what I wanted you to discuss, in your opinion.

General WHITE. I think that it is possible by treaty and by other international instruments to make such agreements. Whether the Russians would live up to them or not is anybody's guess. But until we have an iron-clad or as nearly iron-clad an agreement as we can make to this effect, I am sure that there are military applications to space and that we must be prepared to fulfill those requirements.

Mr. SISK. Well, do you feel that we are overemphasizing peaceful applications at the present time—and by "we" I am speaking of the United States—to the detriment of possible military use of space?

General WHITE. No, sir; I don't think we are overemphasizing.

Mr. SISK. Thank you very much.

The CHAIRMAN. Any further questions?

Mr. CHENOWETH. I would like to ask a question.

The CHAIRMAN. I yield to Mr. Chenoweth.

Mr. CHENOWETH. You say in the future the decisive weapons will be aerospace weapons. How do you correlate that to our long-range bomber which we have now, which we felt was our most potent weapon?

General WHITE. I defined aerospace as a combination of aircraft, missiles, and space vehicles. The balance among them will depend entirely upon technology. As we advance, manned bombers may reduce in number as ballistic missiles become more perfected. I can see how even ballistic missiles may phase down sometime in the future when military space vehicles become available. The military mix is varying constantly according to the latest technology. I don't think it is possible, or, at least, I can't look into the future and tell you exactly what the changes are going to be. But take aviation again as an analogy: When it first started out, we thought very little of it. The military had no conception of what airpower would be. Now, airpower is the cornerstone in our national defense, from my point of view at least. I think the division of resources will indicate the emphasis which is placed on the various systems.

Aviation, in our opinion, includes the natural extension into space because our thesis is that space is merely a contiguous and uninterrupted medium to the atmosphere. The same aspirations that we have always had in flying, to go higher, to go faster, and to stay up longer, apply, even as you go out of the atmosphere into space.

So, now to say what the mix will be, I cannot. But I am sure that evolution is taking place. I can visualize some breakthrough in which revolution in military forces could take place. For instance, if we developed a satellite that had a military use, and a very spectacular military use, it might make every other kind of vehicle obsolete overnight.

Mr. CHENOWETH. You don't foresee that military use or application of the satellite?

General WHITE. I do foresee it as being possible.

Mr. CHENOWETH. You haven't any practical demonstration of it yet?

General WHITE. We have not yet had any practical demonstration of it.

Mr. CHENOWETH. You think it will come, however?

General WHITE. I think quite possibly it could come.

The CHAIRMAN. The Chairman recognizes the gentleman from Iowa.

Mr. WOLF. I am Leonard Wolf from Iowa. I have become extremely interested in this question of military preparedness in the past few months. When you answered Mr. McCormack you agreed our main deterrent to aggression is massive retaliation.

I have visted a couple of military bases in which they frankly took me to different departments and showed me where the key men in these departments was about to leave the service. Outside income was too attractive to hold him. They frankly said they didn't have anyone prepared to take their place.

I would like to ask you, if our main deterrent is massive retaliation, can our defense system work at full strength at all times when we recognize this condition?

General WHITE. We do have personnel problems. However, they are vastly improved since the pay bill came into effect. Our reenlistment rate has gone up. Our retention of officers has gone up. There are many other things that are needed to make military life as attractive as civil life sometimes appears to our technicians.

We certainly have our troubles, but we are improving, and the situation in my opinion is highly satisfactory at the moment.

Now, you could talk to——

Mr. WOLF. Well, that is what worried me into this position. I have done a little research on this thing, and I find even in the Air Force your reenlistment rate is very low, and the expense of training these people is considerable. I was wondering if you might want to enlarge on this question.

Would it be more efficient to pay even a little more for these key people, in the hopes we could be more certain to keep them because the pay is still very low, I am sure you will agree, General.

General WHITE. I do agree, and it is exceedingly expensive to have to retrain people all of the time.

Yes, there are several things that I think can and ought to be done. We ought to pay these people—we have thousands of officers and men on alert. SAC maintains a 15-minute alert on the ground. These crews live near their aircraft so they can reach them in a matter of a couple of minutes from their sleeping quarters. They don't leave for several days while they are in those areas. I am sure you have visited them.

Mr. WOLF. Yes.

General WHITE. Those men deserve special consideration. One of the ways we have compensated them in the past is that SAC has had authority to make what they call spot promotions. If a crew is thoroughly qualified and have what they call a target assigned, meaning that they are fully qualified to take out a certain target, then every member of the crew is given a spot promotion.

If they fail in their next test, they are demoted. It has a terrific impact on attaining peak efficiency.

As the Air Force as a whole is growing older, these higher ranks are beginning to be filled up, but we have a limitation on the numbers of officers that we can have in each of those grades. Therefore the spot promotions for SAC are going to have to be phased out or I am going to have to say that SAC is a special breed of cat, and that they deserve special attention. I can't in truth say that, because while they are exceedingly important, there are people in the Air Defense Command on alert also. There are tactical command crews on alert, ready to go on a few hours' notice, as they did to Lebanon and to the Pacific. You try to equate between a SAC crew that is on alert, an attack F–100 pilot who flies nonstop all by himself across the oceans and it is pretty difficult to say this man deserves a promotion and that one doesn't.

So there is, in my opinion, a very serious need for a means to continue with spot promotions.

Now in the case of others, there should be some pay, in my opinion, for this alert status. We have people all over the Arctic in early-

warning sites who live up there in absolute isolation, a couple of hundred men, supplied the entire year by helicopter only. There are just a great many things like that which have an effect on the morale.

I would say the morale is high, but nevertheless when an attractive offer comes from industry, many people give in and go, and you can't blame them.

So there are things that can be done, and in my opinion, should be done.

Mr. WOLF. This is a tremendous question, this question of retaining the top technical people, I know.

General WHITE. It is one of our key problems, sir. But I think it is fair to say that it has improved.

Mr. WOLF. Yes, I think that is true. I hope it improves a devil of a lot more.

General WHITE. So do all of us.

Mr. WOLF. Thank you.

The CHAIRMAN. Now, any further questions?

Mr. ANFUSO. Just one question.

The CHAIRMAN. Mr. Anfuso.

Mr. ANFUSO. In line with the questions just asked by the gentleman from Iowa about personnel, Dr. Glennan said we are not working hard enough to train scientists. Do you agree with that?

General WHITE. Yes.

Mr. ANFUSO. Do you agree that the Air Force Academy at Denver——

Mr. CHENOWETH. Colorado Springs.

Mr. ANFUSO. Excuse me. Colorado Springs has done a lot in that regard?

General WHITE. Yes, I agree, but we haven't graduated our first class yet. That will be next spring.

The Air Force Academy is analogous to West Point and Annapolis. While it gives general cultural and scientific education, it is not a scientific school.

Mr. ANFUSO. Do you think a science academy is in order at this time?

General WHITE. I question that a national science academy is required. I think we have a great many civil institutions to which we can and do send our people. We have a great many officers and some enlisted men in scientific courses in many of our institutions throughout the country. Much more can be done in that respect.

Mr. ANFUSO. General, we have an awful lot of young men interested in science who don't have the means of entering any of our science institutes.

Don't you think if we had an academy similar to West Point, Annapolis, and also the Air Force Academy, dedicated strictly to science, that we could attract a lot of young men who would go into this science academy and in the future turn out to be great scientists?

General WHITE. That is one way to do it. There are other ways.

I think we can put more emphasis on science, but I think the emphasis should come lower down in the educational period. I think the problem is to get the grammar school and high school grade youngsters interested in the more severe disciplines. They are able to get credits now to graduate on what I would call the soft skills,

and it is there where we need to emphasize the scientific aspects, the mathematics, and all the rest of it, so they will be qualified.

The CHAIRMAN. General, we are planning special hearings on that subject later on. We have already talked with the staff about that.

Are there any further questions?

If not, let's get on with the witnesses, General.

We will call General Anderson, commander of the Air Research and Development Command.

You will be here with us for the rest of the hearing?

General WHITE. I will be here this morning, but I had not planned on being here this afternoon.

The CHAIRMAN. General Anderson, you are commander of the Air Research and Development Command. Where is your headquarters?

## STATEMENT OF LT. GEN. SAMUEL E. ANDERSON, COMMANDER, AIR RESEARCH AND DEVELOPMENT COMMAND, U.S. AIR FORCE

General ANDERSON. My headquarters is divided. A very large proportion of it is at Andrews Air Force Base, outside Washington. There is where I am located.

I also have a division of the headquarters at Dayton, Ohio. That division manages the weapons and missiles programs with the exception of ballistic missiles.

General Schriever's Ballistic Missiles Division, located at Englewood, Calif., is also a part of my headquarters. Its job is to manage the ballistic missile program.

The CHAIRMAN. Do you have a prepared statement, General?

General ANDERSON. Yes, sir.

The CHAIRMAN. Do you have copies of it available for the members of the committee?

General ANDERSON. No, sir; I do not.

The CHAIRMAN. Then will you proceed with your statement and we will listen intently.

General ANDERSON. My purpose, sir, is to explain the organization of ARDC and its capabilities.

The mission of ARDC is to maintain the qualitative superiority of Air Force weapons. It follows that ARDC is therefore a scientific and technical organization and it has experience and facilities able to support—and I emphasize "support"—the space programs of our Nation, both military and civil.

This command comprises about 10,000 military and civilian scientists and engineers, and they are backed up by about 35,000 technical aids and support personnel.

This command has 1,900 contracts for basic and applied research in effect, and these are scattered throughout 249 universities or other nonprofit organizations in the United States.

We also have over 3,600 research and development contracts scattered throughout 1,100 industrial concerns.

I just explained the location of the headquarters, so I will skip that portion of the prepared statement.

We also have 10 major installations to carry out our program of research, development, test, and evaluation.

One of these agencies is called the Office of Scientific Research, and is located here in Washington. It directs our entire program of basic research.

Then we have the Air Force Cambridge Research Center near Boston, Mass. It carries on research in the area of geophysics and electronics.

We have the Wright Air Development Center at Dayton, Ohio, that carries out work in many technical fields. These include materials, structures, airborne electronics, rocket propulsion, electrical propulsion, aeromedicine, and other fields essential to support flight both in and out of the earth's atmosphere.

The Rome Air Development Center, located near Rome, N.Y.. is engaged in the development of large ground electronic equipment for communications and for the control of flying vehicles.

The Arnold Engineering Center at Tullahoma, Tenn., provides a complex of wind tunnels essential to the study of propulsion and flight problems associated with both aerodynamic flight within the earth's atmosphere and propulsion and reentry problems associated with ballistic missile developments.

The Air Force Flight Test Center in California is the focal point of our aircraft flight test activities. It is located at Muroc Dry Lake in the Mojave Desert. The lake is about 5 miles long and about 13 miles wide, and it is firm enough to sustain the heaviest loads. It has been invaluable in the safe recovery of some of our aircraft and some of our test vehicles.

At this center we also have large rocket engine test facilities. One of the static test stands there, for instance, is capable of sustaining thrusts up to a million and a half pounds.

We have a Special Weapons Center at Albuquerque, N. Mex., in conjunction with the AEC facilities there in San Diego, and the purpose of this center is to marry all nuclear weapons to Air Force aircraft and guided missiles and to determine the most effective technique for their delivery on targets.

We have a proving ground center near Pensacola, Fla. This provides a well-instrumented range for the suitability testing of missiles and aircraft which are about ready to enter operational use.

We also have a Missile Development Center at Alamagordo, N. Mex., and it forms with the Army White Sands Proving Ground, just to the south of it, a missile test range which is about 100 miles long and about 40 miles wide.

This center tests comparatively short range missiles. Located there is also a 7-mile-long rocket sled track which is a facility for testing under high stress conditions many of the components of ballistic missles, in particular nose cones and guidance systems.

The Missile Test Center located at Patrick Air Force Base, Fla., is perhaps the best known of any of the centers of ARDC.

As you know, from Cape Canaveral, which is the missile launch site, the test range extends 5,500 nautical miles across the South Atlantic.

This center is supporting the test programs of the Army, Navy, ARPA, and NASA, as well as those of the Air Force.

ARDC is therefore an integrated operational organization for research, development, test, and evaluation; and we do undertake projects in support of the other Government organizations.

As ARPA and NASA have come into being, we have made these resources we have had available to them, and we have cooperated with them. In fact, I have directed unqualified support of these agencies, and in order to illustrate how ARDC works with ARPA and with NASA, I just wanted to mention one example of an order being performed for ARPA. This is for a high-energy, upper-stage vehicle.

For over 2 years prior to the formation of ARPA, ARDC, through a special projects office, have been developing a new type engine, aimed at an advanced weapons system. The techniques and some of the hardware were completed last year. When ARPA came into being, we briefed them on this program, and based upon the work we had already done, ARPA directed us to go ahead with the development of a high-energy, upper-stage vehicle, capable of putting greater weights in higher orbits. This work is being performed with very little change in our organization.

As of the first of this month, February 1, we have received a total of 25 ARPA orders. Some of these orders have several tasks under the one general order heading. The total value of these orders is $218,513,707. The Air Force has transferred to ARPA, at its inception, about $41,670,000. We are now performing six orders for NASA, with a present value of $25,501,000. The Air Force transferred to NASA $57,800,000.

I hope this discussion will bring out that the Air Force thinking and planning for military space developments has existed for several years.

The Air Force ballistic missile program, which got its present impetus in the summer of 1954, is the springboard from which our present capability derived.

The Air Force Research and Development Command is responsible for developing and testing the Atlas, the Titan, the Minuteman, and the Thor ballistic missiles. Their program is managed by the Ballistic Missile Division, but I would like to emphasize that located with the Ballistic Missile Division are major elements from two other Air Force commands. One is the Air Materiel Command's representatives there. These people, although located physically at Englewood, report directly to the commander of the Air Materiel Command, and they have the authority to speak for him on all ballistic missile matters.

Further, they do all of the contracting for ballistic missile development, testing, and procuring.

Similarly, the operating command, that is SAC, the command that will operate these missiles, is represented at Englewood by a special assistant for ballistic missile matters, and his purpose there is to insure that our development actions result in missiles which meet strategic planning requirements.

That is the end of my statement, Mr. Chairman.

The CHAIRMAN. Thank you very much, General.

I want to ask you a few questions.

We are happy to have you here.

Certainly, it is the first time you have been before this committee, which just began its hearings yesterday.

We have a lot to ask you, and we probably won't be able to do it today, because you cover such a wide field, with 3,600 contracts there

and 249 universities which are doing work for your command, 10 major installations you referred to, and then some incidental installations. You have a wide range of activity, and undoubtedly much to attend to.

I want to ask you, though, generally along this line; Do you consider a ballistic missile a space weapon?

General ANDERSON. Oh, yes, sir.

The CHAIRMAN. So if there was any question, you wouldn't need the word "aerospace," you could simply say "space weapon"?

General ANDERSON. That is a new word to me, too, Mr. Chairman.

The CHAIRMAN. Your command is taking the lead in developing the ballistic missile, and it was testified in the Senate hearings that by July 1959, at Vandenburg in California, we will have a wing—or is it a squadron—of ICBM's in operation?

Now, it is not my purpose to find out when you are going to have them in operation, but it is the purpose of this committee to find out what some of the qualities of the operation of those missiles are.

If I ask you something you don't care to answer in open sesison, just pass it by, and we can take it up later. Are the qualities of those missiles such that we can reach from here to Moscow with them?

General ANDERSON. Mr. Chairman, I would like to make two observations. The first is that General Schriever is here and is going to testify, and he is better qualified to answer the missile question than I; and the second is I don't think we should answer that question in open session, sir.

The CHAIRMAN. All right, we will pass it by and take it up in executive session with General Schriever.

May I ask you this: What progress is being made with the Atlas and Titan missiles?

If you can give an answer to that in open session——

General ANDERSON. The progress has been on schedule with the Atlas. I can say that. It is on schedule now.

With the Titan, we have had a little growing pains since they put the first missile on the stand. It is certainly to be expected, I think, in any new weapon as complicated as this. We do hope and expect to fire one before too long.

The CHAIRMAN. Before too long?

General ANDERSON. Yes, sir.

The CHAIRMAN. That is the Atlas, sir. What about the Titan?

General ANDERSON. It is the Titan I referred to.

The CHAIRMAN. Not the Atlas?

General ANDERSON. No; the Atlas is on schedule and doing very well.

The CHAIRMAN. What about the Snark? We have abandoned the Snark, haven't we?

General ANDERSON. No, sir; not entirely. We have procured or are procuring, rather, one Snark unit to be located in Maine, but we have abandoned plans, as far as I know, to procure any so-called advanced Snark weapons.

The CHAIRMAN. So there would be no further development of the Snark weapon?

General ANDERSON. We are not working on any at this time in ARDC.

The CHAIRMAN. What about the Regulus?

General ANDERSON. That is a Navy weapon. So I read in the papers—I can't testify to the fact—that it has been canceled.

The CHAIRMAN. You can't testify for the Navy on that?

General ANDERSON. That is right.

The CHAIRMAN. Mr. McCormack says is that an aerospace weapon?

General ANDERSON. I think so.

The CHAIRMAN. Let me ask you, then, Can you tell us in open session anything about the qualities of the Titan that would be used at least in one base, in Maine, I think you said?

General ANDERSON. The Titan?

The CHAIRMAN. Yes.

General ANDERSON. No; it was the Snark which I referred to as being based up North.

I would prefer, Mr. Chairman, to talk about the capabilities and qualities of these weapons in closed session, if I may.

The CHAIRMAN. All right. I think you are correct. But can I ask you this question, then? We are proceeding on the assumption that if Russia feels that she is able to destroy this country, she will proceed to do so, and therefore we want adequate protection. Can you tell us anything about the operational features of the Russian intercontinental ballistic missile?

General ANDERSON. I actually have no knowledge on that, sir, direct.

The size of the satellites that they have put into orbit which we know about would indicate to me that they have higher thrust engines than we have.

Beyond that, I simply don't know what the characteristics of their weapons are.

The CHAIRMAN. If they had the higher thrust engines, you would naturally assume they had the higher thrust?

General ANDERSON. Yes.

The CHAIRMAN. Would that mean additional range, too?

General ANDERSON. It could mean additional range, not necessarily, but it could mean that, of course.

The CHAIRMAN. Now, is their range as long as our range, 5,500 miles?

General ANDERSON. I really don't know. They manage to keep things pretty well hidden, Mr. Chairman, whereas ours are out in the open.

The CHAIRMAN. Let me ask you this question, then: Are you satisfied with the progress you are making on the missile program, in the Department of the Air Force?

General ANDERSON. Mr. Chairman, that tempts me. I am never satisfied with the progress. I think we are doing well, but we do have troubles, and I certainly keep after them, so I have to answer I am not satisfied; but I think we are doing well.

The CHAIRMAN. I recognize Mr. Fulton.

Mr. FULTON. General, we are glad to have you here. I would like to have you put in the record at this point a comment on the use of the TIR, the Technical Information Reports, distributing technical information among the various services, and then I would like to yield to Mr. Chenoweth, of Colorado, for a question.

(The requested information is as follows:)

Technical information obtained from innumerable sources is collated by the Armed Services Technical Information Agency (ASTIA). This agency provides a central service within the Department of Defense for the interchange of technical information consistent with effective security in order to promote progress and economy in research and development and to prevent unnecessary duplication of such services. ASTIA receives, stores, and disseminates to other agencies and contractors of the Department of Defense both classified and unclassified research and development information of a scientific and technical nature.

