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NASA'S PROPOSED OPERATING PLAN FOR FISCAL YEAR 1969

~~CONFIDENTIAL~~

HEARING
BEFORE THE
COMMITTEE ON
AERONAUTICAL AND SPACE SCIENCES
UNITED STATES SENATE
NINETIETH CONGRESS
SECOND SESSION
OCTOBER 3, 1968
WASHINGTON, D.C.

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(The following testimony was taken in executive session. The committee agreed unanimously to its publication. Further, the National Aeronautics and Space Administration interposed no objection to its publication. Therefore, with the exception of minor corrections, it is printed here in its entirety.)

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NASA'S PROPOSED OPERATING PLAN FOR FISCAL YEAR 1969

THURSDAY, OCTOBER 3, 1968

U.S. SENATE,
COMMITTEE ON AERONAUTICAL AND SPACE SCIENCES,
Washington, D.C.

The committee met, pursuant to notice, at 10:05 a.m., in room 235, Old Senate Office Building, Senator Clinton P. Anderson (chairman), presiding.

Present: Senators Anderson, Dodd, Cannon, Holland, and Hatfield. Also present: James J. Gehrig, staff director; Everard H. Smith, Jr., Dr. Glen P. Wilson, Craig Voorhees, and William Parker, professional staff members; Sam Bouchard, assistant chief clerk; Donald H. Brennan, research assistant; Mary Rita Robbins, clerical assistant; Frank Krebs, assistant to Senator Cannon; Samuel H. Mallicoat, administrative assistant to Senator Hatfield; and Chester Sobsey, assistant to Senator Cannon.

Present from NASA: James E. Webb, Administrator; Dr. Thomas O. Paine, Deputy Administrator; Dr. Homer E. Newell, Associate Administrator; Willis H. Shapley, Associate Deputy Administrator; Robert F. Allnutt, Assistant Administrator for Legislative Affairs; James N. Beggs, Associate Administrator for Advanced Research and Technology; Edward J. Brazill, Office of Manned Space Flight; Paul G. Dembling, General Counsel; Harold B. Finger, Associate Administrator for Organization and Management; Charles W. Harper, Deputy Associate Administrator (Aeronautics).

Also: Milton Klein, Manager, AEC-NASA Space Nuclear Propulsion Office; Dr. Richard L. Leshner, Assistant Administrator for Technology Utilization; William E. Lilly, Assistant Administrator for Administration; Bruce T. Lundin, Deputy Associate Administrator for Advanced Research and Technology; Charles W. Mathews, Deputy Associate Administrator for Manned Space Flight; Dr. John E. Naugle, Associate Administrator for Space Science and Application; Francis Smith, Assistant Administrator for University Affairs; Gerald M. Truszynski, Associate Administrator for Tracking and Data Acquisition; Alan D. Ullberg, Special Assistant to the Administrator; and William Sturdevant, Office of Legislative Affairs.

OPENING STATEMENT BY THE CHAIRMAN

The CHAIRMAN. This will be an executive session.

NASA requested \$4,370,400,000 for fiscal year 1969. The Congress authorized \$4,013,073,000, and appropriated \$3,995,273,000—a reduction of \$375,127,000 in the budget request. Therefore, it is clear that revisions must be made in the program presented to the committee earlier this year.

This morning Mr. Webb, and Dr. Paine and other NASA officials will present and discuss with the committee NASA's proposed fiscal year 1969 operating plan.

Mr. Webb and Dr. Paine, would you indicate whether or not your prepared statements can be made public and whether we may release them?

Mr. WEBB. There is nothing in my statement that could not be released to the public, and I believe that to be the case with Dr. Paine's statement.

Dr. PAINE. That is correct. I have no objection to releasing the statements if the committee wishes.

CHAIRMAN. All right, we will release them later.

Go ahead, Mr. Webb.

STATEMENT OF JAMES E. WEBB, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. WEBB. Mr. Chairman, members of the committee, thank you for this opportunity for NASA to present its fiscal year 1969 interim operating plan, and to relate it to the program plans which were presented to you earlier this year in support of the President's budget request for NASA. As you know, now that congressional action is completed on the independent offices appropriation bill, we will be taking steps with the Director of the Budget to convert this interim plan into approved programs and projects based on the Bureau's apportionments.

Today may well mark my final appearance before you as Administrator of NASA. With your permission, Deputy Administrator Thomas O. Paine will present the interim operating plan in detail, since you will be looking to him as the Acting Administrator after October 7. However, I would like to make a brief statement on several matters of importance during the period of uncertainty when this interim plan is in effect and our Government is undergoing the changes that take place with the installation of a new administration and the beginning of a new Congress.

NASA ORGANIZATION STRONGEST IN HISTORY

As you know, Mr. Chairman, I have felt for some time that at some proper time I should retire from full-time Federal service. During the past year I have devoted a great deal of my time, working with senior NASA officials, to the task of insuring that the strongest possible organization was emerging. Last month I reported to the President on a number of matters and pointed out that NASA has, with the recent induction of a number of experienced executives, the strongest and most capable organization it has had in its 10-year history. I told him that it was fully capable of functioning at peak efficiency without me, and, indeed, without filling the position of Administrator between now and next January if I should retire on my 62d birthday. I pointed out that the next President would find, on entering office,

an effective and versatile agency, ready to follow his leadership. On this basis, the President gave his permission for me to retire on my 62d birthday, October 7. I will remain available to Dr. Paine for at least half my time as a consultant. I relate this because I want you to know that the NASA organization is worthy of your trust and confidence in the coming months and in the next administration.

Led by Dr. Paine as Acting Administrator, by Dr. Homer E. Newell as Associate Administrator, by Willis H. Shapley as Associate Deputy Administrator, by Harold B. Finger as Associate Administrator for Organization and Management, by Mr. Beggs, Dr. Mueller, Dr. Naugle, and Mr. Truszynski as Program Office Directors, and by the Assistant Administrators, who are with us here today, NASA can and will carry on all work assigned to it.

The officials here today and in other NASA offices have my full confidence, and that of the President.

PLAN TO HOLD TOGETHER SMALL SKILLED GROUPS

The greatest challenge which NASA faces in the next year, in my opinion, is the retention to the greatest extent possible of the capability, not only in house, but also in its industry and university partners, that will enable the agency to move ahead again when resources can be made available for missions to follow those we will be completing in the next 2 years. This is not an easy task when a heavy flight schedule must be met by a work force that has been steadily reduced for a period of 3 years. NASA will need all the support you can give in meeting this challenge.

The interim operating plan which Dr. Paine will present is designed, with very few exceptions, to support missions started in previous years. In manned space flight, in nuclear rocket engine development, in the planetary program, in the university program—throughout the areas of NASA responsibility—we are trying to carry out the best possible program to maintain our part of the Nation's aeronautics and space competence. This plan does not include keeping production lines open to meet future needs or to hold experienced teams together. Instead, in most instances, its thrust is to hold together small cadres of able men and women, engaged in important work in support of a limited number of missions, so that they will be able to form nuclei on which to build when the Nation decides to undertake more ambitious efforts.

The skill with which this plan has been devised, and the success which I believe it will have in meeting this goal, is a tribute to the ability of the NASA team I discussed earlier.

In closing, I would like to thank this committee for all it has done for NASA over the last 10 years. We have been through both happy and trying times together. Your support and your counsel have been essential to success. I thank you for that support and counsel, and for the consideration given me, as Administrator, during my more than 25 formal appearances before you, as well as the many other times as we have worked together.

Thank you, Mr. Chairman. With your permission, I would like to present Dr. Thomas O. Paine.

The CHAIRMAN. We are happy to welcome Senator Hatfield to the committee. It has been my pleasure to have the opportunity to serve with him on the Senate Interior Committee.

Before Dr. Paine starts, Senator Hatfield, I suggested we open this hearing up and release the statements, if you don't object—and you, Senator Cannon?

Senator CANNON. No. That is fine.

The CHAIRMAN. We will release the statements at 10:30, then—not the whole record—and we will have people here if there are any questions. Do you see any objection?

Mr. GEHRIG. No.

The CHAIRMAN. They will be released this morning. We may have some questioning later on. Go ahead, Dr. Paine. We are happy to have you here.

STATEMENT OF DR. THOMAS O. PAINE, DEPUTY ADMINISTRATOR OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Dr. PAINE. Thank you. Mr. Chairman, members of the committee, I appreciate this opportunity, in my first appearance before this committee since my confirmation, to present to you the NASA interim operating plan for fiscal year 1969. My statement will be addressed primarily to the policy considerations that have guided us in establishing the plan and to the principal decisions embodied in it. My associates and I are prepared to go into greater detail in response to your questions—both on matters covered in my statement and on any other matters which may be of interest to you.

INTERIM OPERATING PLAN FOR FISCAL YEAR 1969

The interim operating plan, which we placed into effect on August 8, 1968, was, and, with the minor modifications we have made since that time, now is, our response as officials responsible for administering the National Aeronautics and Space Administration to three different and not wholly compatible requirements, which we faced as we entered fiscal year 1969.

