

REVIEW OF THE SPACE PROGRAM

TUESDAY, FEBRUARY 2, 1960

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

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

The CHAIRMAN. The committee will come to order. I want to apologize this morning on behalf of the committee for having to meet in our own room rather than have a larger place in which to meet. The committee's staff made every effort to get a larger meeting room. We tried to obtain the caucus room, the Ways and Means Committee room, Armed Services Committee room, and several other committee rooms, but they were all taken.

We are fortunate in having Dr. von Braun here this morning. We have looked forward to his reappearance before the committee. At the last moment he told us that he has pictures that he wants to present to the committee. That presented another problem to us in our limited space here, but we have arranged to have a camera in this position here. The staff of NASA has been very ingenious in arranging it this way.

When the pictures start, some of the members will have to move over in order to see them. But if you will bear with us, I think we will get along very well.

Mr. FULTON. I would like to welcome Dr. von Braun on behalf of this side and likewise to say I hope he has not too much complaint against this room as a launching pad. Thank you.

The CHAIRMAN. Well, Doctor, do you have a prepared statement this time?

Dr. VON BRAUN. No, sir; I have not. I have brought a motion picture along.

The CHAIRMAN. Whom do you have with you, Doctor, this morning?

Dr. VON BRAUN. This is Mr. Horner, the Associate Director of National Aeronautics and Space Administration.

The CHAIRMAN. Mr. Holaday is here, too. Do you want him up there with you?

Dr. VON BRAUN. No, not as far as I am concerned.

The CHAIRMAN. Doctor, we have adopted the procedure of swearing in all the witnesses. Please stand up and hold up your hand. Do you solemnly swear that the testimony you give this committee in the matters under discussion by the committee will be the truth, the whole truth, and nothing but the truth, so help you God?

Dr. VON BRAUN. I do.

The CHAIRMAN. Thank you, sir. Have a seat, Doctor, and we will be glad for you to proceed.

STATEMENT OF DR. WERNHER VON BRAUN, DIRECTOR, DEVELOPMENT OPERATIONS DIVISION, ARMY BALLISTIC MISSILE AGENCY

Dr. VON BRAUN. We have a 13-minute motion picture which gives a technical report on the status of the Saturn project. After this picture I have two more charts of an unclassified nature which show the effect of the additional funds on the schedule and the program of the Saturn development.

In addition, I have approximately 15 other charts of a classified nature in which I could explain to the committee, in closed session, all the details on where that money would go and what its effect on the program elements will be.

The CHAIRMAN. Do you want to use your motion picture first?

Dr. VON BRAUN. Yes, sir. The motion picture is unclassified.

The CHAIRMAN. When you get ready to use your motion picture, let us know and we will ask the committee members to move to this side so they can see it.

Dr. VON BRAUN. I should like to suggest that we begin with the motion picture right now.

The CHAIRMAN. You would like to begin with the motion picture?

Dr. VON BRAUN. Yes, sir.

(A motion picture of 13 minutes in length, entitled "Technical Status of the Saturn Development," was shown to the committee at this point.)

(The sound track of the motion picture is reproduced as follows:)

SCREEN PLAY—THE SATURN ROCKET

DESCRIPTION OF SCENES	NARRATION
1. Opening scene: Solar system with planets revolving around the sun.	
2. Camera zooms to planet Saturn for closeup.	
3. Film title superimposed over planet closeup.	
4. Title removed and scene of planet remains while narrator explains.	The next step into space has begun. Development has started on a gigantic booster that will give the United States an advanced space capability. The Saturn space rocket will be capable of reaching the planets. It can orbit very heavy satellites—15 tons or more.
5. Fade to CU of model of man, with camera slowly panning up full length of rocket, with upper stages.	When assembly of the first rocket is completed, man will be dwarfed by the immense rocket. It will tower almost 200 feet from its base—as high as a 20-story building.
6. Aerial view of ABMA area-----	Development of the Saturn is underway at Huntsville, Ala., under the direction of the National Aeronautics and Space Administration.
7. Von Braun and others walk out of building.	Dr. Wernher von Braun and his experienced development team started the project in September 1958.
8. Fabrication Laboratory scenes-----	To save time, the experts decided to cluster eight rocket engines of a proven type. Basic engineering problems had been solved in the development of military rockets by the Army Ordnance Missile Command. Work began on the booster, an assembly of nine tanks to carry fuel and oxygen, to provide 1,500,000 pounds of thrust.

SCREEN PLAY—THE SATURN ROCKET—Continued

DESCRIPTION OF SCENES	NARRATION
9. A chart comparing Saturn with Redstone and Jupiter.	The 22-foot-diameter Saturn will tower far above its predecessors, the Redstone and Jupiter ballistic missiles.
10. Forming of a tank bulkhead-----	Fabricating all parts of the rocket, from the largest to the smallest, personnel of the 10 laboratories are working with a sense of great accomplishment.
11. Welding-----	Scientists and technicians brought here from all sections of the country were sure they could produce the challenging objective—a space transportation system.
12. Saturn balance wheel fixture, outside Fabrication Laboratory.	First they built rings that would embrace the tanks. The gigantic size of the first stage could now be envisioned.
13. Fixture in Fabrication Laboratory_	Assembly and checking began within the enormous hangar-type buildings.
14. Sloshing-----	Hundreds of tests were conducted in other laboratories. One major problem to be solved was to prevent sloshing of the fuel during flight. Model tanks helped to find the answer.
15. Wind tunnel-----	Wind tunnel tests of models verified the flight stability of the shape of the booster.
16. H-L motor, still-----	An improved and simplified version of the rocket motor used for U.S. ballistic missiles was to be grouped in a cluster of eight engines.
17. Single motor on test tower-----	These motors have already been tested singly, and have withstood the rigorous firings.
18. Saturn model placed in static tower_	Facilities had to be altered to handle and test this new giant. Major alterations changed a Jupiter missile tests tower so it could accommodate the Saturn. Models were used for planning purposes.
19. Modification work on test tower---	Modifications have been completed on the 178-foot test tower. Complex instrumentation has been installed. The tower must withstand the powerful blast of eight rocket motors generating more thrust than has ever been released. This will be the largest booster yet tested by the free world.
20 and 21. Full size motor cluster in tower.	Awaiting the first firing, the motor cluster section has been fitted to the test tower.
22. Small cluster firing-----	Small scale motors, generating a thrust of 500 pounds each, have performed as expected in testing the concept. The scientists are now confident that the full-sized Saturn can accomplish the planned space missions.
23a. Group of scientists with globe---	Studies have long been underway to select space tasks of more immediate value. One may be a communications system capable of instantaneous transmission of television, telephone, or telegraph signals to any point on earth.

SCREEN PLAY—THE SATURN ROCKET—Continued

DESCRIPTION OF SCENES	NARRATION
23b. Chart of earth with three satellites.	An ideal communications system would include three suitably equipped satellites orbiting around the earth. At 22,300 miles altitude the satellites would remain over the same spot on earth. Messages would be relayed to one satellite, to another, and then back to earth.
23c. Animation of firing sequence----	The Saturn can place these instrumentation packages in the correct position over the equator.
23d. Animation—separation of 1st stage, booster falling toward earth.	At an altitude where the atmosphere thins out, the burned out first stage will separate—and start falling back toward the ocean below.
23e. Animation—parachute opens-----	Parachutes will open to lower the booster into.
23f. Landing in ocean-----	Waiting ships will follow radio signals to the landing spot to recover the spent booster for later study.
23g. Second stage firing-----	Soon after the first stage is dropped, the second stage motors ignite, increasing the speed tremendously.
23h. Third stage firing. Comm satellite.	The third stage builds up the velocity and pushes the payload to the proper altitude and speed. A protective cone is ejected, the sides opened, and the satellite pushed forward to open to its full size.
24. Model of communications satellite.	How the satellite emerges can be seen from this 1 to 12 scale model.
25. Men walk over to model-----	The nose cone containing the payload is many times larger than an average sized man.
26. Man lifts shroud, shows side kick action.	As the last stage nears the planned location over the earth, the nose cone is pushed ahead of the payload. A small side-kick rocket moves the cone out of the path.
27 and 28. Container walls open; satellite lifted out of container	The container walls are opened by spring action, and the satellite is ejected. The container is discarded.
29. Satellite open to full size-----	By automatic action, the communications equipment is opened to its full size, extending 27 feet from one side to the other. Two antennas face the Earth and two may be directed toward the other communications satellites. Power is generated by the solar deck, the oblong white objects. These always follow the Sun from which they draw energy.
30. Full Moon, close up, changing to scene of Moon landscape.	There are many potential uses for the Saturn. One of the first experiments may be to learn more about the Moon, let us follow an artist's conception of the sequence by which instruments could be soft landed on the Moon. Another Saturn could send two or three men around the Moon and return them safely to Earth.

SCREEN PLAY—THE SATURN ROCKET—Continued

DESCRIPTION OF SCENES	NARRATION
31. Trajectory of Earth to Moon flight (arrow) 7F.	To place instruments on the Moon in a soft landing will be one of the more important steps of the national space program.
32. 3d stage of Saturn, animation 4F--	The same firing sequence will lift the third stage, containing the instruments, to the vicinity of the Moon.
33. 3d stage cover ejected, wheels inflate. 10F.	After the necessary speed of more than 24,000 miles per hour is reached, the cover of the payload is ejected. The wheels of a roving Moon vehicle will then inflate.
34. 3d stage reverses, retro-rockets fire (Moon close) 9F.	Small pressure chambers within the third stage will turn the rocket so that the motors will face the Moon. A burst from the rockets will slow the instruments for a soft landing.
35. Chart of wheeled vehicle on Moon 3F.	The scientific package can include a traveling TV broadcasting station—
36. Stationary package on Moon. 2F--	or a stationary information gathering package.
37. Trajectory of manned cone around Moon. 3F.	Another immediate use of Saturn may be a manned trip around the Moon.
38. Cutaway drawing showing men in cone. 5F.	Two passengers can ride within the rocket nose cone, enabling them to observe the dark side of the Moon and to gather scientific information about the natural satellite.
39. Cone dropping to Earth. 14F-----	As the passenger-carrying nose cone starts back toward earth, it must be slowed down so that it will not burn by friction in the Earth's atmosphere. Parachutes will slow the cone in the same way that the Army recovered several missiles.
40. Cone in ocean, radio signals flash. 5F.	Flashing lights, radio signals, water-dissolved dye, and a buoy will direct waiting ships to the floating space ship.
41. Fade—Transporter chart—rocket moved on road.	When the rocket is completed in Alabama, it must be moved to Cape Canaveral, Fla. It will be transported on a trailer from the assembly building to a loading dock.
42. Drawing of loading on barge. 10F--	A river barge will probably carry the giant rocket to Florida. It will begin the 17-day journey on the Tennessee River.
43. Drawing of a river tug. 4F-----	A tug will pull the unusual cargo on its long trip.
44. Animation showing river and gulf route. 8F.	First, down the Tennessee to the Ohio River—then down the Mississippi—across the Gulf of Mexico, around the Florida peninsula—to Cape Canaveral.
45. Model of service tower and block-house. 16F.	At the specially constructed launching site, the booster and upper stages will be erected. A 305-foot superstructure will be used for prelaunch work and for checking the fueling. Before firing time, the tower will be moved by rail to a safe distance from the powerful space rocket.