Technical information reports, including intelligence reports, are primarily used in the Air Research and Development Command to: (1) keep abreast of both the foreign and domestic state of the art in scientific and technological areas affecting the ARDC mission and, (2) search for technological breakthroughs in difficult or "blank wall" areas which U.S. technology has not yet penetrated.

Comprehensive utilization of technical information reports is encouraged, and such reports are made available on a need-to-know basis to military and civilian scientists, engineers, technicians and other specialists throughout the command, and civilian contractors holding U.S. Government commitments under the sponsorship of the Air Research and Development Command.

Mr. CHENOWETH. General, I would like to know something about your budget that covers all of these activities that you have mentioned here in detail. What is your overall budget?

General ANDERSON. The overall budget in the 600 area, which is the research and development area, for fiscal 1959 is—I think this is correct, and I know it is correct within $3 million—$753.8 million.

Mr. CHENOWETH. Seven hundred what?

General ANDERSON. $753.8 million.

Mr. CHENOWETH. What is your budget for 1960, the next fiscal year?

General ANDERSON. $750 million.

Mr. CHENOWETH. Practically the same.

General ANDERSON. The same level, yes, sir.

Mr. CHENOWETH. There has been some criticism over the fact that perhaps we are not making money available fast enough for these scientific research programs.

Would you say that that criticism is justified? Are you spending all of the money that you have for the scientists and personnel that you have? If you had more, could you use more money?

General ANDERSON. Naturally, I asked for more money than I got, but I am only looking at one segment of the total Air Force budget.

I think we have a good program with what we have, but we could use more, of course.

Mr. CHENOWETH. You are spending twice as much as NASA. I believe they told us $345 million yesterday, and yours is over $700 million.

Mr. FULTON. $385 million, currently, $400 million next year.

Mr. CHENOWETH. Not quite twice. What other agencies would be engaged in this, any others?

General ANDERSON. ARPA.

Mr. CHENOWETH. What would their budget be?

General ANDERSON. I don't know. I am interested in what they give us. They have given us $218 million since they came into being.

Mr. CHENOWETH. I was trying to arrive at some overall figure of what we are spending on this program. Could you give us some idea of that, General?

General ANDERSON. Yes, I can give you almost exact figures. If you add in the other money which is appropriated and goes to Air Materiel Command but is spent on our programs, in this year of 1959 it comes to $2,781,100,000.

Mr. CHENOWETH. $2,781,100,000?

General ANDERSON. Yes.

Mr. CHENOWETH. And next year?

General ANDERSON. $2,722,600,000 for fiscal 1960.

Mr. CHENOWETH. You are spending less money in 1960?

General ANDERSON. Yes.

Mr. CHENOWETH. Why?

General ANDERSON. We are getting money to do things from ARPA, and we expect to do things for NASA, so actually the money we will spend overall will be more than presently.

Mr. CHENOWETH. You are talking about the overall program, aren't you?

General ANDERSON. No, just ARDC's program.

Mr. CHENOWETH. Oh, I was trying to reach the total overall figure of all of the agencies, just how much we are going to spend next year on this program.

General ANDERSON. I could get that for you, Mr. Chenoweth, but I don't have it right here.

Mr. CHENOWETH. Would you want to venture a guess?

The CHAIRMAN. The record will be left open for his statement on that.

(The requested information is as follows:)

**The programed total Federal research and development expenditures for fiscal 1960 is $5.484 billion.**

Mr. CHENOWETH. Would that run four to five billion, would you say?

Mr. ANFUSO. About $7 billion.

General ANDERSON. I believe that would be high.

Mr. FULTON. It is between five and six.

The CHAIRMAN. The Chair will say this: I had our counsel look into that, and they gave me the figure of $5.5 billion.

Mr. FULTON. That is correct.

The CHAIRMAN. I think that is substantially correct.

Mr. CHENOWETH. Of that amount, your agency will spend approximately half?

General ANDERSON. Just about.

Mr. CHENOWETH. I think that is all, Mr. Chairman.

The CHAIRMAN. If there are no further questions, Mr. Fulton, Mr. McCormack.

Mr. MCCORMACK. General, you and I have talked over the telephone several times, and we have had very pleasant relationships over the telephone, and I am glad to see you personally. I was interested in asking one or two questions.

In your statement I was interested in the fact that at one of your installations you have a stand capable of withstanding a thrust of a million and a half pounds. Would you elaborate on this?

General ANDERSON. This is a stand for testing of large rocket engines. We have long had the project of developing a very high-thrust, single-chamber rocket engine.

That, of course, is in the NASA area, and they have now taken over that project. But the stand is there, and it will be capable of testing this single-chamber rocket engine when it is perfected.

Mr. McCormack. What is the thrust power of it now?

General Anderson. Right now I think probably the highest it has gone is 360,000 pounds of thrust.

Mr. McCormack. That is in practical operation?

General Anderson. Yes.

Mr. McCormack. How long would it take, in your opinion, to develop it to the capability of a million and a half-pound thrust?

General Anderson. Well, that is a function of how much money and effort NASA puts into it. I don't know—may I ask a question here?

Mr. McCormack. Surely.

(Discussion off the record.)

General Anderson. Our program, as I recall it, called for 3 years' development. It has been taken over, as I said, by NASA, and I don't know whether they will fund it more adequately than we were able to do or less adequately or what their program will be.

Mr. McCormack. Will you state for the record what you mean by the capability of containing the thrust; just give that in layman's language.

General Anderson. I could give you an answer on that, but General Schriever can give you a better one.

General Schriever. Captive testing is testing the entire missile on a stand in a held-down condition, where we attempt to simulate all of the conditions in flight as best we can. In other words, we get test after test in this fashion, which increases greatly our confidence in the reliability of our flight test program.

Now, we also test individual engines. This is not called captive testing. This is called static testing of the engines themselves.

The Chairman. Won't you have a seat, General? You can help us very much with this problem.

Mr. McCormack. Well, this is now under NASA?

General Anderson. Yes, sir.

Mr. McCormack. No further questions.

The Chairman. Any further questions?

Mr. King. I didn't get the distinction between captive testing and static testing.

General Schriever. Captive testing is testing the complete missile; in other words, the missile and all of its parts, held down on a stand.

Static testing is what we have always we referred to as testing an engine as such on a stand.

The Chairman. Any further questions?

Mr. Sisk.

Mr. Sisk. General Anderson, I have two or three questions with reference to your organizational setup, and as I understand it, you sit generally as what would almost be the chairman of a board of directors here. You have a number of establishments and many people involved in these various groups.

I am interested, of course, in the organizational setup, how you control your program, how you control and police contracts to see that we are getting the most bang out of each buck we spend, and so on.

Let me ask you this first: Is there someone else in your organization that will be before the committee that should discuss this, or are you the man that these questions should be directed to, General?

General ANDERSON. I am the man they should be directed to, because, as you say, I am more or less chairman of the board. I have a deputy commander for research. I have a deputy commander for weapons systems. I have a deputy commander for resources. I have a programer. I have General Schriever, who is a deputy commander and also commander of the Ballistic Missiles Division, and I have General Hougan, who is part of the headquarters, a deputy commander, but who also commands Detachment 1.

Now, this detachment is made up of what we call WSPO's, weapons systems project offices, and for every system we are developing there is a project office charged with monitoring day-to-day progress on that particular system. That is what Detachment 1 does.

I have one other deputy commander who is also the commander of the Air Defense Systems Integration Division of my headquarters. This man's job is to manage the integration of all of the components of the Air Force part of the Air Defense system of the United States and see that they fit, that at least our part of it will work when and if it has to.

General Davis, the deputy for research, is here. I think if you are interested in how we manage the research portion of the work, he could best answer that.

Mr. SISK. Now, to go a little further, General Anderson, is your work all contracted out as far as the actual work, itself—that is, the research and development of specific instruments or specific pieces of hardware—and then you have specific groups who supervise and watch and police that operation. Is that true, or do you do inhouse research and development?

Let me ask you this, General Anderson, to pin this down quickly, because I realize we must move along. But let's take, for example, the development of the nose cone of the Thor.

Now, in the development of that nose cone, who did the work; where was that done?

General SCHRIEVER. That work was done in industry under our overall supervision in terms of setting general specifications. But General Electric specifically is the developer of the nose cone for the Thor.

Mr. SISK. They furnished the manpower?

General SCHRIEVER. That is right.

Mr. SISK. And the management that went into that was handled from where?

General SCHRIEVER. Well, GE provided the technical management for the development of the nose cone, and it was under our rather detailed supervision from the Ballistic Missile Division.

We also furnished a great deal of the test facilities, which are governmental test facilities, such as those used for the sled tests that were conducted at Inyokern. These things were developed by the Air Force, and so it has been a team effort. But GE is the company responsible for the development of the nose cone.

Mr. SISK. Let me ask you this. Frankly, what I am attempting to do here, General, is to compare to some extent the type of manage-

ment operation which you handle as compared to the arsenal-type operation.

Now, let's be frank. I am sure you know what I am getting at. And I am not critical of your type or the other type. But I think the taxpayers are entitled to some answers as to the cost of the development of these things.

What was the total cost, finally, as to the development of the nose cone of the Thor? What was the total cost in developing it to its present position? Can you give me that figure?

General SCHRIEVER. I can't give it to you off the top of my head. I can furnish you that figure.

Mr. SISK. There have been totals tossed around in public, as I am sure you are familiar, on the cost of developing that nose cone. I was curious to verify those figures with you gentlemen here today, because I would assume that those were figures that you would have at hand.

The CHAIRMAN. Will you furnish the figures, General, for the record?

General SCHRIEVER. Yes, sir.

(The requested information is as follows:)

**The Thor nose cone development program resulted from intensive nose cone development program at General Electric Co. for the Atlas missile. Inasmuch as both missiles utilized the same nose cone, there is no way of proportioning development costs between the two missiles. Specific development application for this nose cone development program peculiar to the Thor missile cost $38.9 million.**

General SCHRIEVER. I might also say that same nose cone also was used on the Atlas. It was used for both the Atlas and Thor missiles.

Mr. SISK. I might say I have been told that the cost of the development of that nose cone was approximately $300 million. I was curious to know if that is somewhere generally correct.

General SCHRIEVER. I can categorically say it is not correct.

Mr. SISK. It would be substantially less or substantially more?

General SCHRIEVER. Substantially less.

Mr. SISK. Those are questions, Mr. Chairman, that I don't think I will take up further time with. Later on I am interested in getting into some of the operational problems that we are confronted with in their type of management program, because I think it is something that the taxpayers of the country are entitled to know.

The CHAIRMAN. The gentleman from New York.

Mr. ANFUSO. I have just two short questions of General Anderson. I understood you to say, General Anderson, that you asked more money for your program. I gather by that statement that if you had gotten more money, you could have used it.

General ANDERSON. Yes, sir.

Mr. ANFUSO. Did you have to curtail any of your programing as a result?

General ANDERSON. Yes. We have established, particularly in the research area, projects in order of priority, and some of the lower priorities in the research area fell out. In the systems area we, in some instances, are going a little slower than we would like to.

Mr. ANFUSO. You could very well have used that money?

General ANDERSON. Oh, yes.

Mr. ANFUSO. May I ask how much in addition you asked?

General ANDERSON. This year, fiscal year 1959, I asked for $1,220.9 million.

Mr. ANFUSO. That was in addition?

General ANDERSON. No, sir; total.

Mr. ANFUSO. What was the difference? What was the amount cut?

General ANDERSON. We actually are getting, in the 600 area now, $753.8 million.

Mr. ANFUSO. That is a cut of $500 million or $400 million.

General ANDERSON. When my request reached the Air Force, they already had guidelines from the Department of Defense as to what figures they could ask for, so it was cut.

Mr. ANFUSO. Just one more question, Mr. Chairman, and then I am through: Do you think, Mr. Chairman, we could have, either at a public session or in private session later on, the comparative strength of Russia or the comparative knowledge of Russia in this research program?

The CHAIRMAN. Of course a great deal of that will be in executive session. But we already have that planned.

Mr. ANFUSO. Thank you, sir.

The CHAIRMAN. I can say to the gentlemen of the committee, we are going to have these hearings straight through as long as we can.

Now, when we begin to call the members for the third time to come to a meeting, we will slow up the hearings.

Mr. HECHLER. I would like to refer back to the statement of General White that "it is often difficult to separate basic scientific research from military potential"and that "it is our thought in the Air Force that there is at this point in time little if anything in the area of basic space research, which may not have some degree of military application." General White further stated that "extreme caution must be exercised in areas wherein basic research might be mistakenly separated from urgent military requirements to the detriment of those military requirements."

I wonder if you or General White would draw the conclusion from this statement, or if we should draw the conclusion, that there are some aspects of basic scientific research that should be under Air Force control?

General ANDERSON. Draw the conclusion that——

Mr. HECHLER. Should we draw the conclusion or inference from this statement that there are some aspects of basic research that should be under Air Force control so they will be tied in more directly with military requirements?

General ANDERSON. My comment to that, sir, is that there are many aspects of basic research that are under Air Force control.

Mr. HECHLER. Should we draw the conclusion that the Air Force is handicapped by lack of control in any respect?

General ANDERSON. No, sir; I don't think you should draw that conclusion.

Mr. HECHLER. Thank you.

The CHAIRMAN. Mr. Roush?

Mr. ROUSH. I am Ed Roush from the State of Indiana, General. I would like to go back to the question raised by my colleague from New York.

Would you say that it is a fair assumption to state that our scientific program is behind our development and production potential? In other words, General, is it in our scientific program that we are slowing up? Is that the reason we are not able to catch Russia any faster?

General ANDERSON. No, sir.

Mr. ROUSH. I gather if we used more money for research, it would have enabled us to catch Russia faster if we were able to enlarge on our scientific research program.

General ANDERSON. That doesn't necessarily follow. Let's take our materials area, where we have both to develop new materials and also new ways of handling materials in order to develop some of the materials which will withstand high temperatures.

For example, I have been around looking at the development of some stainless steel honeycomb structures, and you find one place we were working on bonding these by brazing and in others bonding by welding. That is the kind of thing we would spend money on. That is just one example of very many.

Mr. ROUSH. That is in the research field?

General ANDERSON. Well, it is technical development. We have basic research and applied research. It is basic when we don't have a particular application in mind. It is applied when we have a particular application in mind. This would be applied research, because we certainly have in mind an application for this kind of stainless steel honeycomb construction.

Mr. ROUSH. Thank you, General.

The CHAIRMAN. Any further questions?

If not, thank you very much, General.

You will be with us here? You are not leaving immediately, are you?

General ANDERSON. No, sir; I will be here.

The CHAIRMAN. As we hear General Schriever, if you could be here available, we might have to call on you for some of these questions.

General ANDERSON. I will be here.

The CHAIRMAN. You made an excellent witness. We are intensely interested in what you have to say.

General ANDERSON. Thank you, Mr. Chairman.

The CHAIRMAN. We appreciate your comments.

General Schriever, do you have a prepared statement? I want to say we have known General Schriever a long time. He has done an excellent job in the Air Force, and I have heard him testify repeatedly, and I think he is a brilliant officer. We are happy to have you.

Mr. MILLER. Mr. Chairman, before we get into this, could we establish this: Should witnesses come prepared with statements sufficient for the members of the committee?

Mr. ANFUSO. I should think so, Mr. Chairman.

The CHAIRMAN. Our rules normally require that the statements be presented 10 days before the session at which they are going to be used. We haven't enforced that because the rules were adopted less than 10 days ago.

We are satisfied these gentlement from the Air Force will give us the benefit of their mature judgment.

Mr. MILLER. At other committees their aids brought up the statements and distributed them to the committee. I don't see why that

can't be done here. It is very hard to follow some of these things. I don't criticize these people, but a man knows 6 hours in advance what he is going to say, and they can certainly have them mimeographed.

The CHAIRMAN. The gentleman from California has followed me from the Armed Services Committee, and there they do pursue that sort of practice.

General Schriever, if you have a written statement, I know that the members of the committee would like very much to have a copy of that statement to look over at their leisure.

The same reference would apply to General Anderson's statement, if you could have them mimeographed, either the Air Force could attend to that or the committee——

Mr. MILLER. General White's statement was mimeographed. I don't see why the others weren't mimeographed.

The CHAIRMAN. That would apply to you and General Anderson. I know the committee would like to look at these statements at their leisure. It would be a very great help to us.

## STATEMENT OF MAJ. GEN. BERNARD A. SCHRIEVER, COMMANDER, BALLISTIC MISSILE COMMAND, U.S. AIR FORCE

General SCHRIEVER. Mr. Chairman, I will be very happy to do this. I was asked to come in and give a very brief presentation on our ballistic missile program, and I had not prepared a statement. I had prepared a few notes, which I will, I think, follow and cover in what I have to say.

The CHAIRMAN. I understand you expected a large part of your testimony to be in executive session.

General SCHRIEVER. It was intended, as I understood it, to be a presentation, a briefing, regarding the status of our program.

Mr. FULTON. May I join with the chairman in welcoming General Schriever? We think you are a fine officer, who has done an excellent job.

General SCHRIEVER. Thank you. I am happy to be before the committee again.

If I might take a few minutes to cover what I have to say before the questions, I think this might answer a few questions.

First of all, my responsibility under General Anderson is as commander of the Air Force Ballistic Missile Division. We manage the development of all of the Air Force ballistic missiles, plus a certain amount of space work, which we do under the auspices and supervision of both ARPA and NASA.

I would like to cover briefly a description of the status of our ballistic missile program. I would also like to give you some idea or indication of how the ballistic missile program resources contribute and are available to this country for a space program, and then an idea of the potential of some of these resources, looking a little bit into the future.

I think it is pertinent to bring out one thing concerning certain features of our organization. General Anderson covered one aspect when he said we had three major commands represented in one physical location—the Air Research and Development Command, the Air Materiel Command, and the Strategic Air Command.

This is a rather unique organization as far as management goes. There are certain other features which have been our guidelines since the beginning of our program on an accelerated basis back in 1954. These have provided a carefully planned program to create a revolution in technology after a late start.

Now, Dr. Bradbury, who is a member of the original committee—the Strategic Missiles Evaluation Committee—which made recommendations to the Air Force to accelerate its ballistic missile program, stated in those days that we were undertaking a program of great complexity, even more complex than the atomic weapon program, or Manhattan project, during World War II. Secondly, the committee recommended that we design our missile systems to attain the greatest capability in the shortest period of time. In other words, our aim was to get an operational capability in the shortest period of time.

Now, we have been funded adequately for our development program since the very beginning, that is, back in 1954, and we have been given the necessary national priorities. There has been established in my organization authority sufficient to carry out the program, and we have carried it out aggressively. We haven't been timid and we haven't been frightened by an occasional failure. These we expect to have in any development program.

I might say in terms of progress against time that the Atlas shot—Project Score—which was the orbiting Atlas, happened just 4 years after we really laid down the foundation for that program.

On the Thor program, which is the intermediate-range ballistic missile, we fired the first operational version from operational equipment at Vandenberg Air Force Base just a week less than 3 years after we laid the program down.

So I think that it is fair to say that we have been pursuing these programs very aggressively.

Let me just take a few moments now to describe the four ballistic missile programs that we have.

This is the Atlas [indicating], which is the first ICBM program undertaken. We have had 19 flight tests of the Atlas. More than half of these have been completely successful, and from most of the others we have received very valuable development information. We have had a full-range demonstration flight, which occurred in late November, and of course the satellite flight I just mentioned.

The CHAIRMAN. What do you call full range, General?