First, it became clear in June and July of 1968 that congressional action on our fiscal year 1969 authorization and appropriation bills would result in the appropriation to NASA of a total of about \$4 billion. As you know, the amounts for NASA, now approved by the Congress and before the President, in H.R. 17023, total \$3.995 billion, a reduction of \$375 million in the President's budget request.

Second, Congress, by a separate action in the Revenue and Expenditure Control Act of 1968, has required the President to make further reductions in the total budget to reduce total Federal expenditures for fiscal year 1969 below the budget estimates. At the time we prepared the interim operating plan it was clear that this provision would require a limitation on NASA's fiscal year 1969 budget below the amounts approved by Congress in its actions on NASA's authorization and appropriation bills. It was also clear, however, that a final decision on the limitations to be placed on NASA for fiscal year 1969 would not be forthcoming until, at the earliest, Con-

gress had completed its action on our appropriation bill and we had received the apportionment of funds by the Bureau of the Budget, and that a final decision by the President might not be possible until after congressional action on all fiscal year 1969 appropriation bills had been completed.

The President has not yet signed the appropriation bill and we have not yet received our apportionment from the Bureau of the Budget. However, we did receive an indication from the Bureau of the Budget early in August that, based on the assumptions then being used by the Director of the Budget, NASA's share of the total of expenditure reductions might amount to \$350 million. Translated into terms of new obligatory authority, this meant that our use of fiscal year 1969 appropriations would have to be limited to \$3.85 billion. In establishing our interim operating plan, then, we have assumed that a limitation of \$3.85 billion will, in fact, be the final decision of the President, although the Director of the Budget even now is not able, at this time, to give us definite assurance that this will be the case.

The third crucial consideration we have faced is the necessity and our responsibility to carry forward the NASA program during a period of uncertainty that could last 4 months or more into the fiscal year. We not only had to provide a basis for moving ahead with those decisions and actions which had to be made during these months, but also to recognize the necessity of making necessary reductions as early as possible in the fiscal year to avoid the much deeper reductions that might be required if we waited for final decisions later in the year.

PLAN DESIGNED TO ACCOMMODATE BOTH FUNDING INCREASES OR DECREASES FOR FISCAL YEAR 1970

It was for these reasons that, in advance of decisions by the Bureau of the Budget or the President, we felt it was essential, in the light of all the information available to us, to construct an interim operating plan within a self-imposed \$3.85 billion limitation and to decide to operate on the basis of this plan, pending final decisions.

Our actions have also had to be constrained by our current instructions within the executive branch to hold expenditures to a minimum in 1970, as well as in 1969, and to be prepared for the eventuality of budgetary limitations in fiscal year 1970 even more restrictive than those in fiscal year 1969. I am personally convinced that the Nation's space program requires an increase in funding in fiscal year 1970 and I am hopeful that as we proceed with the preparation of the fiscal year 1970; budget we will succeed in establishing the need for a significant increase. Until this decision is made, however, we have no alternative but to proceed with an interim operating plan which is designed to take into account the possibility of either an increase or a decrease in fiscal year 1970; that is, a plan which, where possible, holds open options we can exercise in fiscal year 1970 if the budget is higher, but which does not overcommit us if the fiscal year 1970 budget is lower.

Let me now turn to the operating plan itself and its more significant features.

FISCAL YEAR 1969 OPERATING BUDGET

The table attached to my statement compares the amounts in the fiscal year 1969 operating plan with the corresponding amounts in the budget request, the amounts authorized in Public Law 90-373 and those appropriated in H.R. 17023.

(The table referred to follows:)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FISCAL YEAR 1969 INTERIM OPERATING BUDGET, NOA

[In millions of dollars]

	Budget request	Authoriza- tion	Appropri- ation	Interim operat- ing budget
Apollo.....	2,038.8	2,025.0	-----	2,025.0
Apollo applications.....	439.6	253.2	-----	150.0
Advanced missions.....	5.0	2.5	-----	2.5
Physics and astronomy.....	141.9	136.9	-----	132.1
Lunar and planetary.....	107.3	92.3	-----	75.8
Launch vehicle procurement.....	128.3	115.7	-----	100.2
Bioscience.....	48.5	33.0	-----	32.7
Space applications.....	112.2	98.7	-----	98.7
Electronics system.....	39.4	35.5	-----	34.9
Space vehicle system.....	35.3	31.8	-----	31.7
Human factors system.....	21.7	19.7	-----	19.7
Basic research.....	22.0	21.0	-----	21.0
Space power and electrical propulsion system.....	44.8	42.3	-----	42.2
Nuclear rockets.....	60.0	55.0	-----	32.0
Chemical propulsion.....	36.7	30.2	-----	28.9
Aeronautics.....	76.9	74.9	-----	74.9
Tracking and data acquisition.....	304.8	289.8	-----	280.0
Sustaining university programs.....	10.0	9.0	-----	9.0
Technology utilization.....	4.0	3.8	-----	3.8
Total, R. & D.....	3,677.2	3,370.3	3,370.3	3,195.1
Construction of facilities.....	45.0	39.6	21.8	35.7
Administrative operations ¹	648.2	603.2	603.2	623.3
Total, NASA.....	4,370.4	4,013.1	3,995.3	3,854.1

¹ Excludes pay raises estimated at \$23,700,000.

Dr. PAINE. Mr. Chairman, that having been placed in the record, I will not read it in detail but will proceed to discuss each of the principal items.

MANNED SPACE FLIGHT PROGRAM

Apollo.—With respect to the manned space flight program, the operating plan includes \$2.025 billion for the Apollo program, the amount authorized. This is approximately \$14 million below the budget request.

Much progress has been made in the Apollo program this year, despite the many problems, large and small, that we have encountered, and despite greatly reduced flexibility to cope with problems as a result of reductions in research and development and administrative operations funding. Next week we plan to resume manned space flight with an earth orbital mission of up to 10 days' duration in the Block II Command and Service Modules, launched by a Saturn IB. I might mention, Mr. Chairman, that Dr. Mueller and General Phillips are down at the cape today at the flight readiness review, and, therefore, are represented by another member of the staff.

Following this flight, we had hoped to attempt an all-up, manned Saturn V Command and Service Module and Lunar Module mission in December. This Saturn V flight was conditioned, as we have reported to the committee, upon the successful completion of our pro-

gram of modification and retest of the Saturn V in order to arrive at demonstrated solutions to the problems encountered on the Apollo 6 (AS-502) mission. The Saturn V will be ready for manned space flight in December. However, delays in test and check-out, at the Kennedy Space Center, of the first manned Lunar Module made it obvious last month that a manned Lunar Module mission could not be undertaken before February or March of next year. Therefore, we have decided to fly the next Saturn V, No. 503, with the Apollo Command and Service Module only, and not to carry the Lunar Module on that flight. This decision enables us to move forward in employing the Apollo-Saturn V space system while we work out the problems that are currently delaying the checkout of LM 3, the Lunar Module that we had intended to fly on 503.

In the revised schedule, the flight this month, if successful, will be followed by a "Command Service Module only" Saturn V launch in December or January; that is, by a Saturn V launch of the Block II Command and Service Modules into earth orbit without a Lunar Module spacecraft. A Lunar Module test vehicle will replace the spacecraft, and "all-up" testing will be resumed on Saturn V No. 504, which we hope to launch by March of 1969 with Lunar Module 3 and the third Block II Command Service Module.

The Saturn V mission in December or January is planned as a low earth orbit mission to prove out the modifications to the Saturn V launch vehicle shown necessary in Apollo 6 and to cover any difficulties in the CSM that Apollo 7 might encounter. Depending on the success of the Saturn IB Apollo 7 mission this month, it may be necessary to repeat one or more experiments of that flight on the first manned Saturn V flight. On the other hand, should Apollo 7 prove highly successful, we may be able to plan on a more ambitious Saturn V mission in December or January, with deeper penetration into space and with consequently more rapid accumulation of knowledge and experience on the capabilities of the Saturn V CSM system for long range mission operations. With this in mind, we are holding the option open, in our contingency planning, for higher earth orbits, a circumlunar mission or a lunar orbital mission. The final mission decision will be made in November, after a thorough review of Apollo 7 and the status of Apollo 8 at that time.

We testified before you earlier this year that manned lunar landing and return in 1969 remained a possibility if we could accomplish the first eight Saturn V missions by the end of 1969. This is still the case under our present operating plan. During this period, the Apollo operational workload in NASA Centers will reach its peak. This is so not only in the three manned space flight centers and at Goddard, which support manned flight directly, but also at our other centers, almost all of which support each manned mission in one or more ways.

Apollo Applications.—The President's authorization request for this program totaled \$439.6 million. The amount in the authorization act is \$253.2 million. At this level we simply cannot carry out the program which we presented to you earlier this year.

The strong desirability of maintaining the Apollo, aeronautics, and space applications programs at the full level authorized by the Congress; the need to rebalance accounts in order to match the in-house scientific, technical and managerial resources under administrative operations with requirements of our on-going programs; the need

to retain some momentum in the unmanned planetary program; and the importance of preserving the options to move ahead in areas such as nuclear propulsion in the future—all of these factors have forced us to reduce still further the Apollo Applications program.