SCREEN PLAY—THE SATURN ROCKET—Continued

DESCRIPTION OF SCENES	NARRATION
46. Blockhouse model. 15F-----	When fully fueled the rocket will weigh close to 580 tons, of which 500 tons are fuel and oxidizer. The blockhouse—containing checking, firing, and tracking instrumentation, has been planned to provide the necessary equipment and to assure the safety of those who must remain during the fueling and firing operations.
47. Construction work at the cape. 8F.	Before the firing, all buildings and equipment must be ready, inspected, and in working order. Construction is now well within the planned time schedules.
48. Chart showing erection of all stages of Saturn. 5F.	The erection of Saturn at the firing site will mean the end of development work on the first test vehicle.
49. Rocket firing. Chart of launch pad with flames coming from rocket.	As the rocket starts its journey to the Moon or the planets, man will truly have entered the age of space. This space workhorse can be the means of improving our life on Earth—by more accurate weather predictions and worldwide communications—but, beyond this—
50. Animation of Saturn going through the clouds.	Who knows what fantastic changes will come?
51. Radar within dome, turning-----	Each bit of knowledge will bring man closer to the stars.

The CHAIRMAN. Very fine, Doctor, very fine.

Now, will the members resume their normal seating. Dr. von Braun, I think we can proceed with your testimony.

Dr. VON BRAUN. Mr. Chairman, we brought a model along of the Saturn. With your permission, I would like to explain how we propose to phase the Saturn program with respect to the upper stages and then show two charts to give you an account of the impact of the additional funds on the schedule.

The CHAIRMAN. Do you wish to have your model returned to the table?

Dr. VON BRAUN. No; I think we can leave it right there. That gentleman there will demonstrate while I am talking.

The CHAIRMAN. All right, fine.

Dr. VON BRAUN. May I proceed?

The CHAIRMAN. You may proceed, sir.

Dr. VON BRAUN. What you see there is the first version of the Saturn, the so-called C-1 configuration. It will have a booster powered by eight engines of 188,000-pound thrust each as the first stage. This booster carries its propellants in a cluster of eight outer tanks, four of which will be filled with kerosene fuel and four with liquid oxygen, and one central tank which will also carry liquid oxygen.

On top of this booster rides the second stage. Would you lift it off please? This second stage will be powered by four engines of 20,000 pounds thrust each. It will use liquid hydrogen and liquid oxygen as a propellant.

Whereas the first stage is under development as an inhouse project in Huntsville, Ala., the second stage will be contracted to industry.

Just recently we had a bidders' conference in Huntsville which was attended by 35 major corporations. These companies have been given a certain time to make their proposals for this second stage and we expect to have a contractor selected by the 1st of April.

It will take this long to get the proposals worked out by the companies and evaluated by us. On top of this hydrogen-oxygen powered second stage will ride a third stage, which is powered by two liquid hydrogen-liquid oxygen engines which are almost identical with the engines used in the second stage.

This third stage also serves as the so-called Centaur vehicle in the Atlas-Centaur project. Therefore, it will have quite a few flights on record by the time we begin using it as a third stage of the Saturn.

In these earlier Atlas-Centaur flights the Saturn's third stage will serve as a second stage riding on top of an Atlas ICBM which serves as first stage.

On top of Saturn's third stage, of course, is the payload. What you see here then is our first objective in the Saturn program, the Saturn C-1. It gives us an orbital payload capability in the order of 23,000 pounds or 25,000 pounds, depending on the altitude of the orbit, which is far more than anything available today.

But we consider the C-1 only as the first phase of the Saturn program. We propose to develop, parallel to the C-1, a new second stage which will be powered by several engines of 200,000 pound thrust each, in all likelihood four of them. The propellants for this new second stage will also be liquid hydrogen and liquid oxygen.

A contract for the development of the 200,000 pound thrust engine for this new second stage has not yet been let, but it can be expected that it will be let in the very near future. Money for the development of this engine is in the NASA budget and the amount available has also been increased by the recommended additional funding.

The CHAIRMAN. What effect is the recommended additional funding going to have on your program?

Dr. VON BRAUN. Sir, I have a chart that will show that after I have explained the concept.

The CHAIRMAN. All right. Go ahead.

Dr. VON BRAUN. The plan is to switch this new second stage at some later time between the C-1's second stage, and the first stage. In other words, what is the second stage in the C-1 will now become the third stage. This longer configuration we call the Saturn C-2.

For low orbital flights, the C-2 does not need a fourth stage at all, but for high velocity flights, such as transfers to the Moon or the planets, we will use the Centaur rocket which served as a third stage in the C-1 configuration, as the fourth stage of the C-2.

Due to the much greater efficiency of this C-2 rocket, its payload will be more than double that of the C-1. In low orbital flights, where we would fly a three-stage C-2 configuration, the entire slender upper portion will be payload, and the orbital net payload in this case will be in the order of 45,000 pounds.

For high-speed missions, the lower part of this slender upper portion will be made up by the Centaur rocket serving as fourth stage. The payload, of course, will be somewhat less in this case because of the higher speeds required. But it will still be adequate to carry, say, two men around the Moon and back, or to land a very substantial payload

in a soft landing on the Moon. It will also be adequate to carry a rather sizable automatic radio relay station down to the surfaces of Mars or Venus and radio back some scientific information on these planets.

The CHAIRMAN. Will you be able to salvage any of the stages?

Dr. VON BRAUN. The first stage will be recovered in all flight missions. The second or third stage will not be salvaged, but the third stage, of course, may land in an orbit. In certain flight missions where orbital refueling is used, it can be used again for deep-space missions after refueling in orbit.

Mr. FULTON. Will the two men who go around the Moon have any control over the direction of the rocket or is there a ground command control?

Dr. VON BRAUN. No, sir; they will have the possibility of changing the flight path, but they will depend very greatly on ground tracking. The most accurate tracking data we can furnish these men will still be gained by tracking from the ground.

So the men will be told by radio: You are this far off and in order to correct your flightpath, you have to do thus and so. All this information will be developed on the ground but the space pilots can disregard or override the instructions from the ground, if they so desire.

Mr. FULTON. Will it be done by small vernier rockets attached or retro rockets or will there be a swivel action of the large engines?

Dr. VON BRAUN. Sir, for major path corrections, it is planned to turn on the hydrozen-oxygen engines again. Of course, in order to apply the velocity correction in the right direction, it will be necessary to first put the space vehicle in the proper spatial attitude so that the thrust works in the right direction.

For fine control, that is, when we are talking about velocity corrections of a few feet per second, vernier rockets will be used instead of the main engines.

Mr. FULTON. On the fourth stage of a lunar shot, there has been ground command of a retro rocket. Would you have that on this sort of thing?

Dr. VON BRAUN. The final approach for a lunar soft landing will be done by a combination of ground control from the Earth and sensors in the rocket itself; yes, sir.

The CHAIRMAN. Did you finish your statement, Doctor?

Dr. VON BRAUN. No, sir. I am through with explaining the Saturn vehicle but I still have two charts that show the impact of additional funding on the schedule.

Mr. ANFUSO. I have a question.

The CHAIRMAN. Mr. Anfuso would like to ask a question.

Mr. ANFUSO. Dr. von Braun, when this is operational, could you bury it underground and operate it from underground?

Dr. VON BRAUN. No, sir; this is not intended. All our present plans envision Saturn firings from Cape Canaveral.

Mr. ANFUSO. I see. Of course, you have plans to bury the Atlas throughout the country?

Dr. VON BRAUN. Well, sir, the Atlas, of course, is a weapons system and there is some military interest in hardening the sites so that a hostile surprise attack would not eliminate all our ICBM sites.

Saturn is a vehicle for space exploration with no military applications, at least not for the time being.

The CHAIRMAN. Just proceed with your statement now, Doctor.

Dr. VON BRAUN. This first chart here, Mr. Chairman, shows the new funding level on which we shall operate if the Congress accepts the recommendations made yesterday by the President (fig. 77).

It shows that our original funding level of \$70 million will be upped, in 1960, by \$1.5 million, which is just adequate to put the most critical elements of our operation in Huntsville on overtime.

SATURN FUNDING
(IN MILLIONS)

	1960	1961
S & E	27.9	37.5
C & E	6.2	46.5
R & D	37.4	146.0
	71.5	230.0

FIGURE 77

We still have a few months to go and this \$1.5 million will permit us to work 20 percent overtime in the most critical shops and laboratories.

The sign, S. & E., means salaries and expenses. C. & E. is construction and equipment. R. & D. is research and development, and covers outside contracts and procurement for our inhouse operations.

The CHAIRMAN. What is your total increase for 1960, then?

Dr. VON BRAUN. Only \$1.5 million.

The CHAIRMAN. On all of this?

Dr. VON BRAUN. Yes, sir. The total increase for 1960 is \$1.5 million. In other words, we had \$70 and now it is \$71.5. In fiscal year 1961 the old figure was \$140 million and this has now been upped to \$230 million, or \$90 million more.

Now, actually there is an additional \$8 million increase over and above the \$230 million for additional funds for the development of the 200,000 pound thrust hydrogen-oxygen engine for the C-2.

That is the longer configuration of the phase 2 Saturn. Therefore this engine can be rightfully considered an integral part of the Saturn project.

But all our previous funding exercises had been carried out with this engine considered as a separate project. So for better comparison of the old and the new funding levels we have listed only \$230 million versus the old figure of \$140 million for 1961.

Mr. FULTON. How much did you ask for originally on each of these?

Dr. VON BRAUN. We asked for \$240 million in the original estimate and—

Mr. FULTON. For 1961?

Dr. VON BRAUN. For 1961. And we shall now receive 230 under this new increase.

Mr. FULTON. What do you want now? What would you like to have?

Dr. VON BRAUN. Sir, I believe this present figure for 1961 offers a soundly funded program.

To put very much more into fiscal year 1961 would, in my opinion, mean operating beyond the point of diminishing returns. You can always spend more money, but to spend it wisely is a more difficult problem.

Mr. FULTON. How about at the end of 1960 fiscal year, June 30?

Dr. VON BRAUN. Well, sir, of course, had we had more money in fiscal year 1960, at some earlier time, that would have helped, there is no question about it, but most of that fiscal year 1960 is now over.

Mr. FULTON. That is enough though now, this figure here?

Dr. VON BRAUN. Yes, sir.

The CHAIRMAN. I want to suggest this, that we either stop now and question the doctor, or let him finish. I think it would be wiser to finish because when we call upon our members for questioning it is going to take some time.

Dr. VON BRAUN. Could I have the next chart?

This chart shows the impact of that new funding level on the schedule (fig. 78).

Now, this black bar indicates the Saturn research and development firings. In both cases, old funding level and new funding level, we have assumed that 10 research and development firings are necessary before we would be ready to call the C-1 configuration (which is not the long configuration, but the short interim one) operational. "Operational" means that we can now entrust major scientific missions to it.

You will see that under the old funding program (which provided \$70 million in fiscal 1960 and \$140 million in fiscal 1961), there was to be one experimental firing in 1961, two more in 1962, three more in 1963, four more in 1964, so that by the end of 1964, all 10 experimental R. & D. vehicles would have been fired and in 1965, we could have fired No. 11, the first operational firing.

Now, the increase of funds from \$70 million to \$71.5 million in fiscal 1960 and from \$140 million to \$230 million in fiscal 1961 will permit us to telescope our 10 research and development firings into 3 years.