General SCHRIEVER. 5,500 miles was our objective for this particular missile, 5,500 nautical miles. We expect to have the beginnings of an Atlas operational capability before, or rather around, the middle of this year, June or July.

The Titan program is just beginning its flight test phase. We have had several technical difficulties at Patrick. These always occur during the initial phases of a flight test program. I do not have a model of the Titan here because it is still classified, but it is a two-stage system. We expect to get our flight test program underway almost immediately.

The CHAIRMAN. What is your capability there and range?

General SCHRIEVER. This is also a 5,500-mile missile. However, it is a missile that has greater growth potential. It started about 1 year

later as a competitive and also a parallel program to theAtlas. Both of these missiles, incidentally, have considerable growth potential, both for increased range and for increased payload capacity. This, of course, is also a very important factor as far as space work is concerned.

The CHAIRMAN. One of the members asked me to ask you this question: Do they parallel, or why do you have both an Atlas and Titan program?

General SCHRIEVER. I would rather cover that in executive session this afternoon. I would be glad to do that, but you do have to go into some detail.

The Thor program, which is this missile [indicating], is a single stage, single-engine weapon. I might say that this particular engine [indicating], which has 150,000 pounds of thrust, stems from this booster engine for the Atlas. In other words, they are essentially exactly the same components put together in a slightly different way from a plumbing standpoint. So that we have a single engine with the Thor. This is designed for 1,500-mile range. The Thor is being deployed to the United Kingdom now, and we are in the process of progressively turning the First Squadron over to the RAF as the checkout and installation of the First Squadron is completed.

Mr. MCDONOUGH. That one is in multiple production at the present time?

General SCHRIEVER. It is in production. I do not know just what you mean by multiple.

Mr. MCDONOUGH. It has passed experimental stage and it is now in practical operation.

General SCHRIEVER. It has passed experimental stage or development stage in terms of proving out its performance characteristics. We continue our test program for some time to improve reliability. Both our test vehicles and our operational missiles do come from the same production line.

The CHAIRMAN. How many of those do you have? Is that classified?

General SCHRIEVER. That is classified, yes. I can tell you how many we have launched. We have launched 32 Thors to date.

Mr. MCDONOUGH. Where are those launched?

General SCHRIEVER. All except one have been launched at Cape Canaveral, but we are now starting our training launches from Vandenberg Air Force Base in California. That is where we are doing all of our crew training and unit training, both for the IRBM and the ICBM.

Mr. FULTON. And those missiles have reached operational level. How many of them have been successful, what percentage?

General SCHRIEVER. We have only fired one in the truly operational countdown, and that was a highly successful flight, and I might say that the missile is designed for a 15-minute countdown. You hear about these long countdowns at Cape Canaveral, which is true, but those test missiles are loaded down with instrumentation at Cape Canaveral. The operational version does not have that in it. All of the operational equipment was designed to be automatic for the countdown. The first missile fired at Vandenberg went through a 19-minute countdown. We were 4 minutes over our ultimate ob-

jective of launching the missile in 15 minutes, and were highly pleased with that performance. We have equipment at Sacramento on which we are running through countdowns daily, and we have had a high number of successive countdowns right down to the point of pushing the launch button which have been right in the 15 to 17 or 18-minute region. So we feel that we are getting a high degree of reliability in the operational equipment.

The CHAIRMAN. Have you finished your statement, General?

General SCHRIEVER. No, I have not finished my statement.

The CHAIRMAN. Suppose you finish your statement and then we will proceed to questions.

General SCHRIEVER. I would like to go into what we consider a second generation program, the Minuteman, which is a solid propellant ICBM. This particular missile has some very outstanding advantages over the first generation in that it will be simpler, easier to maintain and operate and it will also have an inherent capability to be mobile. We are studying a mobile concept for that particular missile now, in addition to hardening and dispersion. One other thing I know all of you and our taxpayers will be happy about: We consider the Minuteman to be an economic breakthrough in that, at least for the first time since the end of World War II, it looks as though a weapons system instead of being more costly will be considerably less costly than its predecessor. So the Minuteman looks to us to be an extremely promising development. I want to stress, however, that it is a development program. Its operational readiness date is not competitive time-wise to the missiles that you see here.

Now I would like to say just a few words about the foundation which the ballistic missile program has provided for space development. I said sometime ago, and it still stands, that about 90 percent of the resources required during the next 5 to 7 years for space work will come from the ballistic missile base. Just as an example: The Pioneer shots (the Air Force and Army moon shots) used the Thor and the Jupiter as the booster. The Atlas performed the satellite orbit I mentioned earlier. The Thor is the basic booster for the Discoverer series of shots which are scheduled from Vandenberg Air Force Base and which are imminent. The Atlas will be the booster for the Sentry. In addition, almost all the deep space probes (the radiation shots, the navigation shots, and things of that nature) will use the hardware from the ballistic missile programs, not only the hardware but also the launch facilities. I think it is fair to say that the Nation is fortunate that we did start an all-out ballistic missile program back in 1954 because it has given us a very good base for proceeding with an aggressive space program. As a measure of these resources, just in the Air Force ballistic missile program alone, we have put in more than a half billion dollars in new resources. These include research and development, test, and industrial facilities nonexistent before the past 4 years. We have established a very large base of experience in this country, both in Government and in industry. It is a very large program. Our ballistic missile program today exceeds $1 billion a year in terms of total effort measured in dollars. I think, therefore, that a very aggressive program in space is possible, and I think that we will be seeing a great deal accomplished during the next few years. And it will stem largely from the resources that

have been provided by the ballistic missile programs during the past 4 years. This is all that I need to say in terms of a presentation. I will be glad to answer any questions.

The CHAIRMAN. General, I want to ask you two or three questions. In reference to the Minuteman program, what is your target date for an operational Minuteman?

General SCHRIEVER. Mr. Chairman, that is classified, of course, but I would be very happy to give you that this afternoon and show how all of these missiles fit together in terms of a total program.

The CHAIRMAN. Well, let me ask you this: My mind seems to be dwelling on classified questions but in reference to your program now, do we have missiles that will carry from here to Moscow accurately?

General SCHRIEVER. We do not have an operational capability today, no, sir.

The CHAIRMAN. Do the Russians have such a capability in the reverse order?

General SCHRIEVER. I wish I knew. I really can't say, sir.

The CHAIRMAN. Well, you do not know that the Russians do.

General SCHRIEVER. I do not know that they do, and I do not know that they do not.

The CHAIRMAN. When will Vandenberg be in operation?

General SCHRIEVER. Well, it is in operation now for training purposes and for the Discoverer launches that I mentioned. From an operational standpoint it has a dual mission; it actually has a triple mission.

There is certain development work to be done there, training work, and then operational capability. Our target date for a start, that is our initial operational capability, is in July of this year.

The CHAIRMAN. Vandenberg is the base from which you are operating your program for return of the ballistic missile into the atmosphere. Is that not correct?

General SCHRIEVER. The Discoverer program will be launched from there, sir. If you are talking about ballistic missile and reentry tests——

The CHAIRMAN. Reentry.

General SCHRIEVER. Those have all been conducted from Cape Canaveral.

The CHAIRMAN. They have?

General SCHRIEVER. Yes.

The CHAIRMAN. I thought I saw something in the paper with reference to the reentry test being out over the Pacific.

General SCHRIEVER. We have some recovery tests in connection with the Discoverer program. We are carrying out that program under the supervision of ARPA.

The CHAIRMAN. That is different from the reentry test?

General SCHRIEVER. Yes, sir.

The CHAIRMAN. Is there anything you can tell us in open session with reference to the recovery tests that you are making?

General SCHRIEVER. Well, the recovery tests are designed to—well, as Mr. Johnson pointed out in his press conference recently, we have several animal shots and of course, we have to bring them in a vehicle at a much lower deceleration than the reentry of a nose cone. We are attempting to develop techniques for recovering the vehicles. You

want to recover each of these, which necessitates equipment to let us know where it is, and actually give it signals to start it down from orbit. These satellites have many applications, and certainly the results of these tests will be very helpful to the man-in-space program, for example.

The CHAIRMAN. Well, they will depend upon your reentry tests, too, will they not?

General SCHRIEVER. Yes, sir. Much that we have learned in our reentry tests is directly applicable to our recovery program.

The CHAIRMAN. Well, your progress is dependent upon the progress of the reentry tests also.

General SCHRIEVER. Not entirely, sir, but again I would say that much of the data, both from flight tests, experimental tests, and wind tunnels, is very useful to the recovery program.

The CHAIRMAN. What is the pleasure of the committee? It is 5 after 12 now. Could you gentlemen be here this afternoon?

General SCHRIEVER. Well, I am scheduled to be here, yes.

The CHAIRMAN. We will run for 5 more minutes and then we will adjourn until 2:30. I say that because we have an executive session this afternoon and it will probably be a lengthy session. We cannot hope to finish this morning, so we will run for 5 more minutes. I will recognize the gentleman from California, Mr. McDonough.

Mr. MCDONOUGH. General, will you give the committee the primary lesson in the purpose of a countdown and what does 1, 2, 3, and 4 mean?

General SCHRIEVER. It means seconds before missile launch, and when we get down to where we start counting everybody gets real nervous. Actually during countdowns we are checking out everything in the missile which has to operate properly. Countdowns at Cape Canaveral are all personally conducted. The operational countdowns are all done automatically with electronic equipment which just checks in a second the job which takes minutes to do in a manual way. Of course, we have a tremendous amount of instrumentation. We measure pressure, temperatures, vibration, that sort of thing. These missiles are costly and we try to get the maximum amount of information we possibly can from each of them. We have many channels of telemetry on these missiles. It just takes a long time on a research and development countdown to get the missile off and be sure everything is right when you get it off. Of course, the fueling and so forth is all performed during a countdown. I might say that in the operational countdown, the short one I mentioned, the missile starts out completely dry. It is not loaded with fuel. The countdown includes actual fueling and——

Mr. MCDONOUGH. One to two is not 1 second.

General SCHRIEVER. No, sir; when you go down you go 10, 9, 8, 7, 6, and so on, and engine ignition occurs when you reach zero. You see, the flight time, the engine burning time, on these missiles is relatively short and we monitor it closely.

Mr. MILLER. But the countdown is the time you prepare the missile for launching in, and that may take an hour or 6 hours or 15 minutes; is that correct?

General SCHRIEVER. Yes. Normally our countdowns during research and development are a matter of several hours.

Mr. MILLER. If you decide you are going to fire a missile at 7 o'clock in the morning, you start checking it at 4 o'clock in the morning, but it does not mean the actual 10 seconds before you fire it?

General SCHRIEVER. No, sir. We have a book so thick [indicating] that we go through during an R. & D. countdown, and as each page is turned for each step down the line there is a check made.

Mr. MILLER. I assume the term comes from the fact that you generally start in 10 or 20 seconds before you actually fire and you count down by seconds and so you apply that to the preparation of the mission.

General SCHRIEVER. Probably so. That is the dramatic aspect of it.

Mr. MCDONOUGH. Well, if you were engaged in warfare you would not take all of this time to prepare, would you?

General SCHRIEVER. No, sir, that is why I was telling you that with the operational equipment—the demonstration flight that we made with the Thor at Vandenberg—we were extremely pleased, because with our 15-minute goal we made it in just over 19 minutes on the very first actual firing.

Mr. MILLER. May I ask this: Is that with the missile in place on its stand?

General SCHRIEVER. The missile is lying there inert. All of the equipment is designed to operate automatically but the missile is not fueled, nothing is operating on the missile when you start and 15 minutes later it is off.

Mr. MILLER. But your fuel trucks and all that are in position before that 15 minutes?

General SCHRIEVER. Well, we do not operate with fuel trucks. It would take you hours to get a missile off it you had fuel trucks. We put fuel and liquid oxygen into these missiles under very high pressure. It is blown in.

Mr. MILLER. The containers that it is brought up in must be brought up.

General SCHRIEVER. The fuel and liquid oxygen is in place.

Mr. MILLER. You can erect the missile, though, get it ready for firing in 15 minutes.

General SCHRIEVER. We have not quite made 15 minutes yet, but we are getting close.

Mr. MILLER. Well, that is your target.

Mr. MCDONOUGH. General, can you inform us as to how close we are to using this type of defense and finding it unnecessary to use SAC as a defense?

General SCHRIEVER. These are SAC weapons.

Mr. MCDONOUGH. Then they are supplementary to SAC. We still retain SAC with these.

General SCHRIEVER. Well, SAC is operating Vandenberg Air Force Base, for example. All of the ICBM bases that are being built in this country are under the Strategic Air Command.

The CHAIRMAN. This is a basic part of SAC, is it not?

General SCHRIEVER. Yes.

Mr. FULTON. It is one of SAC's weapons systems?

General SCHRIEVER. Yes. As General White pointed out, we depend upon our bomber forces now, but we are beginning to supplement them in the very near future with this type of weapons system.

It performs a strategic mission, and in time the balance will probably go over to the missile rather than the manned bomber. I do not know when that time will be, but for the foreseeable future we will have a mixed force.

Mr. McDonough. What has been your most difficult problem to overcome, guidance or propulsion?

General Schriever. Well, theoretically at first our most difficult problem was the reentry, but our tests have proven that that was not quite as difficult as we had thought it would be. We simply had not operated in the high velocity regions encountered during reentry of an ICBM nose cone. Actually I would say if I had to pick one single system that has been the most difficult, it has been propulsion. Not in the sense of getting the performance, but rather in the sense of getting the degree of reliability that we want. Because this is a system that operates on very narrow tolerances, and has a lot of plumbing, valves, and so forth, many little things can go wrong, and it usually is a little thing that goes wrong.

Mr. McDonough. Well, what accuracy have you established as far as target hitting is concerned?

General Schriever. Well, this is also classified. I will be glad to tell you that this afternoon.

Mr. McDonough. Well, maybe you can answer it this way: Has your propulsion or your guidance been your biggest difficulty in hitting the target?

General Schriever. Well, if your propulsion fails in any way, of course you do not hit the target. Our guidance I might say has performed very well. As a matter of fact, we have attained our goals in our guidance.

Mr. McDonough. We are talking about a 1,500-mile missile now, are we not?

General Schriever. We are talking about both.

Mr. McDonough. And you spoke about the maixmum trajectory of the Atlas at 5,500 miles.

General Schriever. 5,500 miles is the range.

Mr. McDonough. How accurate were your shots on that? Is that classified also?

General Schriever. Yes, sir.

The Chairman. Gentlemen, we have continued in session 10 minutes. If there is no objection, it seems to me the best thing to do would be to adjourn until 2:30. We have two or three members right now who want to ask questions, Mr. Karth, and Mr. Osmers. They will be the first ones to be recognized at 2:30.

Mr. Fulton. Could I finish with something as to Mr. McDonough's comment? Actually it is "Four, three, two, one, and having been at Cape Canaveral it is four, three, two, one, whee," or "Four, three, two, one, damn," is it not?

General Schriever. Just about that.

The Chairman. 2:30.

(Whereupon, at 12:15 p.m., the committee recessed, to reconvene at 2:30 p.m., the same day.)

AFTERNOON SESSION

The committee met at 2:30 p.m., in room 219, Old House Office Building, Hon. Overton Brooks (chairman) presiding.

The CHAIRMAN. The committee will please come to order. Now, we have a good deal of testimony yet to be heard. In fact, I have just been reminded by one of our staff that Mr. Allen F. Donovan, vice president and director of the Astrovehicles Laboratories, Space Technology Laboratories, Inc., Los Angeles, Calif., is here and he has come a long way to be heard and has a story that has not been told before. I know the committee will be very anxious to hear him this afternoon.

I mention that to you so that we can get along as rapidly as possible with our testimony.

When we closed at noon, General Schriever was testifying. Would you have a seat, sir, where you were today at noon and make yourself comfortable. I promised at that time to recognize two members of the committee to be heard. Are either one of them here?

Mr. KARTH. Mr. Chairman.

The CHAIRMAN. The Chair will recognize Mr. Karth at this time.

Mr. KARTH. General Schriever, my name is Joe Karth, and I am from Minnesota's Fourth District. I had one question and it is in line with the chairman's question of you earlier today. I was quite interested when he asked you whether or not you knew if Russia had an intercontinental ballistic missile that they could target into the United States from Moscow. You said you did not know that they had one or you did not know that they did not have one.

My question now is: Do you have any information that leads you to believe that they might have one? You used the word "know," in a positive sense.

General SCHRIEVER. This would be purely speculation.

Mr. KARTH. Would you give me your opinion?

General SCHRIEVER. My opinion based on what I do know is that they do not have an operational missile.

Mr. KARTH. Then I understood you to say this morning, and perhaps I was in error——

General SCHRIEVER. Well, let me clarify or qualify what I said. I said from what I do know I do not think that they do. What I am really trying to get across is that I do not know that we know everything they are doing. We have an open curtain here in the United States. They know exactly what we are doing. I just do not think that our information is adequate enough for us to say positively that they do or do not have an operational missile.

Mr. KARTH. Well, I am not asking you whether you can say it positively. I understand that you cannot, sir, and certainly I appreciate that viewpoint. I am just asking whether or not you have any information which leads you to believe that they might have an ICBM that could be targeted into the United States from Moscow.

General SCHRIEVER. They could have, yes.

Mr. KARTH. Thank you.

The CHAIRMAN. I might say to the gentlemen that there is an article in today's paper, which I have just read, in which the Secretary of Defense of Russia is quoted from Moscow as saying that Russia is ahead of the United States in all phases of the ballistic missile program and that, as a result, the shores of the United States are highly vulnerable.

Would you want to comment on that, General?

General SCHRIEVER. Well, I have not had a chance to really read the article. I would not want to comment on it specifically. I think this would be something that would also have to be covered in the closed session because it does involve intelligence information which I do not think we can talk about here in open session.

The CHAIRMAN. Mr. Fulton, do you have a question?

Mr. FULTON. Yes, I do. I would like to comment on this particular angle. As a matter of fact, General, we have many kinds of weapons systems of which the ICBM is simply one; is that not right?

General SCHRIEVER. That is correct.

Mr. FULTON. So that in the Strategic Air Command, SAC, of the weapons within its system, we have placed greater reliance on other weapons systems than ICBM because ours have not yet been perfected—on planes, on IRBM's, rather than ICBM's. I am trying to show that the ICBM is not the last answer.

General SCHRIEVER. Yes, it is not the last answer.

Mr. FULTON. So we are able to defend the United States and the free world and if attacked give a pretty good massive retaliation with a telling force in case of emergency.

General SCHRIEVER. I think that is true today, but we are also concerned about what is going to happen tomorrow, and when I say tomorrow I am talking about 2 or 3 years down the line. The decisions we make this year really dictate what kind of force we have 3 or 4 years from now.

Mr. FULTON. I think that is a good distinction because we should not have the people frightened of our present-day capability in viewing what might happen in the future. We should distinguish between the two and prepare adequate programs, is that not right?

General SCHRIEVER. That is correct. I think that as far as today is concerned I can go home with a reasonable amount of confidence that we are not going to be annihilated in the wink of an eye. But because I am in the research and development business and am looking ahead, I am very much concerned as we look down the road.

Mr. FULTON. As a matter of fact, on our advance bases—of which we have in the United States over 250—we are within an intermediate ballistic range of the Russians while they are still from their land bases at an intercontinental ballistic missile range. Intermediate range is 800 to 1,500 miles while the ICBM is maybe 3,000 to 6,000 miles, is that right?