Accordingly, we have included in the operating plan \$150 million for this program. This amount is required to work toward the important but sharply limited and deferred Apollo Applications program we now propose.

Under the plan, production of the Saturn I-B launch vehicle will terminate upon completion of the 14th launch vehicle, Saturn 214. This will leave nine Saturn I-B's if we are able to proceed with the Apollo schedule I discussed earlier. The 12th Saturn I-B has been completed, and the last two are well along in fabrication and assembly.

Production of the Saturn V will be discontinued at the end of the first 15 vehicles, which are being procured as part of the Apollo program. Of these 15 Saturn V's, six have been manufactured and four more will be completed this fiscal year.

In the revised Apollo application program, we will work toward launching, in the early 1970's, a single Saturn I workshop and a single Apollo telescope mount (ATM) of the types we have discussed in the past. A backup unit for each will be prepared. There will be one revisit to the workshop before the ATM is joined to it. Later, we hope to proceed with the Saturn V workshop; but work toward that goal under this operating plan will be limited to studies.

Advanced Missions.—In this third element of the manned space flight program, we plan to utilize \$2.5 million, one-half of the budget request, for continued studies related to manned earth-orbital and lunar missions.

SPACE SCIENCE AND APPLICATIONS

Physics and Astronomy.—The amount of \$141.9 million was requested for the physics and astronomy program, and \$136.9 million was authorized.

The operating plan provides \$132.1 million for this program. At this level, the program includes the geophysical, solar, and astronomical observatories, all on-going Explorers, and the Pioneer F and G missions. The small astronomy satellite (SAS-B), and a prototype Sunblazer (using the phased-array antenna to be funded from the Construction of Facilities appropriation) are also included. The sounding rocket program is continued at a level equivalent to that of fiscal year 1968. At the reduced level for physics and astronomy, the level of effort in supporting research and technology and data analysis will be approximately 10 percent lower than in fiscal year 1968.

Lunar and Planetary Exploration.—The amount of \$92.3 million was authorized for the Lunar and Planetary Exploration program, a reduction of \$15 million from the budget request. NASA's interim operating plan for fiscal year 1969 includes \$75.8 million for this program of which \$6.8 million is for lunar and \$69.0 million for planetary. The \$69.0 million for planetary programs is required to support the Mariner-Mars 1969 mission, the reacquisition of telemetry from the Mariner V, and the Mariner-Mars 1971 mission.

Our plan also supports in fiscal year 1969, at a reduced funding level, the capability to conduct a mission to Mars during the 1973

opportunity. This 1973 mission as now planned will include a survivable lander with instrumentation consistent with the minimum scientific objectives recommended by the Space Science Board of the National Academy of Sciences in July of this year. However, the overall scope of the mission will be reduced and the schedule compressed from that which could have been done under the original budget request.

As a related matter, I should note that the operating plan provides for proceeding with the construction of two 210-foot antennas which will provide support for the Mars 1973 mission and other projects, including Pioneer missions, during the 1970's.

Bioscience.—The operating plan includes \$32.7 million for this program, a reduction of about \$15 million from the budget request. The 30-day biosatellites are retained in the program as planned; however, the reduction requires that we slip the 21-day missions by approximately 6 to 12 months to minimize expenditures in fiscal year 1969.

Space Applications.—The interim operating plan supports the space applications program at the full amount authorized, \$98.7 million. This amount is about \$14 million less than the budget request.

The program is somewhat recast from that which we presented in connection with the budget request, however, due to a decision to launch a replacement for the Nimbus B experimental weather satellite. You will recall that Nimbus B was destroyed on May 18 because of a malfunction in the Thorad launch vehicle. The launch of the replacement spacecraft, Nimbus B2, will be in the spring of 1969, according to present plans. Our decision to repeat the Nimbus B mission, using a number of backup experiments which are available, will avoid a delay of more than 21 months in obtaining the advanced meteorological data which the Nimbus experiments are designed to get.

The space applications program includes, in addition to the Nimbus program through Nimbus F, the Applications Technology Satellites through ATS-G; although funding for the downstream missions, ATS F and G and the advanced applications flight experiments is reduced. The Earth Resources Survey portion of Space Applications will be funded at the level of \$11.2 million. At this level we will continue to place emphasis on the Earth Resources Survey Aircraft Program, with extension to higher altitude observations and instrument development using the RB-57 aircraft made available to NASA by the air weather service. Our studies of the Earth Resources Technology Satellite (ERTS) are continuing to work toward defining the optimum spacecraft approach to the space testing and evaluation of instruments and sensors using automated satellites.

Also included are the Tiros-M and planned TOS improvements, the international applications project, the meteorological soundings program and data analysis for the geodetic satellites now aloft.

Launch Vehicle Procurement.—The amount of \$115.7 million was authorized in fiscal year 1969 for the procurement of launch vehicles in support of unmanned space mission requirements, a reduction of \$12.6 million from the budget request. The current fiscal year 1969 operating plan of \$100.2 million reflects further reductions commensurate with flight mission requirements supported by the reduced operating plan.

ADVANCED RESEARCH AND TECHNOLOGY

Aeronautics.—Work in aeronautics will proceed at the level authorized. The original budget request for Aeronautical Vehicles was \$76.9 million, and the amount authorized, \$74.9 million. The authorized level will support the projects essentially as outlined in the original budget justification, with minor revisions. In addition, we will accelerate our efforts to advance the definition and implementation of NASA's supporting function so that NASA can make the most effective contribution to those agencies, such as DOD and DOT, which have specific developmental responsibilities.

Nuclear Rockets.—In testimony before the Senate Appropriations Committee on June 24th, Mr. Webb indicated that it was doubtful that sufficient funds could be programed to begin development of the NERVA flight-weight engine at the \$4.008 billion level. Our analysis of our total fiscal year 1969 budget problem and all the constraints we face at this time for late fiscal year 1969 and fiscal year 1970 have confirmed the earlier judgment that funds sufficient for this development cannot be programed at the \$3.85 billion level. Therefore, we have decided to limit the fiscal year 1969 effort in nuclear rockets and to defer the development of the flight-weight NERVA engine at this time. Originally, the tentative operating plan before you provided \$25 million for nuclear rockets and, thus, \$32.5 million total would have been available for this program during fiscal year 1969, since we would also apply \$7.5 million which was withheld in fiscal year 1968. In addition to continuation of a limited advanced technology effort and experimental engine testing, we planned, in providing funds at this level, to hold together a sufficient cadre of design, development and test personnel to permit us to proceed with development of the flight-weight engine, if possible, in fiscal year 1970. We will seek support to do so.

After the interim operating plan was first formulated, Mr. Beggs, Mr. Finger, Mr. Klein of the Joint AEC/NASA Office, and I visited the various NERVA sites in an attempt to make certain, first-hand, if this could in fact be accomplished at the \$32.5 million level. We have determined that the development could proceed in fiscal year 1970 with greater continuity and momentum if additional funds totaling \$7 million were made available. Thus, \$39.5 million in total would be available under the plan. The additional funds which we are providing would allow more complete experimental engine testing and permit us to retain more of the highly skilled contractor personnel now engaged in the nuclear rocket program, thus assuring the possibility of a more economical progress toward a flight-weight engine in fiscal year 1970. These contractor personnel will proceed with the design of the NERVA engine and, to the extent possible, component design and development, furthering the progress, albeit limited, toward an operational nuclear rocket capability.

We appreciate fully the long range benefits of nuclear propulsion and of the prospects for its use in the future national space program. Faced with the great difficulty of achieving a balanced program in fiscal year 1969, and of holding expenditures to a minimum in fiscal year 1969 and fiscal year 1970, we have taken the actions we believe necessary to achieve some NERVA program continuity and work toward an eventual nuclear rocket capability.

The future scope of the space program beyond Apollo is an important issue facing the Nation. Fiscal year 1969 continues the decline that has led us to such drastic measures as stopping Saturn IB production, discontinuing Saturn V production, and delaying NERVA engine development. The fiscal year 1969 program for NERVA permits some work to proceed and retains the option to resume our past momentum in this program. I am confident that the country will adopt a vigorous space program leading in the next decade to more advanced exploration and exploitation of this new medium. This kind of program will require new propulsion capabilities that are exemplified in the nuclear rocket. We intend, therefore, to urge that the Nation proceed with nuclear rocket flight development if the national goals and corresponding budget levels permit. If conditions are such that we cannot proceed, we will have lost a large national investment and an opportunity for the exploitation of a significant advancement in technology.

Space Technology.—At a time when we are reducing our planned space missions and deferring development of operational space hardware, it is important that, to the extent we can, we continue our efforts in developing and advancing the technology which will be necessary when work toward specific future missions can be resumed.

Of the \$180.5 million total authorized for Basic Research, Space Vehicles Systems, Electronics System, Human Factor Systems, Space Power and Electric Propulsion Systems and Chemical Propulsion, we are providing a total of \$178.4 million in the operating plan. This is a reduction of \$21.5 million from the budget request.