In other words, there will now be one firing in 1961, which we cannot speed up very much. There will be three in 1962, as compared to two; five in 1963 as compared to three; one in 1964 instead of four; and

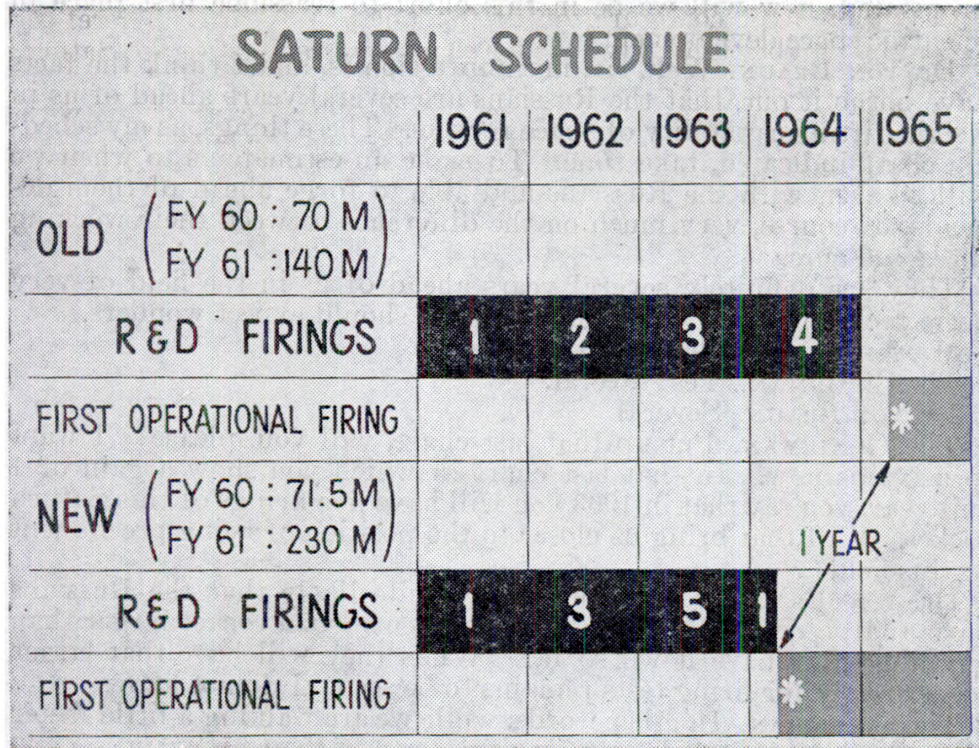


FIGURE 78

in the second quarter of 1964, we will now have the first operational firing with No. 11.

So there is a flat gain of 1 year with respect to the end of the R. & D. period. This is the point I would like to put across.

The CHAIRMAN. It is much better.

Dr. VON BAUN. The new funding plan offers a gain of 1 year; yes, sir. This ends my presentation.

The CHAIRMAN. Thank you, Doctor. Thank you very much for your statement.

Now, the additional sums given you by the President will put you in good shape on the Saturn program to go ahead at your most rapid optimum speed. Is that right?

Dr. VON BRAUN. Yes, sir. I feel that to speed the program up much beyond the present funding rate would be very difficult, if not impossible.

The CHAIRMAN. It would be wasting money?

Dr. VON BRAUN. Yes, sir.

The CHAIRMAN. Now, Doctor, about a year and a half ago, possibly 2 years ago, you told our committee that we were behind Russia in space development. At that time a great many people throughout the country doubted the correctness of your statement. Now, I believe that almost everybody will fully agree with you that we were behind Russia and we didn't realize it.

The idea of this program now is to catch up with Russia in development. Can you tell us now, with the additional amount of money which the President has recommended to Congress be ap-

propriated, how will we be in this effort to reassume first place in scientific space development?

Dr. VON BRAUN. Well, sir, my impression is, and I think the facts have borne it out, that the Russians are several years ahead of us in weight-lifting capability of space rockets. These things, as my schedule chart indicated, take time. To make an estimate as to when we will be even with the Russians and able to forge ahead of them depends, of course, very much on the difference between their working speed and ours.

They are definitely several years ahead of us in the field of very large rockets, and I do not think that we should expect wonders.

Mr. ANFUSO. Did he say several?

The CHAIRMAN. Yes; several.

Dr. VON BRAUN. Several.

The CHAIRMAN. Put up that last chart, will you, please? I want to ask this now. In that last chart in which you show a gain of 1 full year, you say that in 1963 you will have five firings of this Saturn rocket. Will that bring us closer to the position of being preeminent in this field?

Dr. VON BRAUN. Sir, I consider it quite likely that the Russians have a large new rocket under development, too, a rocket larger than anything they have flown so far. When they will have that larger rocket ready for firing tests remains to be seen. I do not know.

The CHAIRMAN. In other words, while we are walking a little faster in our program, they also are moving ahead in their program.

(Dr. von Braun nods.)

The CHAIRMAN. And you feel that they have got a larger rocket than the Saturn rocket?

Dr. VON BRAUN. This I cannot state with definitude. All I was saying is that it is quite likely that they have a rocket under development which is larger than anything they have fired so far. Whether that new rocket will be as large as Saturn or even larger, I am—

The CHAIRMAN. Well, is it a rocket they have tested? Could you say whether they have tested it or not?

Dr. VON BRAUN. I have no information to that effect. No, sir. I would only consider this a logical step for them to take.

The CHAIRMAN. Now, you feel with this additional recommendation of money then, our Saturn program will be all right?

Dr. VON BRAUN. I think a speedup of the Saturn program is the wisest move we can take at this time.

The CHAIRMAN. You have been ordered transferred, since you were here last, from the Army Ballistic Missile Agency to NASA. Would you want to make a comment on that, in open session?

I think in fairness to the public and the press, they would like to know whether, Doctor, you are satisfied with the change that you and your team are undergoing now in the space development program? Are you thoroughly satisfied with it?

Dr. VON BRAUN. Yes, sir, I am.

The official transfer, of course, has not taken place yet. So while we are not in a position yet to say exactly how the transfer will speed things up, one can see already many highly satisfying signs in our relationship.

For example, a few weeks after the President's transfer decision, Dr. Glennan appointed a joint NASA-ABMA committee which

within a few weeks resolved the question of the configuration for the Saturn upper stages. Up to that time this question had been entirely open.

We had been unable to make our own recommendations stick, because there were conflicting opinions and conflicting interests of the several potential users of Saturn. Now, NASA stepped in, appointed a fact-finding committee which within a few weeks buttoned this up. On the basis of its recommendation, Dr. Glennan made a firm decision on what kind of upper stages Saturn should have.

Also, apparently NASA was very successful in getting us the funds we have been trying to get all along, so those two facts alone, I think—

The CHAIRMAN. When we were down in Huntsville, you were having difficulties, we remember, in obtaining funds for the development of your program, weren't you?

Dr. VON BRAUN. Yes, sir.

The CHAIRMAN. Now, you are getting the money and NASA seems to have the knowhow on getting the money. That is something to think about.

This committee has a resolution before it which might actually speed up the transfer of you and your team to NASA. In the event we can work out with committee approval a program to actually speed up the transfer, would you or your team have any objection to that?

Dr. VON BRAUN. No, sir, we would greatly favor it. Much work has been going on between NASA and the Army about the details of the transfer. The cooperation has been quite cordial and efficient, but we are, of course, hampered by the fact that up to this stage, there is no firm decision yet whether or not the transfer will take place. As a result, we cannot commit ourselves to any definite actions.

The CHAIRMAN. Well, thank you, Doctor. I have many more questions to ask you, but this committee operates under the 5-minute rule and I don't want to transgress on that rule. We have a big clock here where we time them all, Doctor. So I am going to yield to my colleague, Mr. Martin, who has just come in here. Would you care to ask Dr. von Braun any questions about this now, or would you rather wait?

Mr. MARTIN. I would rather wait until I hear something.

The CHAIRMAN. Glad to have you anyway.

Mr. Miller?

Mr. MILLER. I will join Mr. Martin and wait.

The CHAIRMAN. Mr. Fulton?

Mr. FULTON. We are glad to have you here, Dr. von Braun. I would like to ask you something with regard to the resolution of Mr. Sisk of California, House Joint Resolution 567, to transfer immediately the Development Operations Division of the Army Ballistic Missile Agency to the National Aeronautics and Space Administration. A good many of us on this committee, including myself, think that is a fine idea. Do you agree with it?

Dr. VON BRAUN. Yes, sir, I do.

Mr. FULTON. And it would help you on efficiency and it would likewise be able to set your policy of administration much quicker and better, would it not?

Dr. VON BRAUN. Yes, sir. In particular, it would enable us to commit ourselves definitely to new people that we want to hire, which we cannot do right now.

Mr. FULTON. So you would recommend prompt action on such a resolution?

Dr. VON BRAUN. Yes, sir.

Mr. FULTON. Then the next problem is this: you are sure that you have enough on the funding, both in the fiscal year 1960, ending June 30 of this year, as well as in fiscal 1961, ending on June 30 of next year, to give you the best and the optimum approach to the Saturn schedule and program?

Mr. HORNER. May I respond to that question. There is, in order to meet this schedule, a requirement for some of the added funds that are shown in 1961 to be applied during the latter months of this fiscal year.

The actual mechanics—our recommendations for the actual mechanics of taking care of that problem aren't quite firm yet. We are looking at several different possibilities. When the request for authorization is transmitted to Congress, we have considered inserting language making possible use of the money early, making the money available to us early, at the time of the appropriation.

We are also investigating the possibility of doing some reprogramming to make money available early and then reprogramming back again after the appropriation is available. Whatever the final solution, the final recommendations, we will make them known to the committee immediately, but we do still have to take care of that problem in order to start the acceleration of the program earlier than the next fiscal year.

Mr. FULTON. I am glad to have that statement of Mr. Horner. Now, on the operational end, I want to ask Dr. von Braun, as the head of this team, is that perfectly satisfactory to you and are you getting enough money? Because if you aren't, regardless of party or politics, some of us on this committee are going to give it to you as a result of some of your briefings down at Redstone Arsenal.

Dr. VON BRAUN. Sir, as Mr. Horner just pointed out, there is a temporary problem with regard to fiscal year 1960. We cannot touch the \$230 million before the 1st of July and any time lost between now and the 1st of July would, of course, retard the program somewhat. But NASA has assured me that ways and means will be found to bridge this gap somehow.

Mr. FULTON. They certainly ought to be able to switch funds from other programs, because they have pretty broad leeway.

Mr. HORNER. We would want to keep the committee advised if we do that.

The CHAIRMAN. I think you should.

Mr. FULTON. You will then bring up to us whatever is necessary, Mr. Horner, to give that proper authority?

Mr. HORNER. Yes, we will.

Mr. FULTON. The next problem is this. Dr. von Braun, when you were before the select committee, of which some of us were members previously, you said there should be emphasis in the space program on research and development much beyond military weapons programs and you felt that that was an essential to the defense of this country

and to the keeping abreast of Russia in the scientific field. Do you still feel that way?

Dr. VON BRAUN. Yes, sir. What I was referring to—and I still hold that belief very strongly—is that there is always the tendency that weapons systems—or even space transportation systems like Saturn—which you can describe in detail will receive a higher priority and more funds than the kind of research and exploratory work that is necessary to lay the scientific and engineering groundwork to do all these things.

Mr. FULTON. I had said to you on page 25 of the select committee hearings, I guess it was April 15, 1958, “then you would really recommend”—this is myself speaking—“then you would really recommend a body in the administrative branch that is a civilian body for the space agency, having cognizance a good bit like the Atomic Energy Commission would, is that about your view?” You answered, “Yes.”

“You have recommended a change in program that the United States should not continue research and development that serves only an immediate military use. I believe that is good. I think you feel that we should broaden the space of the program and look at it not only in the missiles and weapons system area but likewise in the vehicle and spaceship fields, is that right?” And you said, “Yes, sir.”

Now, do you still feel that way?