General SCHRIEVER. Well, generally the ICBM's are identified as from about 4,000 to 6,000 nautical miles, in that region; intermediate range from 1,000 to 2,000.

Mr. FULTON. But we are preponderate with our bases. We not only have one or two ICBM's, but we can have them in almost broadside volley, with very little chance of interception, very little guidance necessary, and a preprogram flight, is that not right? It supplements our ICBM capability.

General SCHRIEVER. Are you talking now about the IRBM?

Mr. FULTON. IRBM. I said ICBM originally.

General SCHRIEVER. Well, when you get into the area of the IRBM, of course, there are so many factors involved that it is almost impossible to say just exactly what kind of force will be deployed overseas. It is beyond my level to give you an answer to that question because of the NATO and other political factors.

Mr. FULTON. Well, we on the Foreign Affairs Committee believe that we are adequately prepared in that field too, I would comment for the record, if you cannot answer on that end of it.

May I finish with this: The strategic area is expanding in what we call aerospace, so that it might be said for the protection of the United States at this time we almost have to have everything translunar, is that not right, between us and the moon?

General SCHRIEVER. I do not know that I exactly follow your question, Mr. Fulton.

Mr. FULTON. What is our strategic aerospace that now we must defend, or have the power or dominion to control, in order to protect the U.S. security. How far our does it go?

General SCHRIEVER. I think I follow you now. I think I can best answer that by saying that space from our point of view is another medium and when I say "space" in the immediate future I am talking primarily as to several hundred or several thousands of miles from the earth. It is another medium in which we can develop vehicles and systems which can do our mission better, just as land, sea, and air are mediums, and I think what you say is true, in the broad sense that in the more immediate future we are interested in anything between here and the moon.

Mr. FULTON. And in that particular field at the present time there is nobody that controls, neither ourselves nor the Russians, and it is really a strategic area that we should move into promptly, is it not?

General SCHRIEVER. I do not think that either the United States or the U.S.S.R. controls this medium. I think both nations are moving toward this in a scientific manner and, of course, there are many applications that we see as we look into the future for military systems.

Mr. FULTON. We do know that the Russians have had ICBM flights or shots, but the thing we do not know is their capability to spot them or direct them or to control them, is that not the case?

General SCHRIEVER. Well, let me say that I do not have information which allows me to answer that question in a positive way. In other words, I cannot say that we do know they can spot them to a specific point.

Mr. FULTON. Yes, but we do know that they had have the flights of the ICBM's, do we not?

General SCHRIEVER. We have information that they have had ICBM flights; yes.

Mr. FULTON. But these claims by Khrushchev and others, so far they are unsupported as to any information we may have as to their possibility of control, so they may just be expanding their heads a little bit by claiming they can go from Moscow to New York or pinpoint anything in this country. As far as we know, there is no practical way to instrument it, is that not right?

General SCHRIEVER. The answer to that is "yes," we do not.

Mr. FULTON. Thank you very much.

Mr. SISK. Mr. Chairman.

The CHAIRMAN. Mr. Sisk.

Mr. SISK. General, I would like to ask you to comment on whether or not and if so to what extent your people are working on an anti-missile missile because primarily, as I understand it, much of our defense is predicated on defensive type weapons, in addition, of course, to our retaliatory power, which after all, of course, is defensive also.

Now there has been no comment made on that at all, or can you in an open session make any comment on what you are doing in that field?

General SCHRIEVER. Not in detail. I can tell you in general. The Air Research Development Command has had an antimissile office as long as we have had a ballistic missile office. We have been studying all aspects of defense against ballistic missiles; this is not in my office directly, but we work closely with this office. This office is actually at Andrews Field, with General Anderson at his headquarters. We have been looking at all means of warning—advanced systems of warning. The Air Force does have the responsibility of developing a warning system against ballistic missiles which, as you all know, is the ballistic missile early warning system (BMEWS). It is in the process of being installed in the far north now. We are also looking at other means, and then, of course, we are looking at ways by which we might go from that into an active defense. As you know, at the moment the Army does have the direct responsibility for the active defense portion, and they are working primarily in the Nike-Zeus system.

Mr. SISK. Yes; I know as to that, and I was curious whether the Air Force was doing any research and development work along the same line that might be contemporary to this.

General SCHRIEVER. In a hardware sense we are not. We are conducting studies, and I might take my answer just a step further. In my office we have a section which adds another "anti" to the first "anti" (anti-antimissile), because we are interested in developing countermeasures to any defense system that might be developed. So from that standpoint alone we have a great interest in the possible defense systems that might be developed against ballistic missiles.

Mr. SISK. With reference to the discussion with the gentleman from Pennsylvania a few moments ago on the IRBM setup or such groups as are operational and so on: that is a direct responsibility of the Air Force and of SAC; is that right?

General SCHRIEVER. No, not quite. The Air Force has the operational responsibility for intermediate range ballistic missiles.

Mr. ANFUSO. Mr. Chairman.

General SCHRIEVER. Actually there have been two systems developed as you know, the Thor and the Jupiter, and the operational deployment of those is under the overall supervision of the Air Force. SAC plays a very vital role in that but the program calls for these units to be manned by personnel from whatever country they might be deployed in.

Mr. SISK. I appreciate that answer. Without getting into what what I am sure is classified information, I do not hold completely

with my colleague. I respect his judgment—that we are in a position, from other information the committee has had, to say that that represents a very strong arm of our defense at the present time. Due to what you mentioned about not only the location and deployment of the IRBM's but the people that are going to handle them and so on, I would assume there is a great deal of work to be done before we can say we have any specific defense.

Mr. FULTON. Will the gentleman yield?

Mr. SISK. Yes.

Mr. FULTON. I was putting it in the context of one of the types of weapons we are using on these advance bases so we have the opportunity for what we call a salvo in the Navy, along with various quantities of these. I do not mean they are in tremendous quantity at the present time.

Mr. SISK. I did not understand that we have any substantial defense at the present time. However, it is being worked on. It is another arm and another one of the things we are dependent on.

Mr. FULTON. Yes.

Mr. SISK. Thank you, Mr. Chairman.

Mr. HALL. Mr. Chairman.

The CHAIRMAN. The Chair recognizes Mr. Hall.

Mr. HALL. I am David Hall of North Carolina, General. In answer to a question posed by Mr. Karth, did his use of the word "operational" have anything to do with your answer? He asked you if you had reason to believe that the Russians had operational ICBM's.

General SCHRIEVER. Oh, yes, my answer was predicated specifically on his reference to "operational."

Mr. HALL. Then I assume you do believe that they have a missile in the development stage or in the testing stage that would bring a warhead to these United States, is that right?

General SCHRIEVER. Yes, sir.

Mr. HALL. Do you have reason to believe that they have any type of exotic fuel for propelling these instruments, or this hardware as you call it, that we do not have?

General SCHRIEVER. This touches on classified information.

Mr. HALL. We will get to that later, then. Do you have to believe the additional range they have achieved is from clustering the same type missiles we are using or are they single-stage and single-range instruments?

General SCHRIEVER. Are you talking about the range of their space flights, sputniks and that sort of thing?

Mr. HALL. I assume it makes no difference where the missiles are going to go, that you have to have so much thrust in order to get the instrument where you want it to finally arrive and if they have one that can arrive in or near the vicinity of the moon, they also have one they can get to the United States.

General SCHRIEVER. There is no question but that they have adequate thrust to get an ICBM to the United States.

Mr. HALL. All right, now, sir, the question is from whence does that additional thrust come, if that is not classified too, if you have reason to assume where it comes from.

General SCHRIEVER. Well, it is just from their normal development of rockets over a considerable period of time. We have adequate thrust——

Mr. HALL. In other words, their instruments are more refined than ours.

Mr. OSMERS. Mr. Chairman, would the gentleman yield for a moment?

The CHAIRMAN. Would the gentleman yield to Mr. Osmers?

Mr. HALL. Yes.

Mr. OSMERS. General Schriever is not an intelligence officer. He is commander of the Air Force Ballistic Missile Division. There is already a contradiction in the record based on his reply to one question about an operational ballistic missile and the question asked by the gentleman from North Carolina, Mr. Hall, that I think will show at one point General Schriever said they did not have it or he assumed, or something like that, and in another answer it made it appear as though he was saying that they did have it. It seems to me, with respect to information as to the enemy's capabilities, we should not discuss them too fully in open session and should wait and have them answered by intelligence officers behind closed doors.

The CHAIRMAN. My thought is this: I will say to the gentleman from California, that 50 percent of the questions seek to elicit information which is classified. We will get ahead much faster in this hearing if we will hear the final witness of the day in open session and then go into executive session and I think that the witness can speak more freely then. He will not be guarded in his answers for fear something he says might be classified and we can save the time of the committee.

I want to say this: Everything we can reasonably get to the press, I think the press ought to have.

Mr. TEAGUE. Mr. Chairman.

Mr. HALL. Mr. Chairman.

The CHAIRMAN. The Chair recognizes Mr. Hall.

Mr. HALL. That is exactly the purpose of my questioning. If you will remember, the only question that I asked yesterday of Mr. Glennan was whether or not they had a public information agency set up in his administration and he stated that they did. I have been reading the newspapers and every report I get is counter to every other report I get.

The President of the United States in his message to the joint session of Congress stated that the cost of these ballistic missiles was $35 million each. There was testimony yesterday or today, or in one of these reports, that the cost of these missiles was $31½ million or $2 million. What I want to do is to try to get the facts and get them before the public. I think that a great deal of the confusion that has come about has come about because of misinformation that has been put out by the various branches of the service and by the various agencies without any attempt to coordinate the dissemination of this information.

The CHAIRMAN. Let me ask this: What is the information you wish to elicit? Why do you not go ahead and ask the witness and we will hear him.

Mr. HALL. That is what I was attempting to do.

The CHAIRMAN. No one is trying to keep you from asking what you wish. My only plea is that we do have another very important witness and we do have an executive session and the sooner we get to it the more information we will get.

Mr. TEAGUE. Will the gentleman yield. I do not think the record should stand that there has been a contradiction, Mr. Chairman, because I do not think there has been a contradiction. If I understood the question from the gentleman from Pennsylvania, he asked if the general thought that Russia had operational missiles and he said that he did not know. The gentleman from North Carolina asked if they had an ICBM that could reach the United States and the general said yes.

I do not believe that constitutes a contradiction.

Mr. FULTON. I would agree with the gentleman.

The CHAIRMAN. I would too.

Mr. OSMERS. It seems to me again if we are going to put it on the record in open hearing——

Mr. HALL. Mr. Chairman, I believe I have the floor.

Mr. OSMERS. I will have to ask the gentleman from North Carolina to yield.

The CHAIRMAN. The Chair has recognized the gentleman from North Carolina. I will ask the gentleman from North Carolina to proceed with his questions and let us get along.

Mr. HALL. I will retain all other questions until we go into executive session, Mr. Chairman.

The CHAIRMAN. All right. The Chair recognizes Mr. Osmers, of California.

Mr. OSMERS. I am not from California.

The CHAIRMAN. New Jersey; I beg your pardon.

Mr. OSMERS. I just think, Mr. Chairman, that in the early days of our committee and in the very friendly and nonpartisan spirit in which you as chairman have approached these deliberations that we should not try in open hearing to peck away constantly at classified information, particularly from officers who do not have full access to it.

In reply to Mr. Fulton's question, as I recall, the question was did they have an ICBM that could hit something in the United States, or words to that effect, and I believe General Schriever replied he did not know whether they did or not. Obviously, anybody knows if you can shoot something into or by the sun, you might possibly get it to the United States.

Mr. MILLER. Will the gentleman yield?

The CHAIRMAN. The Chair will say this, if there is no objection: General Schriever will have full opportunity to go over his testimony and correct any feature or phase of it so that it will respond to the facts as he sees them.

Mr. MILLER. Mr. Chairman.

The CHAIRMAN. Mr. Miller from California.

Mr. MILLER. I realize that my good friend from New Jersey is quite a knowledgeable fellow, but I do not think that his conscience is Mr. Hall's conscience or my conscience.

Mr. OSMERS. Certainly not, sir.

Mr. MILLER. Then I am not going to tell you what you should do and how you should conduct yourself and the line of questioning you should carry on or even suggest that you are heckling the witness.

The CHAIRMAN. We are not getting anywhere, gentlemen.

Mr. MOELLER. Mr. Chairman, I ask the floor.

The CHAIRMAN. I recognize Mr. Moeller.

Mr. MOELLER. General, you made a statement a moment ago that disturbed me a bit and possible subsequent testimony will give the answer. Did you infer that possibly the Soviet Union's intelligence is better than ours or would you say in another way that we are too loose, too free with our information, maybe we have had too many foreign visitors here?

General SCHRIEVER. Absolutely not. Our democratic system does not permit an Iron Curtain. Theirs does.

Mr. MOELLER. But would you think that possibly the fact that their intelligence is advanced to the stage where we think it must be, that that in itself could contribute to our lag in this development?

General SCHRIEVER. No, as far as missiles go, I do not think so because I believe we have adequate evidence that they started on rocket developments on a large scale before the United States did. I do not think that our work was a stimulus to theirs.

Mr. MOELLER. I see. Thank you, Mr. Chairman.

Mr. ANFUSO. Mr. Chairman, I have one question.

The CHAIRMAN. The gentleman from New York.

Mr. ANFUSO. I would not like to leave this open hearing with the impression that we are going over a lot of top secret information or classified information because I do not think we have. I think that everything that has been discussed here, Mr. Chairman, has been well gone over in the newspapers and I think that everybody knows all about it, but I would like to correct this impression, and I think that the public should know it.

I think the impression has been left here that we have perfected an ICBM capable of hitting a target 5,500 miles away, which of course means Moscow, and that the Russians have not. If that is the impression left here in this open hearing and that is what we want to convey to the American people, I think it is wrong because I do not think it is true. It is my personal opinion that the Russians started this missile program way before we did and it is reasonable to assume that they are ahead. And I believe that they are ahead. And I will say this to the credit of the United States: we are doing a darned good job in getting ahead. My only point is to recognize the facts and then wait until we go from there, let us go full speed ahead. I think we will catch up with the Russians. I do not think the Russians are going to start anything right now because they are sure-shot people. They like to make sure everything is a sure-shot before they start and they are not too sure right now that we are not capable of retaliating in force.

That is all, Mr. Chairman.

The CHAIRMAN. Thank you very much.

Mr. DADDARIO. Mr. Chairman, one question, please.

General Schriever, taking your entire program into consideration, to what have you assigned highest priority, what is your primary objective?

General SCHRIEVER. I happen to be in the happy situation where all of the missile programs that are under my control enjoy top national priority. I do not want to leave the impression that this gives me a blank check. I have to fight pretty hard for what we get in support of the program, but, nevertheless, we have gotten everything that we have asked for. The one program that does not at the present time enjoy top national priority is the Minute Man, but it does enjoy top priority in the Air Force. I might summarize by saying the ballistic missile programs under the Ballistic Missile Division have top priority in every respect.

Mr. DADDARIO. That means anyone of these various missiles you are talking about have the same programing, the same number of personnel behind them.

General SCHRIEVER. This boils down to matters of permitting overtime, extra shifts, cutting administrative redtape, the number of things involved in conducting programs of this kind, priority on materials, and things of that nature.

The CHAIRMAN. Any further questions? If not, I would like to ask you a question or two myself.

General, there was something said about the warning lines that we have in the northern part of the United States and in Canada and also on the Atlantic and Pacific. Of course, we have covered that pretty well in prior hearings, but let me ask you: As of this hour, are we vulnerable to bomber attack from Russia or is that warning system sufficient to allow us to say we are not vulnerable to a surprise attack?

General SCHRIEVER. Mr. Chairman, I would like to answer that, but this is really——

The CHAIRMAN. Is it classified?

General SCHRIEVER. It is out of my field and it is classified.

The CHAIRMAN. Now the Secretary of Defense in Moscow said today that our shores were vulnerable. What I would like to ask is in reference to whether he would mean bombers or missiles.

General SCHRIEVER. Well, I must assume that he means missiles.

The CHAIRMAN. That was my assumption.

General SCHRIEVER. That is right, ballistic missiles.

The CHAIRMAN. Mr. McCormack, you just came in; do you have any questions?

Mr. MCCORMACK. No, sir.

The CHAIRMAN. If not, we thank you very much, General. Now we have Mr. Donovan who is director of Astrovehicles Laboratory, Space Technology Laboratories, Inc., Los Angeles, Calif.

General SCHRIEVER. As I understand it, Mr. Chairman, his presentation was to be in executive session.

The CHAIRMAN. Very well. Is there any more testimony in open session?

General ANDERSON. General Boushey has a presentation.

The CHAIRMAN. Just come forward, General. We are happy to have you here today. You have been with this program a long time.

General BOUSHEY. Yes, sir.

The CHAIRMAN. Do you have a prepared statement?

## STATEMENT OF BRIG. GEN. HOMER A. BOUSHEY, DIRECTOR OF ADVANCED TECHNOLOGY, OFFICE OF DEPUTY CHIEF OF STAFF, DEVELOPMENT, U.S. AIR FORCE

General BOUSHEY. Yes, sir.

Members of the committee, Mr. Chairman, and counsel. In the interests of saving time, my statement is prepared so that it can be reproduced. With your permission I would like to use the Viewgraph, but first I would like to go through about 30 seconds of an opening remark to tell you what we are going to do, if I may, informally.

I will stand up by the Viewgraph screen and just tell you the Air Force program, what we have done, what we would like to do, and where we are going in the future during the unclassified session. I have Dr. Roadman, a Chief Flight Surgeon, with me.

Unfortunately, due to the space limitations, our many aerospace medical exhibits which were in the hall could not be displayed in the committee room today, but since I think the Air Force capability is unique, and we are proud of it, your committee, sir, might be interested in a few facts about our aerospace medical capabilities.

The CHAIRMAN. This is the Space Committee. We are having trouble with space and that is not unusual.

Mr. MCDONOUGH. For the benefit of the committee members and the record, would you identify yourself and your assignment, General.

General BOUSHEY. Yes, I am Brig. Gen. Homer A. Boushey, sir, I am on the Air Force staff at headquarters, I am responsible for the Directorate of Advance Technology. This name was chosen to correspond with Mr. Roy Johnson's Advanced Research Project Agency of the Department of Defense. In plain English, my responsibilities are mostly allied to space development matters for the Air Staff.

The CHAIRMAN. Proceed, General.

General BOUSHEY. Yes, sir.

In the limited time available it will be my objective to emphasize quickly, what the Air Force has done to develop a military aerospace capability; to outline what the Air Force is doing in this field, and to present what capabilities the Air Force believes must be developed in the future.

To start with, I would like to define two general areas: the scientific challenge of space and the military requirements in space.

These areas are neither separable nor competing. The former, the necessity to meet the scientific challenge of space and to more than match Soviet scientific capability, is unquestioned.

Likewise, the latter, the need to develop a preeminent U.S. military aerospace capability, is, I believe, no longer subject to debate.

Such a military space capability can greatly improve our security; its lack might prove disastrous.

I shall confine my brief remarks solely to the military aspects.

Also, I believe it will be helpful to briefly review the Air Force role, the areas in which we operate, and the means by which we fulfill our mission responsibilities.

These can be stated very simply.

The Air Force's historic role has been that of continental defense and strategic deterrence. We operate above the land and sea areas

of the world. The techniques by which our missions can be performed—be they by manned aircraft or by unmanned missiles—has always called for greater speed, greater range, and greater altitude.