Work in the important technologies of long endurance life support equipment and man and man-machine relationships will proceed as planned. In many other areas, however, the pace of research and technical development will be reduced, especially in efforts that support advanced space missions. Investigations of high energy space propulsion systems will be limited in scope, as well as the effort devoted to magneto-hydrodynamic power generation and electric propulsion system investigations. Although research on the critical technical problems of new launch vehicles will continue, the \$3.1 million included in the budget request for large solid rockets is not included in the operating plan. Flight experiments on optical telescope technology, on laser communications, and on a meteoroid probe to the asteroid belt is deferred, and SNAP-8 system testing, while continued, is reduced.

TRACKING AND DATA ACQUISITION

The budget request for tracking and data acquisition of \$304.8 million was reduced to \$289.8 million in the Authorization Act. The reduction in total available resources has required a further reduction of \$9.8 million to a new total of \$280 million in the operating plan.

These reductions will limit the amount of tracking and data acquisition support which can be provided for spacecraft now aloft and for future missions; however, the plan provides full support for the Apollo schedule I outlined previously.

CONSTRUCTION OF FACILITIES

The budget request for Construction of Facilities totaled \$45 million. \$39.6 million was authorized and \$21.8 million was appropriated. The amount included in the operating plan is \$35.7 million, the

increase over the appropriation amount being transferred from the Research and Development appropriation. We will initiate an appropriate action to provide for this transfer between accounts.

Under the plan, we will proceed with the construction of the two 210-foot deep space antennas. These antennas, which will be substantially identical with the 210-foot dish at Goldstone, are essential to provide continuous surveillance, command, and data acquisition for future deep space missions, including the 1973 Mars mission. A number of missions in the past have succeeded only because we were able to maintain continuous communications with the spacecraft in spite of anomalies. The risks involved in attempting future deep space missions with a single 210-foot antenna providing only intermittent surveillance and communications are too great, and the benefits in terms of increased data return are too significant for us to have deleted these antennas from the plan.

We will also proceed, as I have stated, with the construction of the Phased-Array Antenna needed to support the Sunblazer project. The amount required for this antenna is \$2.9 million.

Under the plan, we will not proceed with the alterations and rehabilitation of Launch Complexes LC-34 and LC-37 at the Kennedy Space Center; additions to the flight crew training facility at the Manned Spacecraft Center are deleted; and modifications to the environmental test laboratory at the Manned Spacecraft Center are reduced in scope. Facility planning and design is reduced from the \$3 million requested to \$1 million.

ADMINISTRATIVE OPERATIONS

Let me now turn to "Administrative Operations." The interim operating plan anticipates the transfer, in accordance with law, of \$20.1 million from "Research and Development" into "Administrative Operations" bringing the total in that account to \$623.3 million as compared to the \$603.2 million in the Authorization and Appropriation Acts, and the \$648.2 million requested in the budget. (I should add parenthetically that all of these figures exclude the amount that will be required for Federal Employees Salary Act increases, now estimated at about \$23.7 million, which is to be handled separately.)

The CHAIRMAN. Where are you going to get that money?

Dr. PAINE. This will be decided by the Bureau of the Budget.

Mr. GEHRIG. Dr. Paine, do you think this will have to come out of your \$3.85 billion? Or do you expect to get additional money from the Bureau of the Budget to cover this?

Mr. LILLY. If I can elaborate on this, all agencies of the Federal Government were precluded from including in their 1969 estimates the cost of the pay raise. The executive department, Bureau of the Budget, provided a total estimate for all agencies. So, all of our planning has been on the basis that the Bureau of the Budget would decide where these funds would come from. We do not know where it will actually come from; it could come from funds appropriated for NASA but not planned for release for NASA programs because of the expenditure limitations. But we have assumed it will not be absorbed in the \$3.85 billion.

Mr. GEHRIG. It will be in addition to the \$3.85 billion. You are sure of that?

Mr. LILLY. Yes.

Mr. WEBB. Let me intervene here to say that we are not absolutely sure of the \$3.85 billion. The appropriation has been made and gone to the President. After he signs the bill, there will be an apportionment by the Director of the Budget and only after that apportionment will we have a firm plan, a firm figure such as the \$3.85 billion.

Mr. GEHRIG. Well, does that mean that the Bureau of the Budget, then, could apportion you \$23.7 million less than \$3.85 billion and then give you back \$23.7 million for the pay raise?

Mr. WEBB. Yes, sir; it means that. It also means that they could apportion us the whole \$3.85 billion, which I expect them to do.

Mr. GEHRIG. Plus the \$23.7 million?

Mr. WEBB. The \$23.7 million will then be considered at another time and I believe independent of this apportionment.

Senator CANNON. Mr. Chairman, I am still confused as to where that money is going to come from, under those circumstances. You have got—if you have got a ceiling on the appropriated figure, it has got to come within that ceiling, has it not?

Mr. WEBB. Senator Cannon, I think what you find is that there are certain overall governmental contingencies which the Bureau of the Budget does not wish to consider on the basis of having an item included in every agency's budget. They want to consider it on a governmentwide basis. So, they give us instruction not to include it and they provide for it in a contingency fund generally. I do not personally know exactly how they expect to provide for this. They can hold their contingency fund intact and require us to absorb it within our budget levels. I believe from my discussions with the Director of the Bureau of the Budget that in this case he will not do that, that he will add it from some contingency funds which he has in mind.

Senator CANNON. Contingency fund or possibly a supplemental appropriation.

Mr. WEBB. Yes, sir. I agree with that. There might be an appropriation to cover the whole pay raise.

Senator CANNON. Thank you, Mr. Chairman.

The CHAIRMAN. Go ahead.

ADMINISTRATIVE OPERATIONS LEGISLATIVE HISTORY

Dr. PAINE. In presenting the fiscal year 1969 budget to the several committees of the Congress, NASA was very conscious of the critical relationship between the funds required in this category and our ability to carry on in fiscal year 1969 the programs approved in prior years as well as those to be undertaken in fiscal year 1969, and NASA witnesses made every effort to justify the requirements in as much detail as possible. We were highly gratified that this committee and the committees of the House of Representatives which took detailed testimony and examined this matter in depth showed by their conclusions and recommendations that they understood the problems that we face in this area. This committee recommended \$635.6 million. The House Committee on Science and Astronautics recommended \$646.7 million. Both of these amounts are substantially

above the figure of \$623.3 million in our interim operating plan. As you know, the reduction of the authorization of "Administrative Operations" to \$603.2 million came in floor amendments, first in the House as one of several amendments directed at reducing the total amounts for NASA recommended by the committee, and subsequently in the Senate in an amendment to conform the bill to the House figure.

The legislative history relating to "Administrative Operations" this year indicates that there are two aspects on which the Congress as a whole may not have been entirely clear.

First is the point which we made very strongly in our testimony and which I am sure is understood by the committees in both the Senate and the House; namely, that this appropriation does not cover only "administrative" expenses in the usual sense. It pays the salaries of all NASA personnel—engineers, scientists, technicians, managers, and administrators—responsible for carrying out the total NASA program, plus maintenance and operation costs of the NASA capital plant. It is not an overhead account—it covers the direct costs of operating NASA laboratories, research centers, development centers, and launch centers. I hope we can change the name of this account to something more descriptive next year, so that Members of Congress who do not have the opportunity to hear the testimony will not mistakenly assume that it is an overhead-type administrative account and will understand that it is just as essential to our program as the Research and Development appropriation.

The second point is one which we feel in retrospect that perhaps we did not make clearly enough in our appearances before this committee and the other committees concerned. I refer to the fact that most of the workload each fiscal year under the "Administrative Operations" account is not directly related to the size of the NASA R. & D. budget, or of the total NASA budget, in the same year. Over a period of years, of course, the requirements in "Administrative Operations" can be expected to follow the same general trend as the total "Research and Development" budget. But in any given year the work to be done under "Administrative Operations" is very largely of two sorts that are not related to the size of the research and development budget in the same year:

First, the largest portion of our work under "Administrative Operations" is in the testing, modification, checkout, launch, and operation of launch vehicles and spacecraft developed and procured with Research and Development funds provided in previous years. This is the nature of almost all of the work at centers like Kennedy, Houston, Marshall, and Goddard. For example, our funding requirements in "Research and Development" for Apollo hardware are declining in fiscal year 1969, but the hardware itself is moving through our test centers to Cape Kennedy for test, checkout, and launch in greater volume than ever before. The fact that in our \$3.85 billion program we have a lower amount for "Research and Development" than in fiscal year 1968 and do not have as much as we asked for in fiscal year 1969 for new work, does not reduce significantly the basic load on these centers in fiscal year 1969.

Second, a significant portion of the Administrative Operations workload is research and development work done by NASA people

in the NASA centers—work which makes only minor demands on “Research and Development” funds, for technical equipment and the like. This is typical of much of the workload at the Langley, Lewis, and Ames Centers, for example. In the time of the NACA, these laboratories operated entirely on a “Salaries and Expenses” appropriation, with no “Research and Development” appropriation at all. While they now also have responsibility for substantial amounts of “Research and Development” funds for work performed by contractors, the NACA pattern of laboratory work done by civil service people is still their basic mode of operation, and much of our most important work in advanced research and technology, both on aeronautics and space, is done in this way. The requirements for this work have not been reduced by the reductions in “Research and Development” funds.