Dr. VON BRAUN. Yes, sir. We find that within the National Aeronautics and Space Administration there is a very great awareness of the necessity for research. The former NACA around which NASA was built, has a research background of many years—

Mr. FULTON. I only have one more minute so I want to get a point in. The problem comes up when you have once had an experimental making of a vehicle; then the second vehicle is really a carbon copy or some revision of the first—a modification of the first. Why isn't it possible for you to speed your schedule when you come into more or less a department store operation, or a modification operation of your main vehicle program? Why can't you do it faster than 1, 3, 5 years? Why couldn't you move it up so that we could have a manned space platform, for example, in 1961?

Dr. VON BRAUN. Sir, the mechanism of developing such space rocket vehicles works goes something like this. You build a vehicle, you test fire it and then something may happen. Even if the flight was apparently successful you may discover some discrepancies as you evaluate the results. It takes time to first get the raw data reduced, to analyze the results and to diagnose the deficiencies. Then you have to go into reengineering of the faulty component. Then you have to build it. Then you have to test it on the ground again and only after all this has been accomplished can you proceed with the next firing.

Mr. FULTON. You think this, in conclusion, that the Mercury program, which is the man in space project, the Atlas booster, the Centaur, as well as the particular project we are talking about here, the Saturn, are necessary and essential steps that must be quickly taken in space in order to catch up with Russia and, secondly, for the security and safety of the United States as well as our scientific advance, do you not?

Dr. VON BRAUN. Yes, sir.

Mr. FULTON. That is all.

The CHAIRMAN. Mr. Anfuso?

Mr. ANFUSO. Dr. von Braun, I want to thank you profusely for the great job you are doing, but I am not going to do it because I want to save time.

By 1964 you will have the first operational Saturn, the earliest. Is that correct? 1964?

Dr. VON BRAUN. Yes, sir.

Mr. ANFUSO. Now, have you any idea where the Russians will be at that time, considering their research, the amount of money they are spending, and the amount of money we are spending?

Dr. VON BRAUN. I suspect that they will not let off and even with this speedup in our own Saturn program it is quite doubtful whether in 1964 we will be ahead of them. We are just trying to do our best.

Mr. ANFUSO. They may be on Mars by that time.

Dr. VON BRAUN. They may definitely be on Mars.

Mr. ANFUSO. Do you think that we will ever catch up unless we do something much more drastic?

Dr. VON BRAUN. We will just have to keep running. That is—

Mr. ANFUSO. Doctor, wasn't General Medaris supposed to join your team under the new setup under NASA?

Dr. VON BRAUN. No, sir. I think this was never contemplated.

Mr. ANFUSO. Do you find that we are not making it attractive enough for keeping good men, such as yourself, for example, in the Government? I know at one time I read somewhere where you were considering resigning. Do you find that we, as a democracy, lack the means of keeping good men in this field?

Dr. VON BRAUN. Sir, I think the great difficulty in a field like the development of a space transportation system lies in the fact that you cannot simply contract the whole package job to one industrial corporation. There simply is no single industrial corporation in this country that can competently tackle all problems involved in a vehicle like the Saturn, from guidance and control to radio equipment, from liquid hydrogen to rocket engines, from celestial mechanics to launching operations, from human factors research to airframe building, and so forth. So Uncle Sam has to go to a great many contractors, if he wants to utilize his national resources and have American industry make an optimum contribution. But this puts the burden of coordinating such a program on the back of Government agencies. On the other hand, experience has shown time and again that in Government agencies you cannot build up and retain competency over any length of time unless you give Government personnel the possibility to keep in intimate touch with the hardware and its problems. This is the great cause for and the real reason behind a Government inhouse rocket development operation, such as we have it in Huntsville. If we would convert Huntsville to an all-out contracting operation without any continued inhouse work, our best people would soon run away and say: "Here I get rusty. I go to where the contracts go, because that is where the interesting work is done." Soon we would have no capability left to coordinate the overall Saturn effort.

Mr. ANFUSO. Can you recommend to this committee certain methods of improving our negotiations with private industry and bettering our own Government setup in order to speed up this work?

Not now, but can you do that maybe in writing for the committee?

Dr. VON BRAUN. I think one of the problems, maybe the biggest

problem with Saturn is that any large inhouse Government operation in this country is unpopular. The belief that all you have to do to get a job done is to give it to industry is as widespread as it is fallacious. Of course, we expect American industry to do most of the work on Saturn. Of course we want to keep our inhouse operation down to the minimum necessary. But of any \$10 spent in this field it is a good idea to keep \$1 in the coordinating Government agency in order to be able to determine how to spend the nine others wisely in industry. It is that \$1 that we are having most of our difficulties with.

Mr. ANFUSO. Dr. von Braun, when did you first come to the United States, and when did you join the U.S. Government?

Dr. VON BRAUN. In 1945, sir—September 1945.

Mr. ANFUSO. Dr. von Braun, Secretary of Defense Gates has testified before this committee that in 1953 our Government had the decision to make whether to develop the large thrust that you are now trying to develop or the warhead. We chose, said Secretary Gates, to develop the warhead. In your opinion, would it have been more advantageous to the security and well-being of the United States to have done both?

Dr. VON BRAUN. Sir, you are referring to the decision to wait with the ICBM development until warheads became smaller?

(Mr. Anfuso nods.)

Dr. VON BRAUN. Looking backward, it may have been better had we not waited that long and had we gone into active ICBM development while our warheads were still heavier. This is obviously what the Russians did. But, then, the Russians didn't have a potent Strategic Air Command. I think the decision to delay the ICBM development in this country was made because it was felt that the Strategic Air Command provided an adequate deterrent power. So looking at the overall picture it really didn't look so bad at that time.

Mr. ANFUSO. We relied on the Strategic Air Command. Is that correct?

Dr. VON BRAUN. The overall military posture, particularly in the deterrent area, was considered adequate at that time because of our airpower.

Mr. ANFUSO. Isn't it a fact, Dr. von Braun, that both this country and Russia have developed methods of detecting bombers coming over their land, whereas we don't have any detection or defense as far as ICBM's are concerned, at least not at the present time?

Dr. VON BRAUN. Not at the present time, sir. That is correct.

Mr. ANFUSO. And we won't have any for maybe 4 or 5 years?

Dr. VON BRAUN. That is correct.

Mr. ANFUSO. So that has placed us at a disadvantage? They have an ICBM that can strike us from any part of the Earth and touch any part of the United States, any base they want, and we cannot solely rely on air bombers, can we?

Mr. VON BRAUN. No, but in the meantime, of course, we have ICBM's also.

Mr. ANFUSO. We have. But they will have by 1962 about a thousand operational, while we won't have anywhere near that number, will we?

Dr. VON BRAUN. Sir, I am not familiar with the Russian production figures.

Mr. ANFUSO. That has been testified here, that by 1962 they will have about a thousand ICBM's, and at the most we will have 150. That would place us in an inequality of defense, would it not?

Dr. VON BRAUN. Well, I think, as I say I do not know anything about relative production figures, but I have the feeling the Russians just—they started earlier, have a larger ICBM, you might say they have an older model.

Mr. ANFUSO. If that is so, considering bombers and everything else, they will have by 1962 a greater striking power against the United States than we will have against them. Isn't that so? If that is so?

Dr. VON BRAUN. If the figures that you just quoted are correct, it seems this is the case; yes, sir.

Mr. ANFUSO. Thank you.

The CHAIRMAN. Let me suggest this to the members of the committee. Dr. von Braun is available to us today, but he has to leave this afternoon. This afternoon we have two rollcalls on the floor of the House. Dr. von Braun wants to talk to us in executive session before he leaves. Now, we can continue this open session questioning and take a chance on meeting again this afternoon in between rollcalls, or go into executive session at say, 20 minutes to 12 o'clock and give him 20 minutes in executive session.

Mr. FULTON. I think the other members want to question him. I suggest we just go ahead with it at the present time.

The CHAIRMAN. I know they do.

Mr. FULTON. I think it is going well.

The CHAIRMAN. We will go ahead and just before closing time we will go into the problem again. Mr. Osmer's?

Mr. OSMERS. Mr. Chairman.

I would like to ask Dr. von Braun about the little bit of information about the chart. Dr. von Braun, it is only for fiscal year 1961 that you have listed any expenditures of money.

Now, you have, however, in 1962, 1963, and 1964 listed the number of research and development firings. What level of spending are those estimates based on?

Dr. VON BRAUN. Sir, we have exact figures on which this research and development firing schedule has been based.

Mr. OSMERS. Is it approximately a continuation of the \$230 million level?

Dr. VON BRAUN. Yes. It is approximately a constant level for the next 2 years.

Mr. OSMERS. Then, logically the next question would be this. I agree that you do reach a point of diminishing return, particularly early in the program. But, as the program matures and becomes more sophisticated, I was wondering whether in future fiscal years—not in 1962, or should I say not in 1961, but in 1962, 1963, and 1964, whether a sizable increase in the amount of money for those fiscal years would produce a noticeable quickening in the program?

Dr. VON BRAUN. Sir, my appraisal of the situation is as follows: Right now we are at the beginning of the program and, as I said, much more money would not necessarily speed it up. It would, of course, enable us to try parallel approaches. Further increases in funding would permit us to play it safer, to buy assurance to the program,

but it would not necessarily speed it up. In the wartime atomic energy program there was a time when nobody knew whether uranium 235 or plutonium was the better answer, but there was enough money available to try both approaches. This is the kind of thing you can do when you have unlimited funds available. But I have no doubts that this Saturn rocket can be designed and built the way we are planning it now, that there is very little fundamental risk involved. We think it is just a question of getting a difficult job done. Now, by the end of calendar year 1960, after we have gathered extensive captive firing experience, and again by the end of calendar year 1961, when we will have free-flight tested the first of these Saturns, we may be able to appraise our situation much better than now. If the program is moving along smoothly, it may very well be that we would come and say: "Now, an additional \$200 million over what we had estimated in January 1960 may help a great deal." It is for this reason that it would be unwise for us to commit ourselves at this time to a definite Saturn funding level for the fiscal years 1962, 1963, and 1964. After all, we may be reminded of the figures we have quoted, and it would be kind of embarrassing to come back and say: "Now, if you give us more we could speed it up further."

Mr. OSMERS. Of course, Mr. Chairman, I think Dr. von Braun could also be correct. We might run up against obstacles in connection with the program that would not allow us to proceed at the speed indicated on the chart. Now, if I may, I would like to go from the chart and ask Dr. von Braun a question which, while not directly related to his duties, is very close in its application. That is the question of the basic system of scientific education in the United States. Do you feel, Dr. von Braun, that this Nation is carrying on a program of education at the elementary, secondary, and college levels that is required in connection with the scientific problems which the Nation faces?

Dr. VON BRAUN. My answer is that, by and large, the engineers we hire from American schools have an adequate training for their jobs, but the question remains whether that training could be more intensified.

I believe we should realize that for the Russians, who are our main competitors in this field, a professional education has now become the main requirement for a successful career in the Soviet Union. Under Stalin, the way up for an ambitious young man in the Soviet Union led through the Communist Party machine, but I think there are many indications that today a good professional education and a degree from, say, the University of Moscow may be a more popular and more effective approach.

Mr. OSMERS. May I inject a question there? As I gather it, you feel that the quality of the engineers produced today in this country is good. May I ask you about the quantity? Are we training enough scientists and engineers? When you, sir, seek assistants in Huntsville, or industry seeks help, are there qualified people available to do all that needs to be done for the defense and the civil advancement of the Nation?