Even before Sputnik I, Air Force techniques had advanced well into that region above the earth which is now called outer space. In the past there was no sonic barrier. There is, I believe, no space barrier now.

Our missions remain the same, and our traditional sphere of operations extends above the surface of the globe as far as it may prove militarily necessary to so operate.

I would like now to go to the viewgraph screen and point out very quickly some slides which I think you will find interesting, and make a few remarks pertinent to them.

Slide No. 1 illustrates the point I was trying to make regarding "higher, faster, farther." You may recognize some famous names, Doolittle, Yeager, Schroeder, and the original Explorer, the manned balloon flights made in connection with the National Geographic Society.

The chart on the left shows increasing speeds throughout the years.

The chart on the right shows increasing altitudes; again with reference to time, notice the position of the ICBM and IRBM, located only generally so as to avoid classification.

Notice the positions of satellite velocity, escape velocity, and orbital altitudes. You will notice the trends, even before sputnik, which were reaching both satellite speeds and altitudes. We believe this is nothing new to the Air Force. Could I have the next slide, please?

This is a view of our latest research aircraft, the X–15. I am sure you are aware of this vehicle.

It is shown here under the mother ship, a B–52.

Next slide, please.

This aircraft was unveiled to the public in October.

This next view shows it climbing after the drop from about 38,000 feet, and going up to the altitudes of which it is capable—in the order of 100 miles or better.

Next slide, please.

The typical flight profile of the X–15 shows a range of about 450 miles. This typical chart shows the starting location, Wendover, Utah, and the X–15 climbing to an altitude above 99.9 percent of the atmosphere. This represents operations in the near vacuum, or you might say, space conditions. The slide shows the reentry heating during descent, and final landing at Edwards Air Force Base.

May I have the next slide, please?

This shows the heating during the reentry period. The X–15 will be capable of a flight speed of about mach 6, and we expect that it will first have captive flight sometime this month and shortly thereafter, an unpowered free drop.

May I have the next slide, please?

This last view shows the landing of the X–15 on its skid on the dry lakebed at Edwards Air Force Base, Calif.

The X–15 is an outgrowth of the very famous X–1 and X–2 versions in which Captain Yeager first broke the so-called sonic barrier.

May I have the next slide, please?

Following the X–15 will come what we call the Dyna Soar vehicle. It also is for research and investigation of high-speed, high-altitude flight. It will also give us the space- and weight-carrying capabilities to test navigational, photographic, and other systems in the conditions of high speed, high temperature and high altitude.

The area between these two lines [indicating] is what we call the reentry corridor. For safety, it is also the route which should be followed to "escape" the sensible atmosphere and ultimately attain satellite speeds and altitudes.

Vertically, on the left, we have altitude in thousands of feet and speed in thousands of feet per second on the horizontal.

The small green area shown in the very limits of the lower left is where conventional aircraft operate at this time. You can see the tremendous increase in potential.

The X–15 performance is shown only generally, because when we mark altitude and speed together, this becomes classified information.

The Dyna Soar will have the capability of exploring this entire regime, the so-called corridor of escape. A word of explanation might be beneficial here.

Above the upper line, the vehicle would be flying too high and too slow to maintain lift aerodynamically.

Below the bottom line, the vehicle would be flying too low and too fast. The air is so dense we would soon reach a temperature condition which we would not be able to operate in.

Again, the purpose of the Dyna Soar vehicle is to fully explore this corridor, making it as wide as we can, and eventually reaching near satellite speed and altitudes.

The Dyna Soar name is a peculiar one. It is not the prehistoric monster. It stands for dynamic soaring. As we reach the speeds of near-satellite velocity, centrifugal force is the main sustaining power. The "soar" part represents the aerodynamic lift of the final stage, which is an unpowered glider, and which can glide perhaps to global range in the anticipated future.

If you have any questions, I would be glad to answer them now or whenever you wish.

Mr. McDonough. How is that top line established, the escape corridor?

General Boushey. This is a representative pair of lines only, sir. The studies go back to the former NACA studies and the Air Force has also spent perhaps 5 to 7 years of study to look into the feasibility of manned flight through the corridor and the regime up to satellite velocity.

The top line is established this way. Above it, either the air is so thin that the aerodynamic lift of wings cannot sustain the weight of the vehicle, or the vehicle has climbed too high on rocket thrust. For example, by rocket thrust, an aircraft might climb far above the altitude at which it could sustain flight by aerodynamic lift alone. When the rocket thrust ended, then gravity would accelerate the vehicle earthward, and by the time it reached a lower altitude where the air was dense enough to provide significant aerodynamic lift, why then the aircraft would be traveling at such a high speed that the temperature caused by air friction and the generation of shock waves would heat the vehicle beyond controllable limits. Below this lower

line, the combination of density and speed are such as to cause unbearable heating which the vehicle is not designed to stand.

Within this corridor we have enough aerodynamic lift to fly, and we expect to control the generated heat.

Mr. McDonough. Has that been determined through wind-tunnel experiments?

General Boushey. Extensive and numerous hours by both the NACA and private contractors under contract to the Air Force, and also with their own company-sponsored money, sir.

The Chairman. I don't quite follow what you mean by escape corridor. Would you explain that again, General Boushey?

General Boushey. Going from sea level and subsonic flight, following a flight path in speed and altitude that will allow a manned vehicle to finally arrive at satellite altitudes and speeds without detriment to the vehicle or the man.

The Chairman. Why do you say "escape corridor"? Is that the pattern he would have to follow in the event he wishes to bail out?

General Boushey. No, sir; "escape" in this sense means escaping from the dense atmosphere rather than any connotation of escape for the safety of the pilot. Probably a better term is reentry corridor, but since the pilot would wish to follow the same general route on climbing out of the sensible atmosphere to near-satellite velocities and altiudes, in that sense I called it the escape route.

The Chairman. Proceed.

General Boushey. Next slide, please.

Turning now to the sentry system, called weapon system 117–L, this is a graphic portrayal showing when the Air Force interest first started, in 1946, with a contract to the Rand Corp. I believe your committee is familiar, sir, with the Rand Corp. They were helpful in preparing your very excellent space handbook.

These studies were conducted initially with approximately $1½ million. They showed that a military satellite was feasible and possible, and that it would have possibly very pronounced military advantages.

Up to the end of 1953 or early 1954, $7.4 million was expended. In 1956 weapon system 117–L was actually started, and the Lockheed Aircraft Corp. was selected as the contractor.

This small figure at the lower left is merely a rough artist's conception of what the original type of satellite looked like. It is not classified, merely an artist's concept.

The point I want to make is that the Air Force started to study the possibility of military satellites as early as 1946, and actively began the actual work long before sputnik was a fact.

Could I have the next slide, please?

Mr. McCormack was the chairman of the select committee at the time. I, among others, had the privilege of making predictions as to what I thought was the future of space.

I believe that propulsion is the key to further scientific exploration or military purposes in space. So let me discuss liquid-rocket developments in the Air Force.

This, you might say, is the family tree of the Air Force rocket-engine development, beginning back in 1942, with the assisted take-off devices, the liquid-rocket engines of the X–1, X–2, and the various

engines that are shown here, arriving at the very top at the million-and-a-half-pound thrust, single-chamber development which has already been mentioned to your committee.

I mention these to show the time period and the span in which the Air Force has been developing liquid-rocket engines.

These are all liquid-rocket engines.

The Navaho weapon system, you may know, was canceled 2 years ago. Fortunately, an outgrowth of that program, which was an air-breathing, ram-jet powered, intercontinental and hypersonic missile, was the development of the engines which later powered the Thor, Jupiter, and then the Atlas.

Also, the guidance system developed for Navaho enabled the Navy, with its nuclear-powered submarine, to navigate the Arctic Sea, and under the North Pole.

You will notice the Titan powerplant, which General Schriever already spoke about. It uses a liquid-rocket engine developed by the Aerojet Corp. There was also an early 300,000- to 400,000-pound thrust, single-chamber development. It has since been terminated.

Take the overlay off, please.

This shows the development of the high-energy, upper-stages engines which are useful in carrying the final payload into satellite orbits or for space exploratory purposes.

During 1958 practically all of the Air Force liquid-rocket engine developments were transferred to ARPA, or subsequently to NASA.

Could I have the last overlay, please?

This shows the Rover project, the nuclear power rocket engine, which was started by the Air Force, in conjunction with the Atomic Energy Commission.

This, again, has been transferred to the cognizance of the NASA, who are continuing the work with the AEC.

The last overlay, please.

This shows one high-energy upper stage under the management, direction, and control of ARPA, and this rocket engine development will be transferred to the cognizance of the NASA in July of this year.

The only remaining Air Force liquid-rocket-engine development—true development—is for improvements to the small Hustler engine.

That summarizes the liquid-rocket engine development program, sir.

We have developed, over the years, a terrific investment in not only the static test stands but also the laboratories at Wright Air Development Center, and the Arnold Engineering Center, where not only air-breating engines are developed but also rocket engines are fired at reduced atmospheric pressures. Nose cone reentry tests were also made at Arnold Engineering Center at full scale or close to full size in their very high velocity wind tunnels.

Could I have the next slide, please?

This is an aerial view of Wright Air Development Center, and the parts outlined in black show the very extensive power plant laboratory complex at Wright Air Development Field.

Next slide, please.

This is a typical view of a rocket-test stand at Edwards Air Force Base. I am sure you are familiar with these types. They are exam-

ples mentioned to show the investment that the Air Force has in powerplant facilities.

To summarize: It is estimated that our laboratories and facilities in the Air Force are worth close to a half-billion dollars for the purpose of rocket engine development and tests. Other facilities, such as the Arnold Engineering Development Center, are also useful for wind-tunnel tests as well as pure engine development.

The next slide, please.

This, again, is another view of a rocket static test stand, typical of the facility that can handle the million- and million-and-a half-pound thrust unit.

Next slide, please.

Again, a firing view.

The next slide, please.

This shows one of the rockets during the takeoff after the countdown, which was discussed this morning.

May I have the next slide, please?

One thing which the Air Force has found over the years, as our technology improves, our capability also improves, but usually the technical complexity also increases, as this curve graphically illustrates.

These are calendar years at the bottom [indicating], and in this particular chart, engineering man-hours for the design and development are shown vertically on the left. For example a comparison is made 200,000 engineering man-hours for the B–17, (the familiar Flying Fortress of World War 2) as compared to the B–58, requiring 9,340,000 man-hours for engineering development alone.

Could I have the next slide, please?

That former chart was shown merely for the purpose of showing why the weapons system concept is considered by the Air Force to be a necessity. It is a management concept which provides for planning, scheduling, and controlling, from design through its life as an operating entity, the complete weapons system, the air vehicle, its components, supporting equipment, and the preparation for its operational use.

May I have the next chart, please?

Now, here are about a dozen factors which must be considered during the optimization of any weapons system. If the arrows are optimized, or you might say extended to the right, this may adversely affect some other factor. Performance might affect reliability. Some factors are [indicating]: producibility, procurability, maintainability, and economy (which General Schriever mentioned, is a happy circumstance for the Minuteman ballistic missile) transportability, and operability—you could add some more "abilities" if you wish. This is a baker's dozen. You could add to the list or perhaps take away. For instance trainability is most important, and it isn't even listed.

The purpose of showing these three slides was to introduce you to the Air Force weapons system concept, which I believe has since been adopted by both the Army and Navy. The Navy effectively manages their entire Polaris program under the weapons system concept.

If there are no further questions, sir, at this time I would like to introduce Colonel Roadman, who happens to be an Air Force com-

mand pilot and also a chief flight surgeon. He is particularly well qualified to give the committee, with your pleasure, a brief review of some of the aerospace medical capabilities of the Air Force.

The CHAIRMAN. We would be happy to have him.

Mr. MCCORMACK. Might I ask a question?

The CHAIRMAN. Mr. McCormack.

Mr. MCCORMACK. Several years ago, Mr. Riehlman, chairman of the Committee on Government Operations, conducted extensive hearings as to military and science as a team.

Do you remember that?

General BOUSHEY. I certainly do.

Mr. MCCORMACK. I sat in on that.

To pinpoint for the record, would you state what the relationship is now as a team?

General BOUSHEY. Over the years we have learned there must be extremely close coordination between scientists, technologists, between all categories and abilities, and the point that I think is important is that this coordination must be effected with the future operator, right from the beginning of the design and development stage.

Is that the point you were trying to get, sir?

Mr. MCCORMACK. It wasn't an investigation. It was an extended hearing. There were conflicts that existed, men taking different journeys through life and reconciling them.

I assume you studied the evidence of those hearings.

General BOUSHEY. Yes, sir.

Mr. MCCORMACK. And the report of the committee?

General BOUSHEY. Yes.

Mr. MCCORMACK. As you were testifying, I was curious, and my thoughts went back to those hearings as to the close relationship that has been developed subsequent to the hearings.

General BOUSHEY. Yes, I think we have tried energetically to develop that, and the Air Force, as I am sure Mr. Riehlman is aware, has a Scientific Advisory Board and a Chief Scientist, whose sole purpose is to help us effect this close tie and coordination with the scientific fraternity.

Mr. MCCORMACK. Those hearings were not for the purpose of trying to expose anything, but to ascertain the facts in relation to human relationship.

We appreciate the fact that in the military the life of one has got to be strict. Discipline and obedience are very prominent words and must be in practical operation, and when you get into your scientists you get a very individualistic-minded individual and group.

But in developing the spirit of teamwork, having in mind the best interests of our country, and the national interests of our country, that was the purpose of it, not so much to expose or to be critics, because we are all human beings ourselves, and we have our little conflicts here in Congress that we have to reconcile at times. It was more to probe areas of agreement than to create areas of tension and disagreement.

Without going into it fully, I value your opinion very much. Do you think that the team spirit is much stronger today than it was then?

General BOUSHEY. Yes, sir; I believe it is.

The CHAIRMAN. Now, General, will you proceed with the next witness?

General BOUSHEY. May I introduce Colonel Roadman, Chief of the Human Factors Division, Directorate of Research and Development, Headquarters, USAF.

The CHAIRMAN. Will you have a seat, sir?

## STATEMENT OF COL. CHARLES H. ROADMAN, CHIEF OF HUMAN FACTORS DIVISION, DIRECTORATE OF RESEARCH AND DEVELOPMENT, HEADQUARTERS, U.S. AIR FORCE

Colonel ROADMAN. I am Charles H. Roadman.

The CHAIRMAN. Do you have a prepared statement?

Colonel ROADMAN. I have a prepared speech, sir.

The CHAIRMAN. This morning the commitee asked that, if possible, copies of the prepared statements be made available to members of the committee to do a little night work on, if they wished to. If it isn't too much, we would ask you afterwards, later on, in the next few days, to give us copies of your prepared speech.

Colonel ROADMAN. I shall be most happy, sir.

In the space age and the problems we are faced with, I am sure we all recognize that we do have a problem of semantics. What I am going to talk about this afternoon can be called our Air Force aerospace medical effort. It can be called our human factors research and development program within the Air Force, but for the purposes of description this afternoon I am going to refer to this area as our life sciences program. I use the term "life sciences" because at the present time the definition of our program is in the area of life sciences.

This is aviation medicine, psychological work, human engineering and the like.

The Air Force life sciences research and development program is conducted as an integral part of the weapons system concept which General Boushey has outlined to you. Its program is directed specifically to weapons system support.

Now, as in the past, our attention is focused on man and his relationship and contribution to the Air Force mission.

May I have the first chart, please?

Our development program is directed, as you can see, toward two broad problem areas. These are, in the simplest terms, concentrating on the performance and protection of man.

If you will think with me as we go through this briefly, I think it will become more clear to you.

It should be readily apparent to you that our efforts are applicable in the assessment of man-machine interpretation, whether it be one operating within the atmosphere or within space. To us, and physiologically speaking, there is no clear delineation or demarcation between aviation medicine and space medicine, for example.

The Air Force life science program and capability is known by many of you here today.

May I have the second chart, please?

Of necessity, it is important to approach human factors, research and development with multidisciplinary scientific talent. The team effort among specialists has contributed much toward our scientific

success. The magnitude of our present life sciences effort reflects a continued recognition of the important contribution made in support of our growing complex and complicated system development.

In manned systems there must be integrated programs which focus not only on hardware but insure man's capability to perform useful tasks, here again in the items in General Boushey's baker's dozen, reliability, performance, maintainability are in a practical sense concerned with our area of interest.

As a national asset the Air Force has the largest life-science program and capability in the country, both in numbers of people and facilities. These are directly alined to support our aerospace mission.

The listing of some of our better known facilities can be associated with outstanding scientists, both civilian and military. The names of Col. John Paul Stapp, Lt. Col. David Simons, Dr. Strughold, who fortunately is with us this afternoon, and our first full professor of space medicine is with us this afternoon, and the name of Flickinger, as an example, who is also with us this afternoon, are recognized as authorities in their respective fields of endeavor.

May I have the third chart, please?

All too often in the past, systems development has progressed without orderly consideration of man's functions and man's capabilities. In order to assure man-machine capability, these steps must be followed. In short, one should not develop a system and then arbitrarily put man into it. This has been a problem in the past. It is still something of a problem, but this is the design goal for which we are striving.

This orderly and integrated development process is the basic principle of the Air Force weapons system concept.

May I have the fourth chart, please?

This, to me, gentlemen, is the most important chart. I want to elaborate on some of the more important points.

Basically, man was not designed to fly. Because man has ventured beyond the terrestrial environment, we are confronted with human limitations to atmosphere and space variances. These are really physiological barriers which must be overcome and which give rise to our life science programs.

On the left of the chart I have listed a few of these limitation areas. It is impossible for me in the time permitted to go into a full scale of all of our programs. I would like to point out or let us consider one area.

As an example, let us follow through our past, present, and future research and development growth cycle.

At this point keep in mind the basic developmental growth of the Air Force, which has consistently concentrated on greater speed, greater range and altitude.

This, in effect, is the airman's domain. These three factors from a biomedical point of view have provided a functional delineation for past, present, and future aeromedical life sciences effort.

As we progress higher, the need for human protection becomes more sophisticated. Thus we see the growth of oxygen systems progessing from the simple rubber tube that a pilot sucked on in the past, to the development of sealed cabins and closed-cycle, regenerative oxygen systems which will undoubtedly be needed to protect man in space ventures.

Since man cannot exist without his earthly atmosphere, he must take it with him or find a way of recreating it.

I believe there is another very important conclusion to be drawn from this chart. Today the Air Force is operating in a physiological space equivalent area. Two notable exceptions of this, of course, are well known to you, the problems of weightlessness and the problem of the radiation hazard. By this I mean, in terms of space equivalent, I mean the atmosphere at flight levels is insufficient to support life, and in the case of oxygen above 75,000 feet, the atmospheric air cannot be drawn upon to provide oxygen or cabin pressure. Conditions are identical insofar as oxygen is concerned to flight in free interplanetary space. In other words, we are operating now in some of our areas—take the X–15, for example, in physiological space equivalent areas, at altitudes as low as 50,000 feet, man must be contained in a pressure suit or pressure cabin, because atmospheric pressure is insufficient to force oxygen into the bloodstream.

I call your attention to the exhibit we had in the hall, what we call our MC–2 or X–15 pressure suit, which will be worn by Scotty Crossfield in his flights. This is a pressure suit, a pressure garment.

In the future, all supplies to replace atmospheric ground must be brought from the ground, even though the vehicle does not leave the atmosphere. Physiologically speaking, flight conditions will be the same as for space flight. Only the complexity and endurance of equipment must be changed for flight anywhere in space.