I have stressed this point, with examples drawn from our major centers, because it is the fundamental reason why we have found in our detailed reviews that we cannot acceptably make reductions in “Administrative Operations” of the magnitude indicated by the Congress and still carry out the intent of the Congress as contained in the Authorization and Appropriation Acts.

The level of “Administrative Operations” required depends on the work that needs to be done, and cannot be determined by percentage relationships to “Research and Development” in the total NASA budget.

Let me summarize briefly the actions we have taken in administrative operations and the results of the reviews we have made.

As it became apparent that the final NASA fiscal year 1969 appropriations, including Administrative Operations, would be significantly reduced from the budget request and that additional Government-wide reductions would undoubtedly be imposed in response to the then pending Revenue and Expenditure Control Act, actions were started within NASA to begin the necessary adjustments to its planning and operations. A series of intensive reviews involving all principal headquarters and center officials was initiated. In early May, while these reviews were proceeding, authority throughout the agency to employ new personnel was sharply curtailed so as to develop the maximum flexibility to respond to the expected lower funding levels in fiscal year 1969. This action restricted the replacement of positions vacated through separation to only one out of every four separations, with the exception of the Manned Spacecraft Center, Kennedy Space Center, and Goddard Space Flight Center, which had to be exempted because of the heavy Apollo requirements.

We examined carefully the actions that would be necessary to reduce the “Administrative Operations” account to the \$603.2 million authorized by the Congress. It was found that, after all costs other than personnel compensation were reduced as much as possible, the \$603.2 million level would still require us to eliminate 2,570 man-years of civil service effort. Had we taken this course of action immediately and if a reduction in force could have been implemented in time to remove employees from the rolls by September 1, we would have had to eliminate about 4,900 positions. This number of positions would have had to be reduced in order to generate dollar savings corresponding to the 2,570 man-years, because employees, of course,

have to be separated and would be on the rolls for 2 months of the fiscal year and they would also be entitled to lump-sum leave payments and severance pay. If the action were to be completed in October, we would have had to abolish 5,600 positions and, if in November, 6,300 positions.

As we found in our difficult experience with a major RIF at the Marshall Center last year, the number of employees actually affected in RIF procedure is far greater—normally by a factor of two or three—than the number of positions actually abolished. Therefore, we could see that, depending on when the action could be completed, as many as 50 percent or more of the NASA work force would have felt the impact of the actions necessary to stay within an administrative operations budget of \$603.2 million for fiscal year 1969.

Mr. Webb and I concluded that an impact even approaching this magnitude would have had such severe disruptive effects on NASA activities that the successful execution of the programs approved by the Congress at the \$4 billion total level, or of the programs we could conduct within the \$3.85 billion limitation, would have been virtually impossible. We further concluded that we should approach the problem of determining our "Administrative Operations" requirements for effectively carrying out the program at the \$3.85 billion level, making all the reductions we could, and to anticipate in the plan a transfer of funds from "Research and Development" to "Administrative Operations" to the extent required.

A number of alternative planning levels were assessed. It was our conclusion in the end that it was not possible to reduce the Administrative Operations account below \$623.3 million, and, accordingly, the Administrative Operations plan has been established at that figure. This plan requires a 1,661 reduction in planned civil service employment and a slightly larger reduction in man years of support service contract effort. We hope that this reduction can be accomplished primarily through attrition with possibly a few selective RIF's and believe that it represents the maximum reduction and disruption to the work force feasible without unacceptable consequences for our ability to conduct our programs.

With the reductions in personnel now planned, NASA will have reduced its actual employment by approximately 3,000 since July 1967. A continuing effort has been made to keep Administrative Operations costs to the minimum consistent with the effective and economic execution of the agency's approved programs. A measure of the effectiveness of these measures is the fact that if NASA were able to pay salaries on the average of the same rates in existence in 1966, and the 1969 Administrative Operations budget would be approximately \$70 million less than the current plan.

Mr. Chairman, taking account of the total situation we face, I believe that we have had no alternative but to plan our administrative operations on the basis I have described. I also believe that it was not the intent of Congress that we fail to use the flexibility afforded by the transfer authority available to us when the consequences of our failure to do so would have been to frustrate the conduct of the important research and development programs which Congress clearly approved.

Mr. Chairman, this concludes my prepared statement.

JOINT NASA-DOT STUDIES IN AERONAUTICS

The CHAIRMAN. Mr. Webb and Dr. Paine, we are happy to note that there has been no reduction in your operating plan in the aeronautics program. This is an area in which this committee has taken a great deal of interest.

I would like to place in the record three recent letters from within the executive branch pertaining to the joint DOT-NASA study that was recommended by this committee in Senate Report 957 of January 31, 1968.

(The letters referred to follow:)

OFFICE OF THE SECRETARY OF TRANSPORTATION,
Washington, D.C., August 9, 1968.

DR. THOMAS O. PAINE,
*Deputy Administrator, National Aeronautics and Space Administration,
Washington, D.C.*

DEAR DR. PAINE: This correspondence is with reference to the NASA-DOT study on Aeronautical research and development level of effort as recommended in the Senate Committee on Aeronautical and Space Sciences report dated January 31, 1968.

On May 22, 1968, at a meeting of the National Aeronautics and Space Council, Mr. Webb recommended that DOT should take the lead role in directing and coordinating this study. The Vice President requested that DOT assume the lead on the study and broaden it to involve other Government agencies as appropriate.

At a meeting on July 25, 1968, members of your staff outlined a plan for initiating the study. Their proposal would focus on providing early results of selected items. The proposed time-value analysis approach might evolve the methodology for attacking the broader more complex aspects of this study. The Federal Aviation Administration also suggested an R&D-value analysis approach, combined with a study review of the development and growth of aviation relating contributions to the welfare and economy.

I am requesting that you direct the appropriate NASA group to proceed with the time-value analysis part of the study along the lines presented. I am requesting that the FAA proceed with an historical growth related to research expenditures analysis.

In view of the importance of this study effort, I am sure that you and I will want to continue to be intimately involved in the conduct of the study effort. I believe that the above represents a constructive initial approach.

Mr. James E. Densmore will meet with Mr. Harper to develop priorities and a schedule for the initial phase of the study.

I trust that this will meet with your approval.

Sincerely yours,

FRANK W. LEHAN,
Assistant Secretary for Research and Technology.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
OFFICE OF THE ADMINISTRATOR,
Washington, D.C., August 30, 1968.

HON. FRANK W. LEHAN,
*Assistant Secretary for Research and Technology, Department of Transportation,
Washington, D.C.*

DEAR MR. LEHAN: I am replying to your recent letter relating to the discussions between our staff members of plans to undertake the study recommended by the Senate Committee on Aeronautical and Space Sciences.

We are pleased to know that your office agrees with our proposal as to an initial approach to this difficult problem. We have informed our staff of your agreement and instructed them to proceed along the lines outlined during the recent meeting

with your office. At the convenience of Mr. Densmore, Mr. Harper will meet with him to develop any further thoughts your office may have and to establish priorities and schedules.

I am in full accord with your suggestion that you and I follow this study closely. Beyond its immediate importance, the study should assist in establishing a pattern of successful cooperative actions between DOT and NASA that will become increasingly important as air transport develops. Mr. Densmore and Mr. Harper should arrange for a regular joint review process by those involved in the study to keep us fully informed of its progress and of the results as they affect our Agency's plans.

I look forward to this initial step forming the basis for establishing most effective relations between us.

Sincerely yours,

T. O. PAINE, *Deputy Administrator.*

NATIONAL AERONAUTICS AND SPACE COUNCIL,
Washington, September 24, 1968.

HON. ALAN S. BOYD,
Secretary of Transportation,
Washington, D.C.

DEAR MR. SECRETARY: The National Aeronautics and Space Council has a continuing interest and a legislated responsibility in the progress of aeronautical research and development.

As you know, the Senate Committee on Aeronautical and Space Sciences issued a report on January 31, 1968, in which some specific recommendations were made regarding aeronautical policy. One of those Committee recommendations was that a study should be made to analyze the relation between the benefits that accrue to the nation from aviation and the level of aeronautical research and development effort. The Committee went on to propose that such a study be accomplished by NASA and the Department of Transportation and that the results of the study should be transmitted to the National Aeronautics and Space Council. This recommendation went further and urged that the Council, after appropriate consultation, should determine the level of Federal government involvement and the relative effort of participating agencies. In actual fact, the National Aeronautics and Space Council's function would not be one of determining but rather one of proposing to the President and then carrying out needed coordination after a decision had been made.

At the May 22, 1968, meeting of the National Aeronautics and Space Council, the Vice President asked for progress reports on the study recommended by the Senate Committee. Administrator Webb of NASA proposed at that time that the Department of Transportation take leadership in the study because of its direct relationship to transportation policy. Mr. Densmore, representing your Department, reported that high level attention and interest were being devoted to this problem and that NASA-DOT meetings had already been held with the purpose of formulating an outline for the project.

The Vice President requested prompt action on the study and agreed that the expertise of the Defense Department should be coordinated with that of DOT and NASA in this matter. He also asked that interim reports be made to the Council. It would be in the interest of efficiency if such reports would be made to me so that they could be brought directly and promptly to the attention of the Vice President.