Dr. VON BRAUN. Well, sir, in this respect rocketry is pretty well off because it is a highly popular field. So far we haven't had very great difficulties in finding adequately trained people in our field. If you

look at the total numbers of engineers and scientists that Russia is producing every year, and compare these with the figures in the United States, I think the aspect is really frightening.

Mr. OSMERS. That is the point I wanted to emphasize, Mr. Chairman.

The CHAIRMAN. Mr. Sisk?

Mr. OSMERS. Could I ask one more question?

The CHAIRMAN. Yes; although the gentleman has consumed his allotted time.

Mr. OSMERS. Yes, I realize I have. But there has been a great numbers game in the United States conducted with regard to the number of missiles which the Russians have and the number of missiles which we have. Would you agree with this statement of mine: That we will have no major war unless an aggressor has a reliable antimissile missile?

Dr. VON BRAUN. This is hard to tell.

With antimissile missiles one can defend only limited areas of high priority. Any country could ruin its economy if it tried to protect every square foot of its real estate against enemy ballistic missiles.

Mr. OSMERS. May I ask this question, then? Isn't it unlikely that a nation unable to defend itself from the ICBM's of another nation will take aggressive action with an ICBM attack?

The CHAIRMAN. Mr. Sisk, I am going to recognize you next.

Mr. SISK. Following Dr. von Braun—

The CHAIRMAN. Did you finish your answer, Doctor?

Mr. OSMERS. No.

Dr. VON BRAUN. I wish I had a crystal ball.

The CHAIRMAN. Mr. Sisk?

Mr. SISK. Dr. von Braun, I want to express my appreciation to you for your statement in support of my resolution a little while ago. The resolution represents an effort to speed up this transfer, because I think that certainly anything that would speed up this situation would be helpful.

Following the questions asked by my colleague, Mr. Osmers, on the educational situation, are you, Doctor, getting all the qualified people you need on your team in Huntsville?

Dr. VON BRAUN. Sir, our difficulties are not caused by the fact that there may not be enough capable engineers in this country, but there is the very mundane question of Government pay versus industrial pay, and that problem, of course, limits our ability to attract the right people.

Mr. SISK. All right. One further question, then, on the subject. Would your work be substantially aided and your program substantially expedited if you were able to pay a little better salary to some of these people on your team?

Dr. VON BRAUN. Yes, sir. This problem is closely connected with the number of excepted positions available to NASA. NASA had a total of, I believe, 250 excepted positions approved by Congress when the Space Act was passed, but at that time, of course, there was no plan to transfer our team to NASA. Now, that we are being transferred, the problem is that most of these excepted positions have already been committed to people and there are very, very few left

for us even to fulfill the tentative and long overdue promises of higher pay that the Army made to many of our personnel a long time ago. As a result, our immediate difficulty is that we are not only unable to hire new first-rate people. We even have difficulties persuading some people to stay with us. These men have been hoping for a long time to get a super grade or an excepted position and the number that NASA now has available for us is, as I said, very, very limited.

Mr. SISK. In other words, this is something definitely that the Congress could do to substantially aid the situation?

Dr. VON BRAUN. Yes, sir; very much so.

Mr. SISK. This, actually, is of some urgency, then, is it not?

Dr. VON BRAUN. Of very great urgency, sir, yes. If you look at the numbers involved here, the Development Operations Division in Huntsville will make up approximately 30 percent of the total personnel strength of the National Aeronautics and Space Administration. To put it another way, the transfer results in a 50 percent total increase of NASA's strength. But of the 250 excepted positions in NASA we may get only 20, which is less than 10 percent. Those would be in addition to 18 existing supergrades or Public Law 313 positions which would be transferred from the Army to NASA along with the individuals in those jobs.

Mr. SISK. I would like to have you or Mr. Horner furnish for the record, as quickly as possible, a definite statement on this situation, because, in the transfer of this great number of people, I realize the problem you are concerned with. Mr. Chairman, I feel it is something this committee has a very grave responsibility in meeting, because, if we seek, as I feel certain we do in all sincerity, to give Dr. von Braun all the tools with which to work, he must have the right people. People are, I think, still the most important single element in the program. Isn't that true?

Dr. VON BRAUN. This would be the most important single area that I could think of where you could help us effectively.

The CHAIRMAN. Doctor, will you supplement the record with that statement?

Dr. VON BRAUN. Yes, sir.

(The information requested is as follows:)

ADDITIONAL STATEMENT OF DR. WERNHER VON BRAUN IN JUSTIFICATION
OF ADDITIONAL NASA-EXCEPTED POSITIONS

In response to requests during my February 2 testimony before the House Committee on Science and Astronautics, I agreed to furnish the committee more details on the need for additional excepted positions to assure that the Huntsville leadership continues to make a contribution to the Nation's space program. The following information bears on this subject.

1. Previous history of supergrade positions for the Development Operations Division, ABMA

When the President's decision to transfer the Development Operations Division to NASA was made on October 21, 1959, 19 members of the Huntsville team were in positions at rates of pay in excess of the GS-15 level: In addition to my own position, 12 of my colleagues are in Public Law 313 jobs at rates of pay ranging from \$17,500 to \$19,000, the maximum payment under this law. Six others are in so-called supergrade positions allocated by the Civil Service Commission (one a GS-18 and the other five at GS-17). Eighteen of this total of nineteen incumbents will transfer to NASA and the President's plan would trans-

fer their job allocation to NASA as well; the remaining one position is held for Dr. Arthur Rudolph, the Pershing Missile Project Director, who remains with the Army until his weapons system assignment is completed.

These 19 positions had come from an overall Department of Defense allocation as a part of the Army's share in competition with the rest of the armed services. Although the number is far less than the need, this represents substantial progress in the brief 4-year history of the ABMA. At the time ABMA was created in February 1956 one GS-17 position (mine) had been allocated to the Development Operations Division. By the end of 1956 we had succeeded in obtaining a total of 17 such positions including the conversion of my position to Public Law 313. Since then, only two additional supergrades have been obtained; there have been several efforts, however, to obtain additional supergrades. Since September 1958, eight other incumbents and two vacant positions have been awaiting allocation at the Civil Service Commission. These 10 positions have survived all the priority contests within the Army and the Department of Defense. Apparently only the lack of sufficient spaces in the congressional allocation to the Commission has precluded final approval.

In June 1959 the Development Operations Division submitted a new list of 53 additional positions. This included the 10 pending at the Civil Service Commission plus 33 new requests for incumbents, and 10 supergrade vacancies for which we have been seeking the right man for the job. Out of this request for 53 more slots, General Medaris, then the AOMC Commander, had approved and forwarded to the Chief of Ordnance for his consideration a total of 28. These recommendations were submitted to Washington on October 12, 1959 (just prior to the NASA transfer decision).

To date, the 19 superpositions actually available have been assigned to the Director, my deputy, Mr. Rees, our 10 laboratory heads, 3 deputy directors of the major laboratories, the head of our high-frequency branch, and 3 of our major project directors. Thus far, with one exception it has been impossible to recognize any of the major technical branch chiefs even though a number of these rank among this country's finest experts in their particular field of specialty.

The 10 positions pending at the Commission, and the remaining 18, which make up the total of 28 positions recommended by AOMC before the President's transfer decision, in general, would have extended recognition to the deputy directors of the other laboratories, and would elevate 20 branch chiefs out of the 51 technical laboratory branch chiefs (or what might be called the key "research team leaders") in the Development Operations Division.

2. Losses of key personnel

We have endeavored to analyze for the committee what our losses of key personnel have been since the original group of German scientists came to the United States. In any analysis of resignations of people in the research and development field, the problem is who you lose rather than how many you lose. For example, the attractions of higher pay in industry have been such that since 1949 our Guidance and Control Laboratory has had three directors; our Structures and Mechanics Laboratory has had four directors; and our main Test Laboratory has had two. These were all losses to higher paying industrial positions. In addition, we similarly have lost individual outstanding scientists such as the three who went to the Convair Co. alone: Dr. Krafft A. Ehricke, Dr. Walter Schwiedetzky, and Dr. Hans Friedrich who was one of the key Convair people in the development of the Atlas guidance system.

The original group of German scientists who had actual rocket development experience at Peenemuende included 136 individuals of which 116 came in 1945 and 20 in 1948. Out of these 136 in the last 11 years we have lost 49 or one-third of the total. The most striking fact to us was that 22 of these individuals had doctor of philosophy degrees. Practically all of these cases were related to financial considerations which led the men to seek other work in industry. More often as not, when I appealed to such a man to reconsider his plan to leave, he would tell me that he was fully aware of the fact that that new job would be less attractive from the point of view of scientific or technological challenge, but that it offered a substantially higher salary and that he just could not deny his growing children a college education, etc. The resulting losses by years are as follows:

1948-----	2	1954-----	4	1958-----	1
1949-----	15	1955-----	3	1959-----	1
1952-----	9	1956-----	3		
1953-----	7	1957-----	4	Total-----	49

Most important to us is that a high percentage of those individuals who left the Government to enter industry had advanced doctorate training in fields of science and engineering. It has been practically impossible under prevailing rates of Government pay to attract into the Huntsville organization American-trained Ph. D.'s as replacements of those we had lost. At the present time there are some 43 Ph. D.'s on our staff of which 10 are American born. One or two have been recruited through our ability to use Army enlisted specialists during their period of obligated service and to offer the more exceptionally trained individuals a civil service career opportunity. To obtain the balance of the 10 we have had to expend extreme effort on a continuous recruiting campaign covering the entire United States.

In the higher levels of professional employees our total losses in number have fortunately remained in check. In grades GS-14 and 15 we have lost 21 individuals, 7 of which were among the original German group. By years these losses are:

1956-----	5	1958-----	7
1957-----	5	1959-----	4

As I indicated in my earlier testimony, however, we have been relying on the "persuasion of promises" to keep many of our best people with us until they see the outcome of the Army's and now NASA's efforts to improve their salaries. If we find ourselves unable to make any great change in the situation our losses through resignation may indeed become much greater.

Upon a careful review of the total situation, I feel that it is certainly in the Government's best interest to develop some method of pay recognition which will assure our retaining a substantial portion of our best qualified, mature scientists and engineers. In addition, we need to be able to offer an attractive career prospect to the very bright young scientist who immediately after his schooling must choose whether he will do research and development in a Government laboratory or seek a technical or managerial post in industry. The discrepancy in prevailing salaries today between Government and industry seems to me too great to make this anything like an equal competition for the Nation's top talent.

3. The availability of excepted positions under the NASA Space Act

The National Aeronautics and Space Administration under section 203(b) currently authorizes a total of 260 positions for which the Administrator may fix a rate of pay in excess of that provided under the Classification Act. Ten of these may be paid rates up to \$21,000, and 250 at rates up to \$19,000. In its first year of operation the NASA has worked diligently to identify the key positions in its organization which required salary rates within the so-called excepted position category. These plans were made long before the Huntsville transfer became a probability. NASA had proceeded rapidly to identify the individuals who could most appropriately fill such positions. As of today, I understand that 208 such excepted positions have been filled and commitments to individuals are pending on 10 others. A total of 137 of the filled positions are located in the various NASA field research centers and 81 are used for the major areas of policy determination and program direction within the headquarters office. The NASA planning for the remaining 42 positions calls for a reserve of 10 positions for the creation of a NASA capability in the field of space biomedical activities, and for other program contingencies. Twelve others are programed for the completion of the NASA Headquarters staffing.

This means that NASA can give Huntsville 20 additional excepted positions within its existing allocation of 260. These 20 jobs, in addition to the 18 which would be transferred from the Army under the President's plan would provide the Huntsville group a total of 38 jobs.