Other factors in the field of protection of fliers follow a similar course and reach a point within the atmosphere where the requirements for protectton are equivalent to flight in space.

Our life sciences research and development in the Air Force has addressed its effort to protecting fliers from the hazards associated with flight at ever-increasing speeds and altitudes. For certain areas we have already attained the degree of protection required for space flight. Other problems of space-flight protection are only logical extensions of our present program and are directly alined with the facilities and capabilities laboriously acquired by the Air Force in the past.

Other conclusions to be drawn, though less obvious, are these:

The Air Force life sciences effort has kept pace with the ever-increasing speed, range, and altitude capabilities;

Two, Air Force scientific personnel and facilities, who have in the past ensured proper performance and provided protection for fliers, will continue to serve the same functions, whether flight be within the atmosphere or in space.

This concludes my brief talk in terms of our life sciences effort, Mr. Chairman.

I am sorry that we had to remove our exhibit. We were limited in terms of space.

I would like to just make this comment:

Although some of the animals do cause concern with certain groups of people, we recognize this. However, we have had and continue to have a very vigorous aeromedical aerospace program. You all know in this room we do require animals in terms of experimentation. I think for those of you who saw our exhibit, I think this will give you at least a thumbnail observation of the types of work in terms of per-

formance and protection that we are so vitally interested in as we progress toward the space age.

The CHAIRMAN. Thank you very much, Doctor.

We appreciate your statement.

Are you operating out of San Antonio?

Colonel ROADMAN. No, sir; I am here in Washington, in headquarters, USAF.

The CHAIRMAN. Any questions?

Mr. RIEHLMAN. Mr. Chairman, I would like to request that the charts that have been shown may be made a part of the record for clarification, because I think they are important.

The CHAIRMAN. Do you have copies that could be made available for the record?

Colonel ROADMAN. Yes, sir.

(The requested charts follow:)

LIFE SCIENCES

Biological and medical sciences directed toward the problems of—

A. Analyzing the knowledge and skill requirements of a given task and devising methods of selection, training, and man-machine job engineering which will yield a reliable human operator.

B. Analyzing human limitations to environmental variances and providing protection and maintenance where these limitations are exceeded.

LIFE SCIENCE RESOURCES IN THE AIR FORCE

A. Personnel:
   1. Specialties:
      A. Medical.
      B. Biological.
      C. Psychological.
   2. Numbers: 1959—1,225

B. Facilities:
   1. Aeromedical laboratory
   2. Air Force School of Aviation Medicine
   3. Aeromedical field laboratory
   4. Air proving grounds center
   5. Flight test center

A. HUMAN KNOWLEDGE AND SKILL REQUIREMENTS

1. To determine performance required by mission.
2. Develop crew station design criteria.
3. Determine qualifications of operators.
4. Develop training techniques and training devices.
5. Maintain effectiveness of operators.

LIFE SCIENCES DEVELOPMENT EFFORT

B. HUMAN LIMITATIONS TO ENVIRONMENTAL VARIANCES

| Limitations areas | Past (diminishing atmospheric dependence) | Present (biological space equivalence) | Future (terrestrial independence) |
|---|---|---|---|
| Oxygen | Oxygen masks | Pressure breathing recycling system.<br>Liquid oxygen | Oxygen regeneration.<br>Solid oxygen.<br>Conversion of wastes. |
| Pressure | Partial pressure suits | Integrated pressure suit and capsule. | Sealed cabin. |
| Temperature | Insulation from cold | Aerodynamic heating | Climate control in sealed cabin. |
| Atmospheric filter | Sunlight<br>Ultraviolet | Solar radiation<br>Cosmic rays | Solar heating.<br>Cosmic radiation.<br>Darkness of space. |
| Escape and survival | Parachute<br>Land and sea survival kits | Ejection seat<br>Global survival kits | Sealed capsules.<br>Recovery vehicles. |

The CHAIRMAN. Are there any further questions?

If not, we thank you very much for a very fine statement.

Now, let's see, do we have any other witnesses that can be heard in open session?

General ANDERSON. Mr. Chairman, I think that concludes what we are prepared to give in open session.

The CHAIRMAN. Fine.

If there is no objection, then the committee will go into executive session.

(Whereupon, at 3:48 p.m., the committee proceeded in executive session.)

EXECUTIVE SESSION

The committee resumed in executive session in room 219, Old House Office Building, the Honorable Overton Brooks (chairman) presiding.

The CHAIRMAN. General Schriever conveyed to me he had an engagement with the Secretary of the Air Force that we would delay if we were going to use him this afternoon. If that is the case, if we could use General Schriever and finish with him, perhaps he could make that engagement. I leave that up to you as to the order in which you want to call them.

General ANDERSON. General Schriever informs me that has been postponed until tomorrow morning so he can be available to your committee.

The CHAIRMAN. Fine.

General ANDERSON. General White asked me to open with a short statement if the committee would care to hear it.

The CHAIRMAN. Have a seat, General. We will then turn the meeting over to you, and you call the witnesses as you want them to be heard. We will permit the reporter to take down the notes unless you ask that some of the statements be not even recorded. Of course, everybody in here has been cleared for security purposes and the committee knows the intonation behind the meaning of executive session, so they will be careful about what they say.

## STATEMENT OF LT. GEN. SAMUEL E. ANDERSON, COMMANDER, AIR RESEARCH AND DEVELOPMENT COMMAND, U.S. AIR FORCE

General ANDERSON. Mr. Chairman, gentlemen of the committee, this morning we discussed in unclassified terms the Air Force research and development program. We gave you a picture of ARDC, its experience, its capabilities, and its work in fields that will contribute to the furtherance of national projects. As the President has stated and as General White has further emphasized this morning, our objective is to utilize the new knowledge obtained from space science and technology for the benefit of all mankind. However, as General White also stated in these critical days, the practical use of space knowledge must be considered primarily from the standpoint of their application toward the security of this Nation and of the free world. This must exist until such time as the use of space for peaceful purposes is assured.

Therefore, this afternoon we shall discuss on a classified basis our military and astronautics capabilities. Consider briefly, if you will, the essential requirements for a successful military astronautics pro-

gram, regardless of whether the military or other agencies are responsible for the development of this capability.

The first and perhaps most obvious requirement is for a large rocket engine program. Next comes the requirement for the vehicle itself, matched compatibly with rocket engines, payload, and associated equipment, and constructed with due consideration for high stress and temperature conditions. Essential to the vehicle is the provision of a guidance system for accurate positioning and navigation during all phases of flight and last but most important, if the vehicle is to be manned, is the requirement for a strong bioastronautics program. The purpose of such a program is to give us the information needed and develop the techniques required both to maintain man's life in space and to permit him to perform effectively in this environment.

Although somewhat oversimplified, this summary gives the essential ingredients for a military astronautics program. How are we, the United States, to equip ourselves to meet these needs?

Since World War II, the Air Force has been pushing the development of large rocket engines. This program which had its start with the Navaho development has brought forth the liquid rockets used by all major missiles, Army as well as Air Force. It has produced the engines for the Army Redstone and Jupiter and the Air Force Thor, Atlas, and Titan. * * * we have done much work leading to a single chamber rocket of much higher thrust as has been mentioned here today.

Recently, as I said this morning, NASA took over this program. The Air Force retains, however, considerable engine development potential which can be used alone or in cooperation with other agencies. Nose cone reentry work performed by the Ballistic Missile Division and other research done by and with the highly experienced Materiels Laboratory at Wright Air Development Center have given us an excellent background for designing and constructing space vehicles. ARDC has been working intensely in the area of missile guidance for over 12 years. The Navajo and Snark programs paid off here as did our work with Dr. Draper at MIT on guidance developments for other purposes. The guidance system developed for the Atlas ballistic missile is today more than adequate for any astronautics program.

Additional guidance development, however, is underway at our ARDC centers. In the field of bioastronautics the Air Force, in working with manned balloons, rocket sleds, and high altitude vacuum chambers, has developed a unique capability for the solution of the biomedical problems of space. The School of Aviation Medicine, the Aeromedical Laboratory at Wright Field and the Aero Medical Field Laboratory at the missile development center have made significant contributions in this area and are well equipped to continue their work toward the solution of the physiological and psychological problems of space flight.

Since the Wright brothers delivered the first military airplane about 50 years ago, we have been directing our efforts toward flying higher and faster and staying up longer. The most advanced weapons system study that we have underway for strategic air operations is the Dyna-Soar described by General Boushey. Here our concept is one of putting man in a vehicle which is boosted to speed and altitude by several stages of rockets. * * *

Obviously such a development as this will be more than militarily useful. It will serve in its various stages of development as a research vehicle for more advanced space flight programs. We are coordinating this particular program very closely with NASA since it should serve many research requirements of that agency.

I would like now if there are no questions, Mr. Chairman, to turn to a classified discussion of our missile and military astronautics program and ask General Schriever to take the stand.

The CHAIRMAN. Thank you, General.

General Schriever, will you step forward, sir? Now if we reach a point in your statement that you do not wish the statement to be recorded by the reporter, just let us know and we will have it off the record.

General ANDERSON. This particular statement is under preparation for distribution to the committee. I do not think it is so critical that it cannot be recorded if the committee wishes it.

The CHAIRMAN. All right, sir.

## STATEMENT OF MAJ. GEN. BERNARD A. SCHRIEVER, COMMANDER, BALLISTIC MISSILE DIVISION, U.S. AIR FORCE

General SCHRIEVER. I would like to discuss the Air Force ballistic missile program. If you do not mind I will stand up because I am going to point at a couple of charts. I would really like to make two major points this afternoon.

The first one is the nature of our management concept; the leadtimes that are involved to get a ballistic missile from the development stage into operational category. I think I can best describe this by showing the leadtimes involved in the management concept we have been employing for the past 4½ years.

The second point I would like to present to the committee is our current force buildup, that is, the schedule of buildup of ballistic missiles both in the IRBM and the ICBM programs. Then if you have any further questions with respect to details—I will not get into the technical details of our ballistic missiles—I will be available and attempt to answer.

### THE NECESSITY FOR CONCURRENT DEVELOPMENT ACTIONS

The first chart—and I will get back here where I can point to it—indicates the necessity for an integrated planning, programing, and budgeting effort. Here are the five major areas of the Atlas program, leading to an initial operational capability in June of 1959. Our other programs are being carried on in the same way.

We started our research and development program study well before 1954. There was a great deal of study and small-scale experimental work in the ballistic missile effort, but we actually, in late 1954, completed our technical studies, the system analyses, and froze on general specifications for the Atlas program. Our first big job—and this is always the first big job in all major development programs—was to get the research and development facilities established. They require the first long leadtime.

This line indicates certain major development milestones, such as the first battleship test, and I will explain what a battleship test is.

It is a captive test on a stand, but instead of using the thin-skinned tank structure that is in the flight missile, we use a heavy steel structure from which we can get repetitive testing. It is a complete missile with all of the subsystems, however. This is normally our first major milestone in the complete missile testing. It is followed shortly afterward by captive testing of the complete missile. Then comes the first flight, and then a series of flight tests which prove out the missile as a whole—all of the subsystems, from a performance standpoint. Further flight testing, of course, is very important from an operational standpoint to develop the reliability necessary for operational use.

Actually we did not freeze on certain of our final specifications until late in calendar year 1958. Our first operational prototype, actually our first operational capability with the Atlas, will be in June or July of this year.

Now there are other things that have to be done if you want to compress the timetable between the initiation of development and this date out here [the operational capability date]. Our production facilities, for example, must be created on a concurrent basis. You notice here that this is our production capability to produce * * * missiles a month to support the research and development test program. Here we show a * * * missile per month capability. Actually that is on a single-shift basis. We have a total capacity on the three-shift basis of about * * * per month.

The CHAIRMAN. That is the Atlas, you have a capacity of * * * per month?

General SCHRIEVER. That is right. That is the Atlas, and it is not only the Convair end of Atlas, but all of the subsystems, the North American engines, the General Electric guidance, the Arma guidance, the Burroughs computer, and so forth; in other words, all of the major subsystems.

You notice we actually have to make a commitment for those production facilities. There is a leadtime of about 24 months prior to the time that we actually had our first flight in the Atlas program. This means that from a budgeting standpoint we had to plan and budget for this money out here somewhere [indicating the 1954 area]. So when we came to Congress we were a long way away from this first flight, but were asking for production facilities when you just had to take our word that we were going to do what we said we were going to do. This material indicates the long leadtimes and the kind of planning and programing that is involved in the base construction area. In ballistic missile deployment we have had to establish a completely new operational environment. We do not go on to an existing airbase. We have had to develop operational concepts, and all of the things that go with them in establishing operational environment.

As for construction leadtime, starting with the point of site selection, and developing the design criteria, then the actual design involved on a specific site—like Vandenberg or Warren Air Force Base—this is about a 6- to 7-month period prior to commencing construction.

We have in addition to that an installation and checkout period where we install all of the ground support equipment. This takes about another 9 months. Some of this is overlapping. About 3 months of this is overlapping with the construction.

To get to the point where you have a facility that is actually useful, it takes a leadtime of 40 months. I show 40 months here, including training, and we have compressed that a little, but we are still talking in terms of 30 to 33 months from here to here [indicating start to finish]. Then you have the training of your first crews in the operation of units on an operational facility, another 3 to 4 months.

So you see again there is a tremendously long leadtime during which you must perform the programing and budgeting. To set up the initial training program requires a leadtime of about 33 months. Once we get the training facilities established, then, of course, we are in a much shorter time period for training. We are in a training period of, say, 12 to 15 months of individual training, crew training, and unit training.

In the support area we have the same problem, establishing what we need in the way of spare parts, making out unit allowance lists, and the whole gamut of things that are required to support the operation, again a long leadtime.

### THE CALCULATED RISK

The main point I want to make here is that the only way in which we can compress the time period between the initiation of development of a major weapons system until you have it operational is to do all these things concurrently. This is what we have been doing in the ballistic missile program. There is a certain amount of calculated risk involved, but it only is a risk really if you should fall flat on your face and find that you have got a basically unsound weapon.

If you find that you have a fundamentally sound weapon, you actually save money by this technique because you do not stretch out the program so long. With time as important as it is in our day and age of thermonuclear weapons and ballistic missiles, I see no other choice but to do our jobs in this manner.

Mr. MILLER. Mr. Chairman.

The CHAIRMAN. Mr. Miller.

Mr. MILLER. General, this is a good deal similar to the thing that you had to go through with in the development of new planes when there was a major change from piston type to a jetplane, it it not?

General SCHRIEVER. We have not always done it this way. We have too often built just a few experimental prototypes, then proven out the system, and then built up the production base.

In other words, we have done things in series rather than compressing and doing things concurrently.

Mr. MILLER. In the case of the B–47 did you not do it like this?

General SCHRIEVER. No, sir, not in the case of the B–47. That was a bad example.

Mr. MILLER. How about the B–52?

General SCHRIEVER. The B–52 was closer, but you must remember also in the case of aircraft we already had in existence a certain operational environment.

Mr. MILLER. The point I am making is even when you have all of the experience with the aircraft, when you made a major change and brought into the inventory a new craft, you still had to have long leadtime and still had to take a certain amount of calculated risk.

General SCHRIEVER. Oh, yes; this is exactly right.

Mr. MILLER. And what you are doing here is even shorter in my remembrance than some of the others. We viewed some of this in 1955.

General SCHRIEVER. They called it the Cook Craigie plan. We endeavored to build enough aircraft during the development and test program to have the nucleous of the production base to begin with and as soon as you got to a reasonable point in the program you could accelerate production.

Mr. MILLER. That is right. But to get the prototype took a great deal of time.

Mr. TEAGUE. Mr. Chairman.

The CHAIRMAN. Mr. Teague.

Mr. TEAGUE. Without talking about who, where, when, why, or what, what part has money played in this and what about the future? We have had a lot of starts and stops, but overall what has the appropriations to do with it?

General SCHRIEVER. We have not had stops and starts in the ballistic missile program. We have had a lot of reprograming efforts in the Pentagon, of course, but we have steered a very stable course in terms of the development effort, and we have stuck to this philosophy of what we call concurrency of planning and programing all of the elements. They are all under the control of the management complex out in California, where we have the Research and Development Command, the Air Materiel Command, and the Strategic Air Command, and a large liaison office from the Training Command.

So we are all working together.

Mr. TEAGUE. And generally you have had sufficient money to do as your plans called for.

General SCHRIEVER. That is right; we have had enough money to get the job done.

Mr. MILLER. Do you have enough money to produce those * * * missiles per month?

General SCHRIEVER. Those missiles?

Mr. MILLER. Yes, those missiles.

General SCHRIEVER. As a matter of fact, that chart is somewhat out of date. That has been increased. We are moving up to a production rate of * * * a month of the Atlas.

Mr. TEAGUE. Would you say one word about the arsenal concept on this, General, the concept you are following on this.

General SCHRIEVER. I hate to get into a controversial area.

Mr. TEAGUE. Is there any difference?

General SCHRIEVER. In the arsenal concept normally you do a lot of development work in service—that is, the detailed engineering, fabrication, and testing in service—and then you turn over the results of that to the industry to produce for you.

Mr. TEAGUE. You have no great difference in leadtimes?

General SCHRIEVER. The Thor program has been on this concurrency basis. The Jupiter program has been essentially on the arsenal basis.

The CHAIRMAN. Now let me ask you this, General——

Mr. TEAGUE. You have not answered my question, though, General. Has there been a big difference in the leadtime between the two of them?

General SCHRIEVER. There has been a difference, yes, in the leadtime as it pertains to achieving an operational status. I mean having available all of the ground support equipment, the missiles, the operational part of it, there has been a difference. We have contended——

Mr. TEAGUE. Because the arsenal system was not doing that, they were not developing all of them concurrently.

General SCHRIEVER. Well, in fairness though in this particular case, in fairness to the Army, they were not actually directed to build to a particular operational force until fairly late in the development program whereas we had that objective right from the start.

The CHAIRMAN. Now, General, let me ask you this question: Of course, the starts and stops that you refer to apply only to—I mean your statement does not apply to anything but the ballistic program, the ballistic missile program; is that not right? We did have starts and stops in the intermediate range missile.

General SCHRIEVER. No, sir. Well, we had what you might call a temporary slowdown in the fall of 1957 at which time there was consideration being given to whether we go to Thor or Jupiter or both. Actually we were at that stage of the program where the planning and reprograming activities did not have much effect.

The CHAIRMAN. Well, we did have a stop order on the Jupiter C; did we not?

General SCHRIEVER. Well, the Jupiter C is a completely different animal from the Jupiter. The Jupiter C was a test vehicle which actually used the Redstone——

The CHAIRMAN. That is why I asked whether your statement applied only to ballistic missiles.

General SCHRIEVER. My statement applies only to the ballistic missile aimed toward operation capability.

The CHAIRMAN. Now we have reached the point where we are in production on the Atlas at the rate of at least * * * a month.

Also, beginning this year, we are training crews, as I understand your chart, and have been training them for a couple of months.

Now, are we going to put the Atlas out there on the Pacific coast at Vandenberg?

General SCHRIEVER. That is the first base, but there will only be really a very small part of the operational Atlas force at Vandenberg. It will be only * * *, as a matter of fact.

The CHAIRMAN. What are we going to put at Vandenberg, and when will Vandenberg be ready?

General SCHRIEVER. Well, Vandenberg is ready right now for training on the Thor. It will be ready for training on the Atlas within the next couple of months.