Sincerely,

E. C. WELSH.

The CHAIRMAN. Can you tell us when you expect to obtain some results from this study, and will you keep the committee informed of its progress?

Dr. PAINE. May we furnish that information for the record?

The CHAIRMAN. That will be fine.

(The material referred to follows:)

GOVERNMENT PARTICIPATION IN AERONAUTICS R. & D.

The subject study, to be guided jointly by NASA and DOT, will be carried out in its initial phases by the Mission Analysis Division of OART. Representatives of other government agencies related to national aeronautics activities will be brought in as they are required.

The objective of the study is to define the nature and extent of government participation in aeronautics R&D as guided by maximum national return on the investment. Because air transportation is having a major impact on many phases of national development, it is clear that no simple, quick study can achieve the desired end. It may well prove necessary and valuable to continue the study over many years to account properly for the impact of changing technology and changing national requirements.

Initially the study is making time-value analyses to identify grossly the areas of technology to be emphasized as based simply on value of the traveler's time; these analyses provide focus on areas for more detailed study. Much of this broad analysis is complete. The studies will then be directed at determining cost-benefit relations of achieving new and applied technology in specific areas. Costs considered will include those of both government and industry and benefits considered will include both industry returns and national effects. The complexity of the problem has dictated that one area be examined first in some detail. The objective here is as much to establish methods of study and analysis as to obtain first definitive results. It is estimated now that this first focused study effort will be completed by the end of FY 1969.

The CHAIRMAN. Senator Cannon?

COMMENDS NASA OFFICIALS

Senator CANNON. Thank you, Mr. Chairman.

Mr. Chairman, first, I would like to express my appreciation to the chairman of the committee for the great support he has given to this entire program, and I have some matters relating to the NERVA program that I want to go into.

Our chairman has worked diligently every step of the way with the administration in meeting and attempting to solve the many obstacles that have been thrown up in connection with our entire space program, and as Mr. Webb said, he has certainly been very helpful in keeping this program going, and I want to commend him on it.

I also want to commend you, Mr. Webb, on your very fine tour of duty. I for one, will hate to see you leave. I think you have done an excellent job in this position and we will look forward to seeing you work on a consulting basis with NASA and the Administrator in the future.

Mr. WEBB. Thank you very much, Senator Cannon.

Senator CANNON. I also want to commend Deputy Administrator Paine and Mr. Beggs and Mr. Klein, who took time recently to personally inspect facilities at the Nuclear Rocket Development Station in Nevada. Our people out there were happy to have them there. We are very proud of those facilities and I am sure this will help them get a better feel for the progress that has been and is being made there. And, I want to acknowledge the constant and long-standing support given to the nuclear rocket program by Senator Hickenlooper and Senator Smith, and I regret that they cannot be here with us today. I know that Senator Smith does not often miss our meetings; and were she not hospitalized, she would certainly be here with us today.

NERVA PROGRAM

Now, as you know, Dr. Paine, I have been very much concerned about the NERVA program and about the level of the funding that was originally proposed. I note here now that you propose to add an additional \$7 million and I am sure that will add a great deal to boosting the morale of the scientists and engineers who have worked so long and so hard over the years to develop a team and the technology involved in the NERVA program. I have been reviewing the personnel

levels that were anticipated, and believe me, before the announcement was made of this additional \$7 million being put into the NERVA program, it was quite obvious that the personnel levels were going to be such that it would have just completely scuttled the entire program.

Now, while I am encouraged, I am hopeful NASA will be able to do even more than it has indicated here today in this area. I view the nuclear rocket engine program as perhaps the most important project for the future of the United States in space. I believe, Dr. Paine, from your statement here that you think very, very highly of this program and that it is to be extremely important in our future activities in space.

It seems to me that we have successfully completed virtually all of the objectives of the nuclear rocket program as far as the technology is concerned, and I believe that having developed the technology at a cost well exceeding \$1 billion, it would be scandalous to abandon the program now. I must say that I previously discussed this matter with the chairman. We felt that a figure somewhere in the neighborhood of \$15 million, rather than the \$7 million you have proposed, would be more nearly in line with keeping the option open to keep this program on track. That is, if we are able to make a decision next year to go ahead, and if we have the priorities to give us some funds in this area, we would not lose our options through cutting the program back so far this year that we would really have scuttled it.

I think that if there is a more advanced or meaningful program for our entire space effort than this one, I do not know of it. But if I—as I believe—the NERVA program is the most promising prospect of the space effort, then it seems to me that we face a situation like building only one-half a ship which we then allow to sink after proclaiming that we have successfully demonstrated we can build it.

Now, my interest here is that we go ahead with this program because we have proven the theories and the technological assumptions on which it is based. I, therefore, Dr. Paine, have a few questions to ask you in connection with your statement.

First, will the \$7 million increment permit the Government to retain its objective of proceeding in the following year with the development of a flight-weight engine if that decision should be made next year?

Dr. PAINE. Well, I would like to ask Mr. James Beggs, who is in charge of our Office of Advanced Research and Technology in which the NERVA engine falls, to answer that, if I may.

Mr. BEGGS. Senator Cannon, as Dr. Paine mentioned, we did make a rather complete review of this program just about a week ago, and NRDS was, of course, on the schedule. We discussed rather fully the test operations that they will be conducting on the XE engines this year and what would be necessary to maintain the momentum and the thrust of this program should we decide to go ahead with a flight-weight engine in 1970.

The current program, as you know, is one of finishing our technology development with the test of the XE engine. That, of course, will be done more fully with the added funds. We will have those results.

If we are able to proceed with the development of the flight-weight engine in fiscal year 1970, we will still, of course, have to do a good

deal of development work before we are ready to test in Nevada. This means that the test load at the center will probably not be so great, initially, as it is right now.

However, we do feel that at this time it is imperative that we maintain our base of operations and maintain the key people so as to have a good capability to build up for testing the flight-weight engine when it is ready for development testing at the site. Thus, we are not maintaining an operation that could carry a flight-weight engine test program, but we do feel we will have all the key personnel available to us and that we will be able to add to them sufficient personnel to support the flight-weight engine when it comes into being.

Senator CANNON. What stage in time is the last of your present testing program now?

Mr. BEGGS. The present testing program on the XE engines will proceed to about the middle of next year.

Senator CANNON. Well, now, how soon may we expect that new hardware would be brought into the program so that it might be tested?

Mr. BEGGS. Well, our intent with the program as it is configured now is to do experimental engine testing work so that we will have testing going on at NRDS throughout the coming year, that is, throughout fiscal year 1969.

Senator CANNON. In other words, from April on.

Mr. BEGGS. Yes, sir, from April through the end of the year. We would hope to have flight engine component work underway within the next year so that the testing of the flight-weight engines at NRDS could begin early in 1972.

Senator CANNON. And at what stage in time or what point in time would it be necessary for us to make a decision as to the development of a flight engine, flight test engine, to keep that level going?

Mr. BEGGS. Well, clearly this will have to be a part of the budget cycle for fiscal year 1970, and the schedule on this runs from September to September, so that we would have to have clear indication of a decision to go ahead by September of calendar year 1969.

NATION'S FUTURE IN SPACE BEYOND APOLLO

Senator CANNON. Dr. Paine, as the new Administrator, what do you understand to be the Nation's future in space beyond the Apollo program now?

Dr. PAINE. That is a subject to which we have been giving a great deal of planning attention in the agency within the last month, Senator Cannon. In particular the types of missions that we see in the future of a large size that would be suitable for the NERVA engine are also receiving increased attention at this time. We see in the manned space flight area the manned space station earth orbital type activities and we look forward to the possibility of exploiting the capability we have developed in the Apollo program for the exploration of the lunar surface.

In the unmanned area, we see this great opportunity opening before us now of the earth resources satellite area, the entire area of applications in advanced meteorological, navigation, and communications satellites. In the planetary area, we see an opportunity opening before us to extend greatly our knowledge of the near planets and then

beyond that, in the latter part of the 1970's, the more distant planets with the opportunities that open up in the 1977 period.

Many of these missions will require us to develop the kinds of increased capability that nuclear propulsion can give us.

Senator CANNON. Well, now, you indicate here in your Administrative Operations account that you will have to eliminate a number of positions by attrition, and with a small number of RIF's. What do you foresee in the future in that area? In other words, when you get back to this level, is this the level that you are likely to want to proceed, in the future, based on your present thinking?

Dr. PAINE. Our present thinking, and it is of a somewhat preliminary nature, is that the current level is an appropriate level for perhaps the next year or so with reduced requirements that we see in the 1970 period. At the same time, if the United States is to forge ahead and to take a leading position in space—an objective which we have frequently enunciated in the past but which with many other economic and fiscal pressures we have been forced perhaps to cut back on somewhat—if indeed we move ahead we would expect to see some modest increase in the AO level.

Senator CANNON. Well, now, with this AO level for the coming year, will this permit you to retain the necessary scientists and technicians and the necessary skills on hand under the future anticipated level of funding?

Dr. PAINE. It does this in an extremely austere way, Senator Cannon. There is very little margin here but we believe that this is a minimum acceptable level to us.