Under questioning by Congressmen Sisk, Fulton, and Miller, I agreed that additional excepted positions would certainly help to assure that the Huntsville group attracts and retains high-caliber people regardless of the still higher salaries industry offers for similar work.

A comparison of the Huntsville staffing with the other NASA research centers indicates that a total allocation of 60 to 70 positions would place this new center

on reasonable parity. A study of the current excepted positions at each center in proportion to the total number of scientists and engineers at each installation shows the following:

Location	Number of scientists and engineers	Number of excepted positions	Percent of scientists and engineers in excepted positions
Langley.....	1,200	37	3
Ames.....	450	20	5
Lewis.....	1,000	30	3
Goddard.....	450	30	7
Huntsville.....	1,353	{ 1 38 2 65	3 5

¹ Current allocation.

² Proposed.

It should be noted from the above that the proportion of professional staff in excepted positions varies between 3 and 5 percent for the established research centers which became a part of NASA when the National Advisory Committee for Aeronautics was abolished.

The 7 percent figure for the Goddard Space Flight Center is higher than the average because this center is still in the early process of organization and is gathering at this initial stage a number of its senior staff members. When the Goddard Space Flight Center approaches its full staffing of about 800 scientists and engineers, the excepted positions will fall within the 3- to 5-percent range outlined for the other centers.

For this reason, a comparable figure for the Huntsville staffing would bring the excepted position requirement alongside the upper level of the existing research centers; namely, 5 percent. This would make a total present requirement of approximately 65 positions, or a minimum increase of 25 to 30 over those which can currently be provided within the existing NASA authority. I choose the word "minimum" with care because these requirements are based upon our present level of scientists and engineers, whereas our new and expedited program assignment under NASA may require changes in the types and proportion of scientists, engineers, and research managers we will need. Undoubtedly, additional future growth requirements will develop both in Huntsville and the other NASA research centers. Provision should be made now for extra spaces in the NASA authority, perhaps as many as 30 to 50, so that we can recognize with appropriately higher pay some of the other, and often younger, staff members as quickly as they develop exceptional competence in this new and growing space program.

Mr. HORNER. This is one of the more difficult areas we have had to deal with in effecting the transfer. We will be glad to provide the committee a statement on the situation.

Mr. FULTON. Why don't you include that in your resolution that we are going to act on this afternoon?

Mr. SISK. I will yield to Mr. Miller.

Mr. MILLER. I have just asked Mr. Ducander to draw up a resolution for me to provide 100 excepted positions in NASA.

Mr. FULTON. Will the gentleman yield?

The CHAIRMAN. I think that is a matter we are going to have to take up in executive session.

Mr. FULTON. You already have House Joint Resolution 567 on which we are going to act on this afternoon. Why not get a temporary recommendation for Dr. von Braun now for that resolution?

The CHAIRMAN. Well, we will take that up in executive session this afternoon. I think all the ideas advanced have been excellent. We will ask Dr. von Braun in executive session on that. Are there any further questions?

Mr. SISK. I will suspend there.

The CHAIRMAN. Mr. Van Pelt?

Mr. VAN PELT. No questions.

The CHAIRMAN. Mr. Wolf?

We welcome Mr. Wolf back. He has been halfway around the world there. I don't know, he may have been watching that Russian rocket land in the Pacific.

Mr. WOLF. Mr. Chairman, may I say that it was a little terrifying to realize that they can launch a missile 8,000 miles, land it in a garden patch, do it twice, do it quickly, and do it exactly as they said they would, and have our own people there to observe it.

I would like to develop that idea a little later if I may, Mr. Chairman. But right now, Dr. von Braun, if I have gotten this picture correctly this morning, our job is not to catch up with the Russians. Our immediate job is to hold our position somewhere behind them. Is that correct?

(Dr. von Braun nods.)

Mr. WOLF. Right now we are not trying to catch up, even. We are trying to hold a position behind them and try not to get any further behind.

Dr. VON BRAUN. They are way ahead of us and still moving faster than we are. So at first we have to build up the working speed that they have and only then we can talk about closing the gap.

Mr. WOLF. That is right. That is why I think our questions here on catching up are just a little premature.

Dr. VON BRAUN. Yes.

Mr. WOLF. The question I would like to develop, if I can, is this: I would like to know what, in your opinion, is the difference in their system and ours that has permitted this to happen? The Russian system of science and technology?

Dr. VON BRAUN. I think this question has quite a few aspects. In the first place, of course, in a totalitarian system it is much simpler for the government to marshal its resources behind one objective which the government decides is important in the national interest. So if somebody in the Kremlin pushes the button, he can get action much more effectively than in a democracy. Then there is the fact that fewer people have to give their consent as to where the money goes. The totalitarian government can send people around much easier, it can assign them to out-of-the-way places without too much consideration of whether they or their families like it or whether they would quit the job. In other words, it is like in a military organization, where you just tell a fellow "You go to Timbuctoo," and he goes.

Mr. WOLF. But scientists, as I understand it, like to be pretty free to develop their own ideas. It would seem as though this would inhibit that. If they can do this, if they can say, "You go here and go there," wouldn't this inhibit their natural ability to develop their thoughts?

Dr. VON BRAUN. I do not think that the Russian scientist always compares his position with that of a scientist in the free world. He compares his plight rather with that of other Russians, and if for all his personal inconveniences the Russian scientists makes more money and has a higher and more respected position in his society, then he feels he is in a privileged position and does not complain.

Mr. WOLF. The other question that I have is this. Do you have any thoughts on how we might tap the resources, the abilities, of some of our allies? I have just returned from Japan. I might say, Mr. Chairman, although I haven't discussed this with you, that I had some fine visits with the head of the Japanese committee comparable to ours, and with the head of their science and techniques committee. They are very anxious to work with us. I know there are others. Do you have any idea how we could better integrate their activities with ours?

Dr. VON BRAUN. There is a great eagerness on both sides to work together. In the military field one of the main stumbling blocks has always been military security. You cannot expect scientists in another country to make very valuable contributions in a field like ballistic missiles, unless you tell them first what the status quo is in your own country. If this status quo is classified information, then they are working in the dark, which is not very satisfactory for them and not very efficient from our standpoint, either.

In space science, in contrast to rocket engineering, the situation, of course, is quite different because most of these things are not classified anyway.

The CHAIRMAN. Are you through, Mr. Wolf?

Mr. WOLF. I just wanted to be sure I understood the answer. Do you have any idea that you would like to give us, either now or after some thought, on how we might better utilize the capabilities that are perhaps available to us?

Dr. VON BRAUN. I think international symposia while desirable, are not the complete answer. I have attended quite a few, and there is always a lot of beating about the bush going on. People would talk only about things you can read in the newspapers and professional journals anyway. The really important and interesting material, being classified, cannot be discussed. I do not know of a more effective way to promote scientific cooperation with our allies than inviting a substantial number of their scientists, well-selected people, of course, to this country and really showing them what is going on here. Thereafter we would sit down and discuss with them the areas in which they thought they could make valuable contributions.

The CHAIRMAN. Mr. Bass?

Mr. BASS. Dr. von Braun, I have heard many people say that the principal reason the Russians are now ahead of us in this space field is because they got started earlier in a serious way. Do you agree with that?

Dr. VON BRAUN. I think this is certainly one very important reason. But I think there is always this other element that in Russia the entire scientific education is conducted, shall we say, on a survival-of-the-fittest basis, and this is not the case here.

Our educational system is based on the premise that every American is entitled to a higher education, so the country is obliged to provide its citizens the means for a higher education. In Soviet Russia, the approach to scientific education is not unlike the philosophy on which West Point is run in this country. The basic idea is that the country needs so many Army officers a year, and the purpose of West Point is not to give American citizens a chance to get a military education but to produce so many professional Army officers a year. The

Russians run their entire scientific educational system on the same basis: The state needs so many physicists, so many mechanical engineers, and so many chemists a year, and the schools are there to provide them. Since the Soviets provide high incentive pay in these professions, there is a great rush to get the required education, but it is a ruthless survival-of-the-fittest training and only the very best will finally make the grade.

Mr. BASS. Do you know when, approximately, the Russians really started a policy of putting great emphasis on space technology, rocketry, and the space field? When did they get started?

Dr. VON BRAUN. From the information I have, I must conclude that the Russian large rocket program started solely as a military program, with Stalin himself making the decision that he didn't care how big the rocket would be to carry an atomic warhead across the ocean, he just wanted one and he wanted it quick.

Mr. BASS. About when—

Dr. VON BRAUN. And then the scientists in Russia said that these new big rockets would offer them the possibility to put scientific payloads in outer space. At first, it seems that these suggestions were highly unpopular in higher circles in the Russian Government. Apparently some people feared such a scientific space program would dilute the military effort.

Mr. BASS. About what time was this, would you say, what year?

Dr. VON BRAUN. Two or three years before Sputnik I, that would have been 1954, thereabouts, 1953, 1954.

Mr. BASS. Well, the Russians got started much before 1954, didn't they?

Dr. VON BRAUN. Yes, but only in 1954 the point had come where the scientific community in Russia saw that the military long-range rocket program was about to produce a rocket powerful enough to carry scientific payloads into orbit. The scientists apparently tried to get some of the new rockets for their purposes and they were turned down. Apparently they were turned down time and again because the military felt this space science project would distract from the military effort. But at the end the scientists got a rocket and Sputnik I went in orbit. The payoff in political propaganda was so high that now the scientists can get anything they want.

Mr. BASS. What were the Russians doing in 1947 or 1948 in this field? Anything?

Dr. VON BRAUN. Yes. They had a program aimed at the development of large rockets going on all this time.

Mr. BASS. So they were putting considerable emphasis in this field in the years just after the last war?

Dr. VON BRAUN. Yes, sir. Indications are that the Russians may have felt that they would never have a chance of catching up with American strategic airpower, so they might as well leapfrog that whole era of airborne, air-breathing, long-range aircraft, and go to rockets right away.

Mr. BASS. We didn't get started on this until quite a bit later than that, did we?

Dr. VON BRAUN. That is correct.

Mr. BASS. So this would be a big factor, wouldn't it, as to the reason why we find ourselves where we are now in this field?

Dr. VON BRAUN. Well, sir, long-range rocket capabilities had been studied in this country since the end of World War II. The Army and the Air Force knew all along what kind of a rocket it would take, at any given year after the Second World War, to carry x pounds of nuclear warheads over so many thousand miles range. But nuclear warheads at first were heavy, and so the studies indicated that rockets of such colossal dimensions would be needed that the designs were considered militarily unmanageable. Therefore the powers in the Pentagon said: If we build this enormous rocket, it will be a white elephant, so let's wait a little longer until nuclear warheads have become lighter and we can do the same thing with a smaller rocket. Maybe we waited a little too long in our reliance on strategic airpower.

The CHAIRMAN. Mr. Mitchell?

Mr. MITCHELL. Doctor, I have been interested in several of your answers of late. Maybe I do not interpret your views correctly, but I am going to ask you this. I gather that you feel that the American people, as reflected through our governmental processes, have not yet made the decision that we want to be first in space. Is that correct?

Dr. VON BRAUN. I think many people feel we should be first, but there are also many others who don't care.

Mr. MITCHELL. Are we making that maximum effort, if there is such a thing as a maximum effort, to be first in space?

Dr. VON BRAUN. Well, I can talk only about our own project, the Saturn. As I said, I don't believe that a higher funding rate for 1961 than the one now planned would give us much additional gain in time.

Mr. MITCHELL. Well, of course, I feel that you are qualified to speak for our space efforts in general. You speak of certain things, such as the Russian philosophy of the survival of the fittest. You speak of the fact that we definitely should be in a position to pay more for the scientists on your project and others. Doesn't that of itself say that we really haven't made the determination that we are going to go all out to be first in space?