The CHAIRMAN. Well, now, would you call it operational, because I notice in the Senate hearings they referred to Vandenberg not being ready for operations before mid-1959, and there was some dispute about that.

General SCHRIEVER. Well, I think you have to define what you mean by "operational" in this case. It is operational today from the standpoint of Thor training and from the standpoint of launches that relate to the Discoverer program. It is not operational yet as far as the Atlas program is concerned.

The CHAIRMAN. Now, when the Atlas, there at Vandenberg—the range of the Atlas is about * * * miles?

General SCHRIEVER. Yes, sir; it has a range of * * * nautical miles.

The CHAIRMAN. That is not far enough to reach across the Pacific.

General SCHRIEVER. Yes, sir. I don't happen to have a chart.

The CHAIRMAN. By the northern route?

General SCHRIEVER. Well, it will shoot right over the polar regions, and it is more than adequate to reach Moscow.

The CHAIRMAN. May I ask one or two more questions?

It is not proposed to stop at that in the development of the Atlas? Is this the end of your development of the Atlas?

### AIR FORCE BALLISTIC MISSILE FORCE BUILDUP

General SCHRIEVER. No, sir; the next chart that I have will indicate what the present program buildup is; in other words, what is planned at the present time and what is programed in the 1959 and 1960 budget for the ICBM operational buildup.

The CHAIRMAN. Is that the chart that you refer to?

General SCHRIEVER. This is the chart; yes, sir [indicating].

I can point out here that actually this is the Atlas buildup, and the present program calls for a buildup to * * * squadrons of Atlases, which means * * * operational Atlas missiles.

The end of that comes—you are looking here at the calendar year—in the spring of * * *, when we complete the present approved program, with the first * * * coming in right at mid-1959.

### HARDENING AND DISPERSAL

Now, I might say something else about the Atlas. We started off with the Atlas on a "soft" base; in other words, the missle was exposed. This first * * * will be "soft." As a matter of fact, the first * * * squadrons will be "soft," because we are tied to a radio-inertial guidance system, which requires quite a bit of land on which to place the system. Although we are dispersing after the * * * squadron, the next * * *. The last * * *.

There has been an evolution in the whole business of "hardening" and dispersion in the ballistic missile business. We didn't know very much about "hardening" back in this time period back here in 1956 and 1957.

However, on the Titan program, because it was about a year behind developmentwise, we plan from the start to "harden" the Titan to what we call * * *. Actually that is nominal. We think our design criteria indicate that it will be "hardened" to considerably greater—that it will withstand greater overpressures than * * * .

The CHAIRMAN. What do you mean by "hardening?" Is that the base you place them on?

General SCHRIEVER. That means that everything, the men and the equipment and the missile, will be underground and will withstand a nuclear attack up to * * *. And I would say between * * * which essentially says that * * * .

Now, the * * * them in the same way.

This means that an enemy either has to fire a * * *.

The CHAIRMAN. What about that Minuteman?

General SCHRIEVER. We spent a year and a half of study on the Minuteman. We had a very good research program for improving the state of the art in solid propellants prior to that. Improvements in the state of the art of solid propellants, plus the fact that we learned a great deal about the nose cones so that we could * * * plus the very good progress that was made in guidance system, particularly in bringing the size and weight of guidance systems down, these all stem from our ballistic missile program. We have been able to initiate development of the Minuteman system for which the general specifications were firmed up in the fall of 1957.

This particular missile will weigh in the order of * * *. It will be a three-stage solid propellent missile and will have a range of * * * at the minimum, and will deliver a * * * warhead which will have a yield between * * *; in other words, right in the * * * region.

Mr. MCDONOUGH. What is the weight of the Minuteman as compared with the weight of the Atlas?

General SCHRIEVER. The Atlas weighs approximately 260,000 pounds, with fuel and liquid oxygen on board.

I might point out that empty it weighs about * * * pounds, so you can see that it is mostly liquid.

The Titan is about 250,000 pounds, again mostly fuel.

The CHAIRMAN. It would be about * * * times the weight of the Minuteman?

General SCHRIEVER. That is right, gross weight with fuel.

Mr. OSMERS. Mr. Chairman.

General Schriever, does the Titan also use liquid fuel?

General SCHRIEVER. Yes, both use liquid fuel.

Mr. OSMERS. Now, I was interested in the chart that you had up just prior to this one in connection with leadtime, which showed a leadtime of 3½ years for the development of the Atlas up to an operational situation.

Now, if that is so, that same leadtime would not apply to the Minuteman, I gather?

General SCHRIEVER. Yes, sir; it does apply to the Minuteman. The Minuteman is such a completely different system that our operational deployment scheme here is quite different from these other missiles. We actually have two deployment plans. One calls for a single missile in a hole, hardened, dispersed at about * * * distance between missiles, tied into one control center, so that one control center might control as many as * * * missiles.

The missiles, themselves, will be unattended.

Mr. OSMERS. This is the Minuteman concept?

General SCHRIEVER. Yes, sir.

Mr. OSMERS. Go ahead.

General SCHRIEVER. Also, the second deployment scheme, and I am sure we will have a mixture of the two, provides that a certain fraction of the force will be mobile, and there are several different ways in which we can make them mobile. We have looked at * * * looks like the best at the moment, but this is a type of missile that very definitely lends itself to this type of deployment.

Mr. OSMERS. Well, now, if I read your chart correctly, it would be * * * before a Minuteman was operational?

General SCHRIEVER. No, sir; we begin in operation—actually, we feel out here we will have the beginnings of a missile that will have operational characteristics and it might well be this line which shows here [indicating] might be moved back just a little bit in this direction. We could perhaps start the buildup sooner. We call this the operational development phase simply because we are introducing such a completely different operational concept that we think we need about * * * time actually developing in the field, marrying the crews to the missiles, and the ground support equipment, and so forth. So we show a buildup and operational force here in * * * although we expect to have a missile that will demonstrate operational capability in late * * *.

Mr. OSMERS. Is fuel the most difficult problem confronting you in connection with the Minuteman?

General SCHRIEVER. I want to answer that this way: Right now it appears to us that as far as getting the performance characteristics out of the solid propellant, that this will present us with no serious problem, but the * * *.

Mr. OSMERS. * * *.

General SCHRIEVER. Yes, sir.

The CHAIRMAN. General, we are planning some hearings on propellants in the future, but in the meantime in your judgment are we moving toward solid propellants and away from liquid fuels or not?

General SCHRIEVER. I don't believe that you should conclude that entirely. From an operational standpoint—that is from a military operational standpoint—because of the simplicity both from an operational and a maintenance standpoint, and because historically the solids have been more reliable, I think that we will move largely into the solid propellant area in missiles, starting in the 1963–64 time period.

This doesn't mean we won't keep certain liquids in our force, because we will have the operational environment of our liquid missiles. We have bought that. The actual replenishing of missiles over the years is not a very costly thing. The missile doesn't cost so much. It is putting it in the field that costs a lot. The liquid-propelled missile, that is the Atlas-Titan type, for the foreseeable future at any rate, will have a much larger weight-carrying capacity than the solid propellant, so I think that we will have a certain percentage of our missile force in the liquids * * *.

I don't know just what that percentage will finally work out to be, but I think it will be a significant percentage.

Now, in the field of space development, there is no question but that liquids will play a predominant part, at least in the foreseeable future, because of the much larger thrusts that are available there. Although we are using the solids now in second and third stages, the big boosters, the ones that lift the thing off in the first case, I think will be liquid engines for some time to come.

The CHAIRMAN. Mr. Anfuso.

Mr. ANFUSO. Will you tell me, General, what the destructive capability of the Atlas is, say if it hit Moscow, for example, how much damage would it do?

General SCHRIEVER. Well, I would have to get the atomic effects information, which I just don't have at my fingerprints, but the

first Atlas missiles will have a yield of about * * * and starting, as I pointed out, in about early 1961, we will introduce the * * * which will have a yield of about * * *.

Mr. OSMERS. Mr. Chairman.

How does that compare generally with what fell on Nagasaki?

The CHAIRMAN. Are you through, Mr. Anfuso?

Mr. ANFUSO. I am not through.

Mr. OSMERS. Will the gentleman yield?

The CHAIRMAN. Let the gentleman finish there.

Mr. OSMERS. I was just going to ask for the gentleman's information, how does the * * * yield compare with the bomb that hit Nagasaki? That might give an answer to the gentleman's question.

General SCHRIEVER. Well, the Nagasaki bomb was 20 kilotons, and this would be * * * a factor of * * * times greater.

Mr. OSMERS. * * * times what hit Nakasaki?

General SCHRIEVER. I beg your pardon; * * * times.

Mr. ANFUSO. A similar missile, then, if the Russians had it, could destroy New York City?

General SCHRIEVER. When you start talking about megaton yields and accuracy of * * *, you are not very safe in any city, New York or any other.

Mr. ANFUSO. Just one more question, Mr. Chairman.

What is the distance from California by way of the polar region to Moscow?

General SCHRIEVER. We can check that.

Mr. ANFUSO. Is it less than 5,000?

General SCHRIEVER. It is less than 5,000. I think it is between 4,500 and 5,000.

The CHAIRMAN. Just go ahead, General, with your charts.

Mr. MCCORMACK. I have a question.

The CHAIRMAN. Mr. McCormack would like to ask a question.

General SCHRIEVER. This in essence completes what I had to say.

I wanted to get across the importance of concurrency, planning, and programing together, in order to compress the time schedule, and then show you the sort of program we have for the force buildup.

The CHAIRMAN. Mr. McCormack.

Mr. MCCORMACK. General, when the Minuteman is perfected and completed, does that mean that the Atlas and the Titan are pretty well outmoded, to the best of your opinion?

General SCHRIEVER. I would say the Atlas and the Titan would have a uselfulness through the sixties. Percentagewise and in numbers, the Minuteman, if we have a succesful development program, we will have many more Minutemen than we will have of Atlas and Titan types.

The CHAIRMAN. Any further questions?

Mr. MCCORMACK. Has any consideration been given to the use of your bombers for projection purposes?

General SCHRIEVER. Yes, sir; there is quite a bit of work going on in long-range air-launch missiles, including a ballistic missile type. This comes under another division of General Anderson's, which he mentioned, Detachment 1, in Dayton, Ohio. We work closely with them, but they have the management responsibility for that.

Mr. MCCORMACK. I think the committee would be interested in that, not to press it now, but I know I would be interested in getting what

information I can, because I can see how valuable that would be as a part of not only our national defense but our striking power.

General SCHRIEVER. That is right; the Air Force considers this an important development.

Mr. MCCORMACK. Because then you would have a moving site.

The CHAIRMAN. Any further questions?

Mr. CHENOWETH. I would like to ask just one question, Mr. Chairman.

I would like to know, in the event hostilities would start tomorrow, just where are we in this missile picture? What have we got? Where would we be?

General SCHRIEVER. If hostilities started tomorrow * * *

Mr. CHENOWETH. How long would it take to get one?

General SCHRIEVER. As I pointed out, we hope to have the beginnings * * * in June and July of this year at Vandenberg.

Mr. CHENOWETH. Is it the general feeling that the Russians have them now?

General SCHRIEVER. Well, this is the great debate. As I say, the Russians say they have them, and it is really hard to say. * * *

Mr. CHENOWETH. Thank you.

Mr. MCDONOUGH. We have an IRBM that is operational, however, don't we?

General SCHRIEVER. * * *

Mr. MCDONOUGH. What is their range?

General SCHRIEVER. * * *

Mr. MCDONOUGH. What kind of operational missiles do we have at the present time—Nike?

General SCHRIEVER. I have been so busy working in the ballistic missile field I am not sure I can answer that completely.

The Air Force's Matador is operational.

Mr. MCDONOUGH. The Nike?

General SCHRIEVER. That is an Army missile. They are operational; yes.

The Bomarc.

General ANDERSON. That is not yet operational.

The CHAIRMAN. They are short-range, aren't they, 1,500 miles or less?

General SCHRIEVER. I don't know the operational status of the Snark now.

General ANDERSON. * * *

The CHAIRMAN. Then we do not have an operational IRBM.

Mr. MCDONOUGH. Why was the Regulus discontinued?

General SCHRIEVER. I had better let the Navy answer that one.

Mr. TEAGUE. I would like to ask a question, Mr. Chairman.

Mr. MCDONOUGH. It was an operational missile.

General SCHRIVER. I understand they have a limited number in operational category today.

The CHAIRMAN. Mr. Fulton wanted to ask a question.

Mr. FULTON. Could I comment on that? * * *

Mr. TEAGUE. Mr. Chairman.

The CHAIRMAN. Mr. Teague.

Mr. TEAGUE. Mr. Chairman, I am interested in the same thing Mr. Hall was talking about. I don't know how apppropriate this ques-

tion is to you, but how good is our intelligence? What can we learn from electronics as to what is stationed around Russia in missiles? We have little chance to travel in Russia. We can't learn from what is published in the newspaper. So what can we learn from the electronics we are able to place around the country?

General SCHRIEVER. Mr. Teague, I would like to answer you.

Mr. TEAGUE. This is not a proper question?

General SCHRIEVER. This is just not one I can get into.

The CHAIRMAN. May I say this to the gentleman from Texas: We have plans to have the CIA appear in executive session.

General SCHRIEVER. I think this would be the more appropriate group.

Mr. MCCORMACK. If you get as much out of them as the select committee got out of them, you won't know any more than you do at this time.

Mr. TEAGUE. The Russians have never lied about anything of this nature, according to Senator Symington. Whenever they have said they had this or that. it has turned out that they had. Is that generally true?

General SCHRIEVER. I can't categorically answer that. They certainly have produced in a number of instances when they said they had done something or were going to do something. Usually it is after they had done it. We have underestimated them at times, and we have overestimated them at times.

There are studies that have been made with respect to just the point that you touch on, but I haven't reviewed them recently enough to be able to hazard an answer to that.

The Rand Corp. has made a number of studies of this particular thing.

Mr. TEAGUE. May I say one thing in complete secrecy?

The general went to the school I went to and graduated 1 year ahead of me. It is one of the best schools in the country.

The CHAIRMAN. Mr. Fulton.

Mr. FULTON. You spoke, of course, of the proposed installations in Britain, the fact that they are going into operation now in IRBM's.

We do have plans in * * * and proposed in * * * for IRBM installations, so we are making progress on these bases. With the political difficulties out of the road, I think we have a tremendous advantage on Russia in that we can use these IRBM's quicker and at more dispersed points, while they will have very few ICBM's, which must travel a long distance, like the old Big Bertha that did at Paris. So strategically I believe we are moving along.

I wanted to explain to the gentlemen from Texas and New York when they raised the question.

The CHAIRMAN. Mr. Sisk.

Mr. SISK. Mr. Chairman.

General Schriever, of course in answering my question, which is primarily along the same line as the gentleman from Pennsylvania has mentioned, and that was actually how many squadrons we have deployed in Europe or in any of the other places that are prepared today to launch this IRBM missile. Isn't it a fact that we actually do not have them there?

General SCHRIEVER. We have the first squadron's worth of missiles and all of the equipment over there, and we are in the process of * * *. It is moving quite fast. Our present target is by the end of * * * turned over to the * * *.

Mr. SISK. That is by the * * *.

General SCHRIEVER. By the * * *.

Mr. SISK. Now, let me ask you one other question in connection with this, and I hope that the question is clear.

I understand there has been some controversy in the use and handling and deployment of squadrons with this IRBM as to whether it be left as a mobile or flexible weapon or whether you put it in hard bases, and the Air Force has generally taken the position it must be in hard bases, and therefore it has created a political problem. For example, let's mention Italy or certain other countries, due to the necessity of the ground, going into a hard-base setup. Why is the Air Force opposed to the use of this weapon as a flexible or mobile unit?

General SCHRIEVER. We are not opposed to it. The only thing is, in our best judgment this is * * *.

Mr. SISK. I know the Army feels the Jupiter is and can be used as an effective mobile weapon; is that correct?

General SCHRIEVER. That is correct as far as I know now.

Mr. SISK. I am not trying to take sides here, but it is the Air Force's feeling generally that it is not a good mobile weapon, and it should be in more or less hard bases; is that correct?

General SCHRIEVER. * * *.

Mr. SISK. But isn't it a fact that the political problem, that is, the securing of the bases and the willingness of the people to permit those bases to go in, isn't that proving to be a really stupendous problem in many of these countries?

General SCHRIEVER. * * *.

The CHAIRMAN. Isn't there a safety factor involved too in reference to placing the missiles in hardened receptacles? Would that have anything to do with your decision in Europe?

General SCHRIEVER. Actually, just intuitively, if you put them in a hard base, this would be a safer system than if you fired them from above ground, because the plan would be to * * *.

The CHAIRMAN. And those that live in the vicinity would feel much safer if they were in a hardened vessel of that sort?

General SCHRIEVER. They probably would, but I think this is a matter that is completely blown up out of proportion. We had a couple of mishaps early in the program, but we haven't had a catastrophic failure of that kind now in months and months.

The CHAIRMAN. Let me ask you this. This is the question I wanted to get to:

The Air Force program of deploying these missiles overseas, the IRBM, has been predicated on the thought or the belief that Russia was not able to deliver an atomic warhead missile into the United States at this time; isn't that right?

General SCHRIEVER. I don't believe I can answer that * * *.

The CHAIRMAN. Isn't it our belief that the Russians cannot deliver the long-range intercontinental ballistic missile into the United States—well, deliver it at all at this time?

General SCHRIEVER. No; I think it was generally the policy of the United States to increase the overall deterrent strength of the free world and provide our allies with some of the more up-to-date weapons. That was my thinking on this, and I believe this was generally the underlying philosophy as to IRBM overseas deployment.

The CHAIRMAN. Rather than the ability of Russia to deliver a missile, an ICBM?

General SCHRIEVER. We always knew that they would eventually have a capability of delivering ICBM's against us. We didn't know just exactly when.

The CHAIRMAN. We didn't think it would come in the next year and a half or 2 years, though, did we?

General SCHRIEVER. Well, most estimates have not differed too much. They have varied anywhere from * * *.

The CHAIRMAN. Are there any further questions?

Mr. RIEHLMAN. I would like to ask the general a question, Mr. Chairman.

You have stated that we have been successful in flying one squadron to England. At what rate will we fly additional squadrons during this year of 1959?

General SCHRIEVER. We have a total of four squadrons scheduled for there. I don't know whether I have got that on the chart, or not. I have got that here. I will have to look it up exactly.

The last squadron becomes operational in * * *.

Mr. RIEHLMAN. In other words, we are committed to four squadrons for England?

General SCHRIEVER. Yes, sir; for the United Kingdom.

Mr. RIEHLMAN. Now, they are manned by people who have been trained in this country and are with the British troops; is that correct?

General SCHRIEVER. That is right. We have had Royal Air Force people over here for months in training, in factory training. We have not had facilities ready for crew training at Vandenberg, so the first unit or portion of the first unit will be trained on site in the United Kingdom, but the second, third, and fourth squadron, the people will get complete training, individual and crew training, in this country.

Mr. RIEHLMAN. Now, do we have any other countries that have people here observing this program and are under training at this time?

General SCHRIEVER. No, sir.

Mr. RIEHLMAN. So if we had agreement with France or Greece or Turkey we would have to bring those people here for training or furnish men to man a squadron in that country; is that correct?

General SCHRIEVER. We would have to man it ourselves, or bring people here, and we have to figure particularly if there is a language barrier, we are talking about * * * months.

Mr. RIEHLMAN. Are we in a position to furnish the men to man one of these units or squadrons in another country?