PROSPECTS FOR NASA FUNDING NEXT YEAR

Senator CANNON. Do you have any kind of feel for the prospects for NASA's funds next year?

Dr. PAINE. No, sir, I do not. It is my hope and my belief that the Nation will indeed want to proceed on with its aeronautics and space program, and we are making every possible effort to see that the best possible case for this will be put before the Nation.

Senator CANNON. In your preliminary planning do you anticipate building a program at about the same level as this year's, that is, independent from the Apollo?

Dr. PAINE. In our present stage of our planning, Senator Cannon, we are looking at a very wide range of alternatives, including a somewhat reduced figure over this year and including some very substantially increased levels, and we are trying at the present time to carry forward our planning that will allow us to make the best possible program mix when we have a better idea as to what can be achieved at these different levels of funding.

SPACE OBJECTIVES CHANGE

Mr. WEBB. Senator Cannon, could I comment just a moment on this situation—

Senator CANNON. Sure.

Mr. WEBB (continuing). Since it has been important to President Johnson and to me to explore the situation as we have considered how to get continuity and stability in this important program.

We have recognized in examining the overall position of the United States in aeronautics and space and relating it not only to the 1969 operating plan that we will soon make final, but also to the 1970 budget, to the fact that we will then have a new President who will undoubtedly make some changes in the budget that will be submitted in January by President Johnson, as well as to the fact that we will have a new Congress, which will then have to examine both President Johnson's budget and any changes suggested by the new President.

I think perhaps I could add to what Dr. Paine has said, two things. First, in this examination the President and I recognize that over the last 7½ years we have gone through a period in which we were seeking leadership, world leadership, pre-eminence in aeronautics and space, and his budget messages for every year up to 1966 were keyed in that direction.

For instance, in 1965 the President's budget used the words "maintaining world leadership in space," as the objective. In 1966, "securing the benefits of world leadership in space exploration and in scientific knowledge and technology."

Now, as we move from that period into 1967, 1968 and 1969, there was a definite change in the objective stated by the President. The words he used in 1967 were "our task is to use the tools that have been developed wisely, carefully choosing our priorities in space in the context of overall national policy priorities."

For 1968 his words were: "The primary objectives are to extend our ability to operate in space, to use that capability for the benefit of mankind."

In 1969, the budget we are now considering, when he submitted it he spoke of "programs to improve our ability to operate in the space environment, advance man's knowledge of the universe, and use the experience gained for man's benefit."

So, you see, we have had a shift from the stated objective of world leadership and preeminence to the use in these times of the capabilities we have developed. With each passing year, however, we have not been inserting new programs in and we have had developed a capital base of about \$4 billion of which about \$3 billion has been added in the last 6 years or so, and we did build up a personnel competence in NASA with 33,000 people or so to manage a much larger group, ten times that number in industry and in universities.

So, I think it is fair to say in answer to your question about the future that there is a very heavy pressure to hold down expenditures for fiscal year 1970 which, in my opinion, will have to be faced by the President as he considers the budget that he submits. I can see no letup of those pressures in connection with actions to be taken by the new President when he considers modifications he wishes to make in the budget.

PRODUCTION OF SATURN V'S

I think the key issue which is related to your questions is whether or not any new starts, using the capabilities we have built up, can be included, and whether or not the 1970 budget can maintain production of the Saturn V rocket. If we do not in 1970 buy some long leadtime items for Saturn V, then you are going to terminate those production lines, and we will be in regard to the booster stages, the

lower stages of the booster very much where we are now with respect to NERVA. We will be in the position of considering how we can resume production of the lower stages at some other time with better equipment just as we are now considering how to improve the performance of the upper stages by replacing one or more of them with NERVA.

I hope very much, and I have mentioned this very strongly to President Johnson—I know he is deeply concerned—that we do not terminate the production of the Saturn V at a time when the U.S.S.R. is about to fly a booster that in dimensions is, in my opinion, considerably larger than the Saturn V.

Senator CANNON. But, as things stand now you would actually procure the last of your proposed Saturn V's in the 1970 program, is that right?

Dr. PAINE. Yes, sir, but we would not be buying any items that would run beyond number 15 of the Saturn V's. Now in this 1969 budget we are planning to terminate production at the end of No. 515, but still maintaining a somewhat flexible stance in the hope that in 1970 a decision can be made to keep at least a minimal production of Saturn V's going beyond No. 515.

Senator CANNON. What do you define as a minimal number of Saturn V's?

Dr. PAINE. Senator Cannon, we have in the industrial base, which is spread widely throughout the Nation for the first three stages and the instrument unit, a capability to produce up to six a year. That is being eroded this year. We, I think, should certainly consider a minimum no lower than two per year and this is not a very efficient production level. The real problem we face is can we phase in with, say, two Saturn V's a year some other work so you have available in this large industrial base, in the assembly facilities at Michoud, and at the same time at Mississippi Test Facility and the launch facilities at the Cape enough work that can be efficiently done so that you do not have your costs rise to astronomical figures for the number delivered. It is very hard to specify anything lower than two.

Of course, if we were told produce one per year so as to have a minimum of all the skills necessary, it could be done but the cost would increase rapidly. Maybe Dr. Mueller—he is not here—Mr. Mathews is deputy to Dr. Mueller in the manned space flight program. He was the manager of the Gemini program and he has been concerned with how you build and fly manned equipment for some time. Maybe he would want to give you an opinion as he sees it from the operating standpoint, if you wish to hear him.

Senator CANNON. I have another question or two here and then perhaps he might want to comment on all of these.

In an August press release you referred to a gap, NASA referred to a gap with reference to continuing the Saturn V production.

Now, just what did you mean by that gap? Is this what you have just been talking to?

Mr. WEBB. Yes, sir. I really mean, we are fighting hard to get enough money in the 1970 budget to make sure the production is continued beyond No. 515. Even at best we will have some gap in deliveries, although work will be going on aiding future deliveries. I think the gap is mainly in the production for 1 or 2 or 3 years, when we

may have some Saturn V's in storage if we have good results from the Apollo missions to the moon.

SATURN V INVENTORY

If we had perfect results on our present plans, we could have, perhaps five or so of these in storage against future missions. But we would not have the money to develop payloads to fly those.

So, we have got a very real problem in this Nation as to whether we are going to stop flying big payloads or build some payloads that go along with any such boosters which might be placed in storage and further maintain the production of these big boosters.

Senator CANNON. If lunar landing is achieved with vehicle No. 8, how long would the Saturn V inventory carry our space program after that?

Mr. WEBB. It depends on whether this Nation wishes to build the payloads to fly on those Saturn V's that we would have in storage. We are now preparing no payloads to fly after the equipment built for the moon. We have four equipments that could be landed on the moon; four of the instrumentation sets for the moon. So, we could have up to four attempts without running out of equipment.

We could go back for a revisit if we were completely successful on No. 1 or 2, but that decision has yet to be made. The only funding available to us in the 1969 budget up to now is to do one landing and to have these extra equipments available, because no one can be sure that we may not have to use up some of this equipment in orbit around the earth before we ever head for the moon.

LARGE LAUNCH VEHICLE CAPABILITY

Senator CANNON. What is your recommendation for providing the Nation with a large launch vehicle capability after the Saturn V supply is exhausted?

Mr. WEBB. It is too early, Senator Cannon, to be specific on this. The problem that we and the Department of Defense have faced this year is whether with the serious reductions being made in research and development in both agencies it would be possible to agree as to payloads and booster requirements. We both have taken steps to obtain data on which this decision can be based but it has not yet been possible to examine with all of the other problems, requirements, and priorities, precisely how you could get to a common use basis with respect to boosters, and, to some extent, pay loads.

We have now a coordinated program. We are getting a base of data on which we can consider whether an even closer association of activities could take place.

Now, I think we will find in connection with the 1970 budget that the question of Saturn I production and Titan III production can be considered on the basis of better figures than we have had. But, there is still the issue of what the payloads for even Titan III ought to be and I am sure you know that in certain classified areas, there are various possibilities for this.

We have no plans for flying Saturn I's beyond the Saturn I Workshop cluster which will take five Saturn I's, and as you know, we have abandoned the plan to shift from the Saturn I to the Saturn V for

lunar exploration and following this shift, to continue to fly earth orbital missions with the Saturn I's. We have abandoned that and will not fly Saturn I's again until we have finished the flying of the Saturn V's on the lunar mission.

At that time, when we can resume Saturn I flights, we hope to use five of them for this cluster we call the Saturn I Workshop and the Apollo Telescope Mount. So there simply are not any payloads in the budget except for that.

INTERMEDIATE CLASS LAUNCH VEHICLE STUDY

Senator CANNON. What is the status of the intermediate class launch vehicle study which was discussed during the authorization hearings?

Mr. WEBB. It awaits the development of further data, more time to discuss at senior levels in the Department of Defense and NASA the requirements that are projected, some examination of what the 1970 budget can support, and with the basic requirements on the President for reducing expenditures in 1970 as well as 1969, I think we may well find that decision postponed beyond the 1970 budget, that is, as to whether or not we want to replace our intermediate booster with about a 100,000-pound booster capable of much lower costs per pound in orbit.