Dr. VON BRAUN. I agree with you, sir.

Mr. MITCHELL. Thank you, Doctor, that is all, Mr. Chairman.

The CHAIRMAN. Mr. Riehlman?

Mr. RIEHLMAN. Dr. von Braun, if the program that you have set forth here today is followed and you had the funds and the scientists, is there any question in your mind that we aren't eventually going to catch up with Russia in this space program?

Dr. VON BRAUN. Sir, I think we can catch up in any field where we really make an earnest effort, whether that field is space or bombs or anything.

Mr. RIEHLMAN. Well, now, you outlined pretty clearly to this committee today what your program is with the Saturn booster, which would put into orbit a tremendous payload.

It is my understanding that if that is accomplished within the next 18 months or 2 years, that we will have a greater capacity to put into orbit a larger payload than the Soviets have as of today. Am I correct in that?

Dr. VON BRAUN. Yes, sir; as of today.

Mr. RIEHLMAN. Yes. Well, now, we recognize that they are probably not going to stand still. We are not going to stand still, are we?

Dr. VON BRAUN. No.

Mr. RIEHLMAN. If we continue in this program?

Dr. VON BRAUN. No.

Mr. RIEHLMAN. Well, isn't it possible that if this program of yours is successful that we can expand at a greater speed in the years ahead in the production of larger boosters?

Dr. VON BRAUN. It is for exactly this reason that I suggested that we take another look in late 1960 or during 1961 and ask ourselves: "How is Saturn coming along? Do we now want to build two or three times as many?" Such an increase in production rate is definitely possible. But since today we are only at the beginning of the development program, much more than the additional moneys we are now to receive would not speed things up very much.

Mr. RIEHLMAN. Let me ask you this. Since this study has been made for increased urgency in this program how many people have you put on overtime

Dr. VON BRAUN. We have not put our entire development organization in Huntsville on overtime. Rather we apply overtime to widen certain bottlenecks. Our difficulty in the past was that whenever an unforeseen minor difficulty developed. I mean the kind of thing that could be straightened out by a relatively small team of people working 36 hours in a row, we couldn't make such an extra effort because we couldn't pay the men overtime. We are now using overtime discriminately, a small group here, a small group there. These groups are put on overtime for limited periods of time, so they can catch up time that would otherwise be lost to the overall program. In other words we use overtime to open up bottlenecks.

Mr. RIEHLMAN. There is a supplemental appropriation pending in the House. Do you have any plans for using those funds for a broader program of overtime in your field of activity?

Dr. VON BRAUN. No, sir. At least not until July 1, 1960. So far we have only this \$1.5 million which does not permit us to go all out. And I am not aware of any additional appropriation for fiscal 1960, other than what NASA may make available to us through internal reshuffling of funds. We do whatever our funding permits.

Mr. RIEHLMAN. How important would the additional funds be for overtime in your program?

Dr. VON BRAUN. In this increased 1961 budget, an adequate allowance for overtime has been made. It is included in the \$230 million figure. In fiscal 1960 we have a temporary funding difficulty which, as Mr. Horner pointed out, NASA will try to overcome through internal reshuffling.

You see, even if we put the entire NBMA organization in Huntsville on overtime between now and the 1st of July this wouldn't take up more than an additional \$2 million, I think, anyway.

Mr. RIEHLMAN. What effect would that have on your program? Anything of a substantial nature?

Dr. VON BRAUN. Yes, it would help some; yes, sir.

The CHAIRMAN. Mr. Riehlman, are you through? Mr. Quigley?

Mr. QUIGLEY. I have no questions, Mr. Chairman.

The CHAIRMAN. Mr. Karth.

Mr. KARTH. Doctor, I want to congratulate you on finally having sold your program to the powers that be so that you can get along with it with the sense of urgency I think it deserves.

In the last 3 years, how much of your productive time have you spent acting as salesman to the powers that be in attempting to convince them that this is a worthwhile project?

Dr. VON BRAUN. I would say more than 50 percent.

Mr. KARTH. You have on several occasions indicated that the moneys available for fiscal year 1961 are sufficient to carry on your program. How about 1958, 1959, and 1960? Do you think there was quite a considerable lack of interest during those years insofar as moneys are concerned, which set you back, let's say 1 or 2 or 3 years?

Dr. VON BRAUN. Sir, the Saturn program started out as follows: Somebody from ARPA came to us and asked us whether for \$10 million we thought we could demonstrate on a static test stand that eight rocket engines could be fired up simultaneously. We asked, "Well, do you mean to make a decent missile program out of this?" He replied: "We don't have more than \$10 million, so answer our question whether you can make that static test for \$10 million." From these humble beginnings Saturn started snowballing.

Mr. KARTH. I think you have answered my question, Doctor, thank you.

Knowing what you know about Russia's state of the art and eliminating conjecture as much as we can, when would you say they would make their first soft landing on the Moon?

Dr. VON BRAUN. I wouldn't be surprised if they make it this year.

Mr. KARTH. And when would you suggest that they might first orbit their man around the Earth?

Dr. VON BRAUN. I wouldn't be surprised if they made it this year.

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

The CHAIRMAN. What was the last question?

Mr. KARTH. This year.

The CHAIRMAN. Put a man in space this year?

Dr. VON BRAUN. I would not be surprised if they did it this year.

The CHAIRMAN. Mr. Hechler.

Mr. HECHLER. I believe you have made a tremendous contribution for which people in this country and those all over the free world will always be grateful.

Dr. VON BRAUN. Thank you, sir.

Mr. HECHLER. And I think in addition to that, you having been born, brought up, and lived under a dictatorship, you perhaps appreciate the meaning of freedom a little bit more, maybe, than some of us here.

Dr. VON BRAUN. Very much so.

Mr. HECHLER. I am particularly impressed in what you have done over the past 15 years. You have shown a dedication to the ideals of America. You have shown not only scientific genius, but you have also shown an understanding of just what we ought to do in this program.

You have shown a sense of urgency. And I think that this committee will stand 100 percent behind you in what you are trying to do.

I hope bureaucratic and budgetary considerations will never again hamper you in your work. I would like to make one gentle correction in an observation that you made about NASA providing you the funds. It is my understanding that Congress provides the funds.

Dr. VON BRAUN. I am sorry.

Mr. HECHLER. And I say that in all good humor. I would like to reemphasize that if ever in the future there is any program that you feel is not being treated with the proper priority that you will come to this committee and let us know about it.

Now, I was impressed with some of the things you said about education. Do you think that we are running low in our stockpile of basic research upon which we have to draw?

Dr. VON BRAUN. Yes, sir.

Mr. HECHLER. Do you believe that in order to replenish this stockpile, it is just as important to spend money on education as it is on hardware at the present time?

Dr. VON BRAUN. Yes, sir.

Mr. HECHLER. Could you point to any particular way in which we could improve our educational system in order to strengthen the work that you are doing and others who follow you in the future?

Dr. VON BRAUN. I think anything would help that would make scientific careers more attractive as compared with free enterprise careers. I think we should never lose sight of the fact that in Russia the opposite number to the American businessman doesn't exist. So the young fellow in Russia who wants to get ahead in life has only one chance, he must go through the Soviet educational system, which, as I pointed out, is a survival-of-the-fittest type screening system. To survive the many exams he has to work very hard, and if he washes out he just does not qualify for the higher strata of the Soviet society.

Now, here in America there is always the easy way out. When a young fellow says, "I had enough schooling, I will go across the street and take a job as a filling station attendant," chances are that 10 years later he will make a lot more money than his friend who stuck it out at school and got a Ph. D. because he may have the Standard Oil franchise in town.

I think this is the crux of the entire problem of scientific education in this country: The huge gap between the low relative incentive for a man who decides to become a scientist and the high incentive which the free economy can offer.

Mr. HECHLER. I would like to ask one very personal question. Over the past 15 years, what are the two things that have brought the greatest pride to you, personally and professionally?

Dr. VON BRAUN. Well, I would say I felt my greatest personal and professional satisfaction when we placed Explorer I in orbit. To me it meant two things: In the first place, we had shown that the Western side can launch a satellite also, and, secondly, and this is a very personal matter with me, by making this contribution we could express our thanks to our adopted country.

Mr. HECHLER. Thank you, Dr. von Braun.

The CHAIRMAN. Mr. Daddario?

Mr. DADDARIO. Doctor, you said earlier that when the Saturn is tested, it will be the largest to be tested in the free world.

Now, in your motion picture, you also showed that when we are able to do this, we will be able, perhaps, to have a soft landing on the Moon or to orbit the Moon.

In view of the answer you have given to Congressman Karth, do I then understand you to mean that the Russians now have a million-and-a-half-pound thrust capacity at least?

Dr. VON BRAUN. This I do not know, but I would consider it logical that the Russians—having already fired several rockets with approximately one-half of that thrust, and knowing that we are trying to leapfrog their rockets of the 600,000- or 700,000-pound thrust class—are probably busy developing a bigger rocket, too.

Now, whether their new rocket will have a million and a half or 2 million or 3 million pounds of thrust or only 1 million, this I don't know, but I consider it very likely that they are busy at this very time developing a rocket at least the size of the Saturn.

Mr. DADDARIO. As we discussed part of the fiscal problems and the efficiencies through which money can be spent, you noted that there is a strong lack of the top type of personnel because of lower Government salaries.

Have we, therefore, reached the point where in order to catch up with the Russians, if we believe that is necessary, that we must do something to take the limit off of salaries so that you can get the type of people you need in order to propel your program forward faster than you now can with the type of people whom you can pay to stay in Government?

Dr. VON BRAUN. Yes, sir. As I pointed out, you can develop a rocket system such as Saturn only if you have high competence in Government quarters, simply in order to be able to spell out to industry what you expect to get for the tax money you are willing to spend in industry.

And I think this is our most critical problem—to build up and retain this kind of competence in Government. Let me give you an example. During the recent bidders' conference in Huntsville, for the second stage of the C-1 Saturn, we were confronted with very highly qualified representatives of 35 corporations. These men sat a whole afternoon asking very intelligent questions about all kinds of details. We were sometimes almost embarrassed to suspect that some of these industry representatives who, after all, wanted to get the contract from us, may know more about certain Saturn problems than we did. We work on the Government payroll, and that limits our ability to attract and hire highly experienced people. But you cannot contract the responsibility for the spending of tax money to industry.

Mr. DADDARIO. Is it then one of your recommendations that something ought to be done in order to give you the capacity to not only attract this type of person, but to pay them?

Dr. VON BRAUN. Yes, sir.

The CHAIRMAN. Mr. Moeller.

Mr. HECHLER. Will the chairman yield for one quick question?

The CHAIRMAN. Yes.

Mr. HECHLER. I would like to ask one quick question. Because you believe the Russians are going to make a soft landing on the Moon and make an orbital manned space flight so quickly, isn't there

danger in building up the people with our emphasis on the Saturn program as we did prior to Vanguard, to feel that we might possibly get the first man up there and then to have a great letdown which would follow?

Dr. VON BRAUN. Sir, I think in a free society where you expect the taxpayer to put up the money for all these things, you just have to keep him informed. The Russians are better off in this respect because they don't ask the taxpayer whether he would agree to such a program, so they don't have that problem.

Mr. HECHLER. I would merely hope the press reports that by putting our emphasis on Saturn, we are not definitely going to be the first nation to get the first man in space?

Dr. VON BRAUN. No, I think in a free country the public must be expected to be mature and intelligent enough to accept a couple of setbacks, too.