General SCHRIEVER. Yes, sir; as a matter of fact, we have trained one squadron under the Strategic Air Command. I don't know whether their planning goes further than that, but one squadron has been trained, and those people are over in the United Kingdom, as well.

Mr. RIEHLMAN. They are assisting in training people?

General SCHRIEVER. Yes, sir; they are assisting and getting on-the-job experience, and so forth.

The CHAIRMAN. Any further questions?

Mr. MCCORMACK. Will you elaborate a little more on this question I asked you but didn't press, about what the Air Force is doing in the use of our big bombers for projection of the war heads, air launch?

General SCHRIEVER. I hate to give this answer in detail, but, No. 1, we do have—I might get some help here, but I will start.

This is the air launch program. General, would you rather take this on?

General ANDERSON. * * *.

Mr. MCCORMACK. That would be quite an advance if successful, wouldn't it?

General ANDERSON. Yes, sir.

Mr. MCCORMACK. A tremendous advance.

General ANDERSON. * * *

Mr. MILLER. Will the gentleman yield?

Mr. MCCORMACK. In just a minute.

Following what you stated, General, you have confidence it can be perfected?

General ANDERSON. I feel confident about it, myself. I know there is some disagreement in scientific circles, but I know also that there is some agreement in scientific circles, so we think we have to prove it out one way or the other.

Mr. SISK. Mr. Chairman.

Mr. MCCORMACK. I yield to Mr. Miller.

Mr. MILLER. Didn't we try something like that about 1955, make some mockups and studies of piggyback planes?

General ANDERSON. I wasn't working with the Air Force in those days. At the period of time you were speaking of I was Director of Weapons Systems Evaluation Group in the Joint Chiefs of Staff, Office of the Secretary of Defense.

What do you think about that, General Davis?

General DAVIS. I can't think of anything. Navaho was sort of a piggyback.

Mr. MILLER. We went on tour with the Hébert committee, and at Fort Worth they had a mockup of wood already made.

General DAVIS. Perhaps at Fort Worth you are referring to the B–58 with the missile pod underneath.

Mr. MILLER. What happened to that?

General ANDERSON. The airplane has to carry that all of the way to the target. Instead of releasing a bomb from the B–58 they release a missile pod. We are building a missile called Hound dog right now for the B–52 fleet; it is a much shorter range than I am talking about today. * * *

Mr. SISK. I have one question of General Anderson, or General Schriever.

In reference to the past comments by Mr. McCormack, are you prepared to say anything—maybe it has no part in this picture, but speaking about the weapons systems, what about the weapons system now being worked on by North American?

General ANDERSON. As of now, that is a development program. * * *

Mr. SISK. That is some 4, 5, or 6 years away, based on leadtime, and so forth.

General ANDERSON. * * *

Mr. SISK. But it is being actively pursued and would be in a sense, and I wanted to ask General Schriever a little while ago when he had his first chart up there with reference to lagtime, discussing the Atlas chart, is this * * * weapons system being pursued generally along a similar line of approach to that program where you are planning not only the actual research and development on one side, but you are moving into various phases of it? Is that correct, or not?

General SCHRIEVER. I will have to let General Anderson answer that.

General ANDERSON. At this stage, no, it is a development program * * *.

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

The CHAIRMAN. I asked you, General, in open session something about our protection to the north, the DEW line, the Pine Tree line, and this other line there. Do you have anything you would like to give the committee on that?

General SCHRIEVER. The present DEW line is of no value as far as giving you warning of ballistic missile attack; it is strictly a system against aircraft. What is called the BMEWS (ballistic missile early warning system), with the first radar installation going into Thule, and there are two more planned—this is not under me, but there are two more planned—I think they plan to get into operation sometime in 1961, which would be the earliest we would have any warning.

I would like to be sure to correct the record on that date because I am just using my memory on that, but I think it is 1961 before this becomes operational.

The CHAIRMAN. We are moving forward on that plan, but it will be 1961 before it is operational?

General SCHRIEVER. Yes, sir.

The CHAIRMAN. At that time do you believe it will be a system of detection that will be without flaw?

General SCHRIEVER. I don't know there is any system that can be completely without flaw, but I think under normal circumstances this system would give us about 15 minutes' warning of a ballistic missile attack.

The CHAIRMAN. And it would be reasonably efficient in making returns and giving warning, would it?

General SCHRIEVER. This depends on the communications system, it ties right into the air defense system, and, of course, the communications system planned is such that the warning should be instantaneous at least to the air defense net.

The CHAIRMAN. To sum it up, our main deterrent for war is still the bomber?

General SCHRIEVER. Yes, sir.

The CHAIRMAN. The reliance is not now on the missile.

General SCHRIEVER. That is right.

The CHAIRMAN. Any further questions?

If not——

Mr. HALL. Yes, Mr. Chairman, I would like to return to my line of questioning now, if I may.

The CHAIRMAN. Mr. Hall.

Mr. HALL. Before we went into executive session I was asking you some questions about the type of missiles, about the type of missiles, if you know—you don't know, of course, but you have to assume that the Russians, if you accept the fact they have showed in their Lunik missile, in the area of the moon to the sun, that they are superior to us in at least thrust; is that right?

General SCHRIEVER. There is no question but that they have larger thrust engines than we do.

Mr. HALL. Now, do you have any idea how they have been able to procure that additional thrust? Has it been by the use of more exotic fuels, the use of better designed single-engine instruments, or by the use of multiple-rocket instruments, or a combination of the three?

General SCHRIEVER. They undoubtedly are doing development work in exotic fuels, but it is generally believed they are using essentially the same type fuels in their engines as we are using in ours at the present time.

Mr. HALL. Do you mean they are using the same type liquid fuels?

General SCHRIEVER. Same type liquid fuels; yes.

Mr. HALL. All right; I didn't mean to interrupt. Go ahead.

General SCHRIEVER. The reason they have larger thrust in a single chamber is the fact they simply design a larger engine to begin with. If I were to postulate the reason for that, it is because they probably started design on a long-range missile or started working aggressively on it before we did, and were planning on the delivery of perhaps a larger payload because of the start of the art in warhead development.

We have ample thrust in our ICBM's to get the payloads that I have mentioned, the intercontinental distances. As a matter of fact, we will be getting larger payloads that distance with the engines we now have.

Now, the single-barrel engine is a nominal 150,000 pounds. The North American engine has been uprated from an original 120 to 150, and it can go another * * * pounds, perhaps, up to * * * pounds of thrust. The Aerojet engine was designed at the low end of the spectrum at * * * to begin with, and there is no reason with growth why that engine cannot go up to about * * * pounds of thrust—single barrel, I am talking about.

Mr. HALL. Then I gather that you fear that our thermonuclear devices are more refined than theirs, and it became necessary because of their lack of refinement in those devices to devise a larger thrust engine to deliver that warhead; is that right?

General SCHRIEVER. I am not qualified to answer that. I said that they started sooner in the development of the long-range missile, and at that particular point their nuclear development probably hadn't reached the refinement that ours had when we started very aggressively after a ballistic missile capability.

I wouldn't be qualified to say where we stand today relative to refinement of the warhead.

Mr. HALL. Now, these solid propellant missiles, of which you spoke, is the main problem there one of guidance after the missile is launched, in that it is necessary to have some heavier type structure in order to properly deflect the gases or to contain the gases that

escape from the solid propellant; is that the reason for the additional weight?

General SCHRIEVER. No, the * * *. This has not been done except under test conditions in solid propellant engines, but it looks like the most promising approach to us.

Mr. HALL. Even so, under the present state of development, it will be necessary to have these extremely * * * within that instrument; is that right?

General SCHRIEVER. No; I would say even with today's state of the art, if we were to freeze immediately, we would probably get * * *. Now, we are shooting for something in the order * * *.

The CHAIRMAN. Any further questions?

Mr. HALL. That is all.

The CHAIRMAN. Any further questions at all?

Mr. HALL. Mr. Chairman, I would like to ask one more question that requires a very short answer.

The CHAIRMAN. Go ahead.

Mr. HALL. You stated, I believe, that we had to date, fired 32 Thor missiles; is that right?

General SCHRIEVER. Yes, sir.

The CHAIRMAN. How many of those firings were successful?

General SCHRIEVER. I would have to give you a record of that. About half of them were completely successful. The rest of them partial successes, and then we had several that you simply have to say were complete failures.

Mr. HALL. All right, now what is the ratio of success of the liquid fuel firings; half, or 25 percent?

General SCHRIEVER. In the Atlas program we have had about 75 percent success, which has been phenomenally good. In the Thor it has been running between 50 and 60. You would think with a single sustaining engine you would do someawht better than that, but the Atlas has been actually a little better in its test program from a reliability standpoint than the Thor has.

The CHAIRMAN. May I ask you this question, General: Didn't you build five Atlas prototypes?

General SCHRIEVER. I don't quite understand your question. We have fired 20 Atlases already in the test program.

The CHAIRMAN. I am thinking of someone else. With the lunar probe you had five missiles?

General SCHRIEVER. The lunar probe, the first stage were all using Thors.

The CHAIRMAN. Now, did you build five prototypes for the lunar probe?

General SCHRIEVER. No, sir, we just built three, that is all.

The CHAIRMAN. I got the impression from my colleague, Mr. Fulton, that we had two extra there that were not available, not used.

General SCHRIEVER. Actually, there is a Thor-Able series which has been a reentry test vehicle, and the second stage of the Thor Able is the same stage we were using on the lunar shot, but the lunar shot had a third stage in addition. We do have still a number of so-called Thor-Able shots to make in the reentry test program.

Mr. FULTON. They are interchangeable?

General SCHRIEVER. The second stages are interchangeable.

The CHAIRMAN. When are you going to proceed to use those?

General SCHRIEVER. Well, we used one last month and in this particular case we had a completely successful first stage, and we didn't get ignition of the second stage. We have about * * * more shots. They will be fired this year.

The CHAIRMAN. As I read that, it seems to me you were so close to success in two instances there that you would proceed to use the other missiles if there were additional missiles available?

General SCHRIEVER. Well, we were not directed to do so. We had three shots. It would take a little time to put the necessary guidance and control system that is different from the Thor-Able shots. Also, all these Thor-Able shots have Bell Telephone Laboratory guidance systems involved. You may recall my difficulty on the "mouse" situation last year. We are not putting any mice in them now, but we do have guidance in the second stages now of the Thor-Ables in order to get precise hits out in the impact area, and also to give us some early flights on the BTL guidance, which will be part of the Titan program.

The CHAIRMAN. When do you think they will be ready for use? You said you did not get the order to go ahead with them.

General SCHRIEVER. They have been in the reentry test vehicle program. They would have had to have been ordered out of that and redirected ino a lunar probe program.

The CHAIRMAN. They have not been ordered out of that into a lunar probe?

General SCHRIEVER. No, sir.

The CHAIRMAN. Do you think they should be ordered out of that into the lunar probe?

General SCHRIEVER. That is a matter of judgment. There are certain other space probes that we have programed, * * * We are very anxious to get the information that we want on these reentry tests. My judgment would be that we should not redirect these to the lunar probe.

The CHAIRMAN. Well, they are available if you wanted to redirect them, and your judgment is that some other program has a priority over that program?

General SCHRIEVER. Well, in my mind, yes; but there are other things that can be done. There are other ways of doing the same thing, but nothing could be done just overnight. It takes time to get everything set to make a lunar shot. I personally would rather see an attempt made at a larger payload than we can lift with a Thor-Able combination, and use that for further space probes.

The CHAIRMAN. How much further removed, then, will be your probe with a larger payload, in time?

General SCHRIEVER. The Atlas would take up a payload—using the Atlas as a first-stage booster, would take up a payload in approximately the same magnitude as the Lunik, a little bit less, a hundred or so pounds less payload, with the proper combination of second and third stage.

The CHAIRMAN. But I mean if you don't use what you have available now and almost in readiness to be used for the lunar probe, how much longer is it going to take you then to use the other method of building up a rocket with a larger payload?

General SCHRIEVER. Well, of course, there is only a limited number of vehicles available for all of the purposes that have been laid down.

The CHAIRMAN. Don't you think that lunar probe is so important as to use another one of these rockets to try to make it?

General SCHRIEVER. Well, I think it is very important, but there are certain other space projects that I think probably are equally important, or perhaps more so, and these have been directed.

The CHAIRMAN. The reason I ask is because a select committee passed a resolution unanimously asking the Department to go ahead and use the other two available missiles for that lunar probe. You feel, though, that would not be wise?

General Anderson.

General ANDERSON. That is not a decision the Department of Defense can make. This program is under NASA now. Actually, NASA has on its program two probes with about $1,990,000 lined up against them, but they have not directed that these two probes be fired.

The CHAIRMAN. If they directed the firing of those two probes, you could do that in short order, couldn't you?

General ANDERSON. I will refer that to General Schriever.

The CHAIRMAN. We would be glad to have General Anderson or General Schriever, either one, answer that. If it embarrasses you to answer the question——

General SCHRIEVER. No, no, I can't give you the exact time. We have presented dates that we could do certain things. I think it would take between 3 to 5 months in order to get another shot off; in other words, to make the necessary modifications to get another lunar probe off, using the basic Thor Able combination.

The CHAIRMAN. Well, now, if we don't use them, it will be much longer, wouldn't it, to get another shot to the moon?

General SCHRIEVER. Well, I don't know what the Army can do. The Jupiter has the same sort of basic payload capacity as the Thor. They are very similar. There aren't any extra Atlas boosters lying around either because they are all taken up for specific programs.

As a matter of fact, we don't know where we can find all of the boosters that are desired for programs that have been directed on us or that NASA and ARPA want to direct on us, so it is a matter of judgment as to what you want to do and what you consider to be more important from a scientific standpoint and from a prestige standpoint.

The CHAIRMAN. Would you give the Jupiter C the lead then on this lunar probe and take it away from Atlas, because as I read it, it looked like you were very close to success with that probe?

General SCHRIEVER. Yes.

The CHAIRMAN. Then all of a sudden, although you had two of these missiles available you backed away from it and decided to try something else?

General SCHRIEVER. No, sir. We didn't back away from it.

The CHAIRMAN. I am not trying to put the burden on you, but the Government did.

General SCHRIEVER. That is right. As General Anderson pointed out, that is not our prerogative.

Mr. FULTON. As a matter of fact, General, you had three programed and you successfully completed those. The Army has two, one remaining to be done.

General SCHRIEVER. One remaining to be fired.

Mr. FULTON. And you have the equipment on the Thor Able but it is on other programs and the question is whether to use it in the deep probes, or whether to put it back into the lunar probe area.

General Boushey is here, who, I believe, has had some part in the programing of this particular project.

General BOUSHEY. May I make a remark, sir?

The CHAIRMAN. We want to hear you, General.

General BOUSHEY. I would like to remind everybody that the unanimous recommendation of the select committee was made January 2, and Lunik appeared in the skies on January 3. The payload differences between the Thor Able configuration, which on our three lunar attempts is so much lower than the Lunik, that it seemed to me it would be more wise with an attempt were going to be made to do as General Schriever suggests, based on an Atlas booster even though this might take more time.

I discussed this with General Schriever when he was in the Pentagon, I imagine about 2 weeks ago. Of course, as General Anderson has pointed out, these scientific probes are exclusively the province of NASA, and if they want us to do something, they have to ask before we have the privilege.

The CHAIRMAN. As I understand you, General, what you say is this: Even though we were successful with the Atlas-Able shot, the payload was so small that against the Russian success we couldn't make a favorable comparison.

General BOUSHEY. With the Thor as the booster, sir. It might be scientifically very valuable, but the chances of success—again I got this from General Schriever's organization and from General Schriever—the chances of success appeared so marginal that the recommendation would be, if we were asked, I believe, to base it on the Atlas with better guidance and a better chance of success. Is this your understanding, General Schriever?

General SCHRIEVER. Yes; although I don't quite agree that the chance of success of the Thor would be highly marginal. I think, of course, having fired three, that your chances of succeeding go up, because we learn things as we go along, but I heartily agree from an overall prestige standpoint we probably would not gain too much by putting a small payload up there after the Russian Lunik. On the other hand, from a scientific standpoint, it has quite a bit of value. We are talking about something on the order of 80 pounds of payload versus some 600 or 700 or 800 pounds.

The CHAIRMAN. When the select committee passed that resolution unanimously, we didn't know the Russians were going to put the Lunik up in the next day.

Mr. FULTON. We were competitive but not as to size. We said we better get on with the moon shot because the Russians will do it.

General SCHRIEVER. We would like to try from a personal standpoint because you don't like to quit when you haven't achieved your objective. We got pretty close. We came within 2 percent of the

velocity required on the second shot, and third shot we had perfect first and second stage performance and failed to get ignition on the third stage. It is just bad luck.

The CHAIRMAN. It was a tragedy there.

General SCHRIEVER. The Army came reasonably close, too. Their first shot got up to about the same velocity as ours—our second one.

Mr. FULTON. Getting away from the size of the payload, wouldn't it be strategically to your great advantage as the Air Force to be able to orbit the moon regardless of payload, and secondly—I don't know whether I should mention the particular system, but don't you want to prove out to the area of the moon to the Air Force certain systems to contract things?

The CHAIRMAN. And wouldn't pictures of the moon from a relatively close point of view be very helpful?

General SCHRIEVER. I think you would have to say that all of this, at least at the moment, would fall in the area of scientific endeavor and, therefore, would not directly be the responsibility of the Air Force. There is no question but that we would benefit by what we would learn but then this is a matter for NASA to make a decision on.

Mr. FULTON. But that is a strategic gain, if we get these experiments out to the vicinity of the moon we are then keeping America safer and put that into comparison to the two deep probe shots possibly to Mars or Venus that are in prospect for purely basic scientific information.

Wouldn't you gain much more by having your shots and put the effort on to these deep probes you are talking about, under NASA?

General SCHRIEVER. Mr. Fulton——

Mr. FULTON. We want you to stand up for yourself. We want to balance things here. Maybe we are not all for NASA.

General SCHRIEVER. I am going to look at it from the standpoint if I can imagine in my own mind—and I fail to do so at the moment—a military mission involving the moon in any sense at the moment. I am sure that one of these days we will.

Mr. FULTON. Well, I will refer to General Boushey for that. I think he was the first one publicly to say that it has a security value, 2 years ago.

General SCHRIEVER. Then I will let General Boushey speak for himself.

Mr. FULTON. Have you not said that publicly, General?

General BOUSHEY. Yes, sir.

The CHAIRMAN. It does have a security value.

Mr. FULTON. From the Air Force point of view.

The CHAIRMAN. Any further questions?

If not, gentlemen, it is nearly 5:30 and I want to compliment all of the members of the committee for remaining here at this late hour and staying from 10 o'clock on, and I especially want to compliment the Air Force for a very, very fine presentation on a subject that is of fundamental importance to this committee, General Anderson, General Schriever, General Boushey, Colonel Roadman, and all of you for what you have done. We appreciate it very much.

Mr. FULTON. And Mr. Donovan who waited.

The CHAIRMAN. Now, General, do you have something more you want to say?

General SCHRIEVER. No, sir.

The CHAIRMAN. Well, I have this further admonition to the members of the committee. Tomorrow morning there is a shot, but a different kind of shot. It is a photograph of the committee. We will meet at the Veterans' Affairs Committee meeting room at 10 o'clock tomorrow morning.

(Whereupon, at 5:26 p.m., the committee recessed until 10 a.m., Wednesday, February 4, 1959.)