Senator CANNON. When do you expect the study and recommendations to be available?

Mr. WEBB. I would say that if we had any indication that the budget could support the building of some pay loads, it would not take us very long to decide what booster configuration is the best for the country.

Senator CANNON. Are you saying you are not going ahead with a study at the present time? You are just sort of in limbo?

Mr. WEBB. No, sir. We are pursuing the study and getting information on a common basis so we can compare the cost of using present boosters and the cost of developing and using an intermediate range booster, but it's not proceeding at full steam because there is no indication as yet that we have a green light for pay loads that would require it.

NERVA ENGINE DEVELOPMENT

Senator CANNON. Dr. Paine, getting back to the NERVA, when can we look forward to the early development of a flight weight engine?

Dr. PAINE. We intend to put, if possible, in the 1970 budget, funds which will enable us to proceed with the development of a 75,000-pound thrust NERVA I engine.

Senator CANNON. Now, do you have any information concerning whether this add-in of \$7 million you propose here will result in a like added increment by the AEC, inasmuch as this is sort of a joint program with the cost being borne by both agencies?

Dr. PAINE. I think perhaps it would be best to have Mr. Milton Klein, who is the manager of our joint AEC-NASA activity, who is with us here today, to comment on this.

Mr. KLEIN. Senator Cannon, I believe the amount provided in the AEC program as it came out of Congress in fiscal year 1969, \$53 million, would be consistent with the amount in the NASA budget of \$39.5 million that Dr. Paine mentioned.

Senator CANNON. In other words, the AEC has given no indication that they propose to cut back from that \$53 million figure?

Mr. KLEIN. There has been no indication to that effect.

Senator CANNON. And if they do not, of course, cut back, that \$53 million figure would be quite adequate to go ahead with your \$39.5 million that you are talking about.

Mr. KLEIN. That is correct.

Senator CANNON. Now, just one final question, Dr. Paine. In view of the review that you have made of this and the fact that you do consider this such an important program, I am wondering if you would take another look at it to see if there is any possible chance of getting into this program another \$7 or \$8 million? As I told you, the chairman and I had initially been talking in terms of about a \$15 million add-in over your 32.5, and I am asking now if you would be willing to take another look at that and see if you think it is advisable. If you think it is advisable, can you try to find some funds go to in there?

Dr. PAINE. Senator Cannon, we have this whole program under monthly review and I certainly will accede to your request to take another hard look at this.

Senator CANNON. Thank you very much.

Mr. Chairman, that is all the questions I have at the moment.

SPACE BUDGET FOR 1970 DISCUSSED

The CHAIRMAN. Senator Hatfield?

Senator HATFIELD. Mr. Chairman, Senator Cannon, Senator Holland, first, I would like to say I am delighted to be on this committee and I have been assuring my friend, Mr. Webb, there is no relationship between his departure and my coming to this committee.

Mr. WEBB. None. Senator, I remember when you were Governor, we had some discussions of the importance of these programs out in your State.

Senator HATFIELD. That is right. We enjoyed very much your visit there and you did much to stimulate the people of our State in thinking toward the type of educational programs that would add much to, I feel, the whole space effort.

I would like to refer to page 4 of Dr. Paine's testimony. In the second paragraph, and this is in line with Senator Cannon's questioning a while ago, Dr. Paine, you state: "I am personally convinced that the Nation's space program requires an increase of funding in fiscal year 1970 and I am hopeful that as we proceed with the preparations of the fiscal year 1970 budget, we will succeed in establishing the need for a significant increase."

I have two questions. One, on the basis of the objectives we were discussing a while ago, toward the world leadership role or toward utilization of our present capacities, what would be the ideal 1970 fiscal budget, as you refer to it here, and secondly, the amount of increase that would be necessary over the present approximately \$4 billion?

Dr. PAINE. Senator Hatfield, it is too early to make a definitive statement on that but in our preliminary looks at this, it appears to us that a 1970 budget on the order of \$4½ billion would be a first step

toward getting the program into a far more rapid pace and would permit us to begin to get the new starts, the new program starts under way that are so essential if we are to have a space program that will indeed be competitive with the Soviet Union in the post-Appollo period.

Mr. WEBB. Senator Hatfield, the record has been made over a number of years that it would take between \$5½ and \$6 billion sustained over a period of time to make sure that we were developing the full range of capabilities that would assure world leadership in these fields.

Now, we have dropped backward from the \$5¼ billion level which we did attain, to \$4 billion in this year. So, it would take some time to build up to this.

Now, you do understand that as we develop these capabilities, they are used by others, such as the Weather Bureau, the Department of Defense and the Communications Satellite Corporation and others. So that budgets outside of NASA for operational use, which is also a part of the world leadership picture, are building up; they are building up to figures above \$2 billion already.

So, we have to consider the NASA program along with those others. But our job is to be in advance and prepare the way; to lay the base for proving that it is a good investment for the operational agencies.

Senator HATFIELD. I understand.

Dr. PAINE. To amplify the two statements and put them together, Senator Hatfield, our studies show that a \$4½ billion approximate level would permit new starts which would return the Nation over about a 5-year period to the \$5½ to \$6 billion level that Mr. Webb spoke of.

Senator HATFIELD. Well, then, on page 18, relating to the NERVA project, when you talk, in the second paragraph of holding the expenditures to a minimum in fiscal year 1969 and fiscal year 1970, that minimum, I assume, is inclusive of your \$7 million increase that you are recommending on page 17, but it is still at the level pretty much of the \$4 billion that you are talking about in 1969; is that correct?

Dr. PAINE. Yes.

Mr. WEBB. Let me be specific. We are proposing to the Director of the Budget that he give us an apportionment on the basis that \$7 million will be added to the interim operating plan on the NERVA budget.

Now, his decision on this will be keyed in some manner to how he believes the 1970 budget will support NERVA.

Senator HATFIELD. Well, Mr. Webb, what are the minimum expenditures that you are thinking of in terms of 1970 that you refer to on page 18, or Dr. Paine? Is this still within that realm of \$4 billion or \$4½ billion?

Mr. WEBB. The expenditures are coming down as new obligational authority is reduced. As we went up, the expenditures lagged the authority. Now, they are lagging the downward trend. And it will take something like \$3,600 million of new obligational authority to continue the projects that we already have underway with no new starts—to fly them out and complete them.

So, it would seem to me that at about \$3.6 billion you would have expenditures that probably would be somewhat under \$4 billion. This year they will be about \$4.1 billion or so. \$4.2 billion. So, we have this problem of the downward trend in expenditures following NOA and then lagging any upward start, so it is very hard to give you a specific estimate.

Expenditures in 1970, if they are below \$4 billion, will be a very, very austere budget and will produce more serious consequences than we have seen up to this time in our nation's aeronautical and space capability.

Again, I would like to point out that aeronautics is included, and so we have to think of the two fields, aeronautics and space, in terms of these trends.

Senator HATFIELD. You mentioned about a new President and new Congress, both of which will have to redefine perhaps or define anew our goals and objectives and also compare that review with the recommendations of President Johnson's outgoing budget.

What I am really trying to get at, I guess, is at what point do we become informed, or perhaps we already are, I am not aware of it, of what the recommendation of the agency is to achieve certain goals? We talked about two possible goals here today. At what point do we get some information on the dollar volume that we are talking about in the best estimates of the technical and professional capacity of this agency?

Mr. WEBB. The President's budget submitted in January will be the first authoritative indication to you of his fiscal plan for the total Government including NASA. My judgment is that as soon as the new President has been elected, President Johnson will begin some discussions in the so-called transitional processing on these important matters. How soon a new President would indicate his attitude toward this program in conjunction with all other problems is a matter that I cannot answer. Insofar as what NASA is prepared to say, we answer your question, sir, as Dr. Paine just did. He says that our judgment is about \$4½ billion of new obligational authority should be provided in the year 1970 if we are to begin to reverse the trend of the last 3 years. So, we are prepared to answer your questions; but under the budgetary system which you operated as Governor and which the President operates very rigidly we are not permitted to volunteer our own plans in competition with the President's plans.

Senator HATFIELD. I appreciate that. I have changed my viewpoint since moving back to the legislative branch of the Government.

Mr. WEBB. You remember, Senator, I was Budget Director and then took this job, so we both changed.

Senator HATFIELD. I am really looking more for education and edification here really, because I am not very well schooled in this subject and I want to get materials which will give me a better understanding, and I will look to our chairman for that and to our staff. But, thank you for your comments.

Mr. WEBB. I would like to say one other thing within the privilege of perhaps my last appearance here. Senator Anderson as chairman and Senator Smith as the ranking minority member have always encouraged us to be full and complete in giving information of the kind you are asking for to members of the committee in sessions here. And

they have, I think, an outstanding record in the publication of this kind of information for public understanding of the program. I think that either in these committee sessions or at any other time that you wish information, the chairman will encourage NASA to provide it in any form most useful to you.

Senator HATFIELD. And you would be receptive to receiving information from us, I suppose, too, concerning the great opportunities and advantages of various parts of the country for this type of study and development.

Mr. WEBB. Yes, sir. We are always prepared