The CHAIRMAN. Mr. Moeller?

Mr. MOELLER. Dr. von Braun, you and General Medaris have been a very successful team. It is very apparent from newspaper articles that General Medaris is quite critical of our present space program, both in NASA and in the military.

I don't know if he has told everyone exactly what he thinks ought to be done. But as you view it now, from NASA, do you think that we ought to have an entirely different approach, maybe, to the entire space program, both in NASA and the military?

Is there need now for a Cabinet post on space?

Dr. VON BRAUN. What is that?

Mr. MOELLER. A Cabinet post on space? Are we at the place where we need one person to make these decisions both for the military and for NASA?

Dr. VON BRAUN. I think when the Congress and the President assigned the space program to NASA, it was out of a realization that we first have to explore space before we can put it to military use. I think neither the President nor the Congress ever meant to say that the military can forget about outer space. After all, ICBM's are flying through outer space right now. But it is very difficult, if not impossible, to spell out in detail what forms warfare in outer space may take before anybody has ever been out there.

Now, the military way of budgeting big technological programs is by wrapping up all necessary elements into one package which is called a weapons system. For example, the military services no longer talk about airplanes, they talk about the complete weapons system capable of delivering bombs. This includes aircraft, weapons, navigation equipment, ground support equipment, and so forth. It is obvious that it is somewhat difficult to describe a military space weapon system in too much detail, before the first Mercury astronaut has ever returned from an orbit.

On the other hand, I don't think anyone has ever meant to rule the military out of outer space. A rocket vehicle like Saturn can be clearly justified today by the simple fact that if we ever want to send someone to the Moon we just need a vehicle of this size. We don't have to be nearly as specific to get the work on Saturn started as if we had to spell out all the details of a weapons system.

On the other hand, once you have a Saturn rocket, you can use it for many military applications also. So I do not believe that the military is losing its future capability in space by the fact that the Saturn program is administered by NASA. We will be responsive to all their needs.

Mr. MOELLER. In other words, you don't feel that at this particular time we need a new organizational setup with which to carry this on?

Dr. VON BRAUN. No. I think as long as enough money goes into this effort, we can handle it with the present organization—in fact, possibly with any organization.

The CHAIRMAN. Mr. King?

Mr. KING. Dr. von Braun, I assume from your testimony that eventually we will be producing many Saturns. Are you concentrating right now on one particular Saturn, or are you actually contemplating going into production on a larger scale?

Dr. VON BRAUN. Saturn, and all stages of it, can be produced in quantity like any ICBM. There are only a few peculiar things to consider, such as the size of it, which creates certain transportation difficulties, but that is all. Produceability is just as good as that of any other smaller missile.

Mr. KING. You are thinking in terms right now of many?

Dr. VON BRAUN. Yes, sir.

Mr. KING. Multiproduction?

Dr. VON BRAUN. Yes. Use of one basic rocket system for a great variety of space missions is the only way to get reliability and assurance. We consider the Saturn as the most promising future workhorse of space flight and we want it to become just that.

Mr. KING. On your chart, I believe you pointed out that there would be 10 test firings and the 11th you would consider to be operational? Now, those test firings, do they involve a complete Saturn vehicle so that the 11th one becomes the operational one and 10 of them are—I won't say wasted, but at least they are used just for experimental purposes?

Dr. VON BRAUN. The first three will be single-stage flights, in other words, only the first stage will be live and the second and third stage will be replaced by dummies. Then there will be a number of flights with the two-stage arrangement, where the first and second stages will be live and the third stage will be a dummy. And then we will finally have full-fledged three-stage flights.

After a number of complete three-stage flights, we hope we will have attained a sufficient degree of reliability to entrust multimillion-dollar scientific missions to Saturn or even the lives of a crew.

Mr. KING. So that it is the 11th one, then, when we get down to business of getting a man in space or using it for communications or one of the other purposes that you mentioned?

Dr. VON BRAUN. That is correct.

Mr. KING. One final question. Do you feel that this country ought to sponsor officially an amateur rocketry program under the aegis of our own military organization, perhaps, supervising and encouraging young people to enter into this under supervised conditions?

Dr. VON BRAUN. Sir, I have been approached by many rocket ama-

teur groups, who inquired whether some action along those lines could be taken.

I was chairman of the membership committee of the American Rocket Society during the last year. In this capacity I initiated a so-called youth rocket workshop where personnel active in the youth rocket program met for 2 days in Princeton to work out a policy and recommendations, how such a youth program could be organized. They came up with a plan to run such a program jointly with the Boy Scouts of America. The reason for this was that the American Rocket Society under its charter as a professional society cannot conduct any experimental program. The charter doesn't allow it, for liability reasons and several other legal aspects.

I presented the program which this youth workshop proposed, in a talk to the membership of the American Rocket Society. The board of directors took a vote on it, and decided that the American Rocket Society could not back it up because the hazards involved were too great.

The board felt that with no amount of scientific supervision by experts, was it possible to protect a young rocket experimenter from blowing himself up, or maiming himself while testing an inadequately designed rocket.

Mr. KING. Yet many of the youngsters are going ahead anyway.

Dr. VON BRAUN. This is the other side of the ledger. They are now going underground and do it anyway. I've pointed to this danger repeatedly, but this was—my colleagues on the board of the American Rocket Society realize the danger, too, but the majority felt that there is all the difference between endorsing this kind of thing and discouraging it.

Mr. KING. Do you feel that there might be merit in further exploring possible schemes for organizing all of this amateur rocketry effort that is now being expended, whether we like it or not?

Dr. VON BRAUN. The American Rocket Society has adopted the official position that it will encourage things like youth science and youth space fairs, that it will encourage all kinds of educational programs that get the kids away from playing with gunpowder and get them closer to physics books and studies of the fundamentals, instead.

The American Rocket Society has initiated a youth program along those lines, but will definitely not support and will in fact discourage any rocket experimentation by youngsters. Since the directors of the American Rocket Society took this vote and since I am a member of the board of directors, I am now, shall we say, tied to the party line.

The CHAIRMAN. Mr. Roush.

Mr. ROUSH. Dr. von Braun, I appreciate the fact that you are here today. I have always thought that you had considerable imagination and that you certainly have had a sense of urgency for this program.

How many Saturn vehicles will we have when the Saturn becomes operational in 1964?

Dr. VON BRAUN. How many operational?

Mr. ROUSH. Will we have a backup vehicle for the one which is fired in 1964?

Dr. VON BRAUN. Yes, sir. The present program provides that from 1964 on we will have a regular flow of production. The old funding

plan envisioned four a year, but with the new program, if we provide an adequate funding level in future fiscal years, we can probably increase it to six a year. After we have passed the hurdle or R. & D. firings, I mean once Saturn is successful and generally liked, there is no reason in the world why with more funds, we couldn't go up to a production rate of 10 or 20 a year thereafter. From then on it is just like putting a large aircraft in quantity production.

Mr. ROUSH. I had thought that there were at least four reasons why we are behind in this race to conquer outer space. One has been, in the past, a lack of imagination on the part of, shall we say, our administrators. Would you agree with that? I am not referring to either party. I am thinking of those people who are administrators responsible for drawing budgets, for providing funds, developing programs.

Dr. VON BRAUN. I do not quite agree with the word "lack of imagination."

I think the possibilities that space flight offers for scientific research are generally accepted by the scientific community. But there is a certain amount of soul-searching going on when various scientific programs start competing for the tax dollar.

Take the question: Shall we spend \$100 million more on the Saturn program? Now there are a lot of other competing scientific programs that would like to have these same \$100 million. And it is not possible, in my opinion—this at least, has been my experience—to justify a thing like the Saturn solely with scientific reasons.

You see, the Moon has been there for several hundred million years and nobody cared about its far side until the Russians photographed it. It is kind of difficult to prove that for scientific reasons we have to photograph the far side of the moon in 1961 and not in 1962.

On the other hand—

Mr. ROUSH. Those who won't believe that we have to lack imagination, don't they?

Dr. VON BRAUN. My answer is that this is not really a scientific question at all. It boils down to this simple fact: If the value of American stock in the eyes of the world drops a billion dollars because the Russians publish a photograph of the far side of the Moon, and if we could have done it for one-tenth of that amount, it would have been a good investment to have done it ahead of the Russians.

So this is not fundamentally a scientific question, it is rather a question of national prestige in the eyes of the world. It has something to do with our recognized position of leadership in the world.

Mr. ROUSH. I have one other area I want to touch on. Of the scientists—I will put it this way: How much could the top scientists on your team command in salary in industry?

Dr. VON BRAUN. The top people, easily twice as much as they are making now.

Mr. ROUSH. How much are they making now?

Dr. VON BRAUN. In the Government service?

Mr. ROUSH. Yes.

Dr. VON BRAUN. The top layer?

Mr. ROUSH. Yes.

Dr. VON BRAUN. Right now between \$17,000 and \$19,000.

Mr. ROUSH. And in industry they could command salaries at least twice that; is that correct, sir?

Dr. VON BRAUN. Yes.

Mr. ROUSH. That is all, Mr. Chairman.

The CHAIRMAN. Now, it is noon, gentlemen. Mr. Fulton has just one question.

Mr. FULTON. The question is this, because it has been a matter of strategic balance on the effort that should be put into our present force in being, the Strategic Air Force and our other methods of military defense, and the progress that we can make in space on a broader basis through civilian purposes and scientific research and development, as you say, the competition for the tax dollar.

Now, there has been a committee, a subcommittee of the Policy Committee set up, of 17 scientists. This committee on January 24 came up with a recommendation that man in space programs, for example, the Mercury, and, as a consequence, the Centaur and your particular program, the one you are working on, have their target dates postponed 3 to 5 years in order to give more attention to practical military purposes and security.

Now, to me your program for man in space and your aiming at the development of a broad scientific base for our U.S. programs are a necessary part of our progress in space and our catching up with Russia.

So, I, therefore, favor the greatest speed in the Saturn program and that it be given a DX, the highest national priority.

Now the question is, Do you agree with that approach or do you agree with this group of 17 scientists that there should be the postponement of the targets 3 to 5 years for man in space programs?

Dr. VON BRAUN. I have not read that particular recommendation, but I am greatly surprised—

Mr. FULTON. I can assure you it was made.

Dr. VON BRAUN. I am greatly surprised by it. In my opinion it would be a most fateful mistake if we let our man in space program slip several years. I also believe that this country can easily afford both space and military programs.

Mr. FULTON. That is what I feel.

Dr. VON BRAUN. And should do both.

Mr. FULTON. Thank you very much.

The CHAIRMAN. Mr. Hechler wants to put something in the record.

Mr. HECHLER. I would like to ask unanimous consent that every time Mr. Fulton brings this matter up, that I be given an opportunity to make my response in the record.

The CHAIRMAN. Will you put it into the record?

Mr. FULTON. I would like to bring—this question is as political as a "cat on a hot tin roof," because that was the subcommittee of the Democratic National Policy Committee that made the recommendation on January 24.

The CHAIRMAN. Are there any further observations here, political or otherwise? If not, Doctor, can you be here at 2 o'clock?

Dr. VON BRAUN. Yes, sir.

The CHAIRMAN. The committee will recess then until 2 o'clock and we will go into executive session at that time.

We have two rollcalls coming up. We may be interrupted, Doctor, but we hope, everything being in our favor, we can go right on through and finish up.

Whereupon, at 12:05 p.m., the committee adjourned to reconvene at 2 p.m. in executive session.)

(At 2 p.m., the committee being unable to resume because of House business, Dr. von Braun met informally and briefly with various committee members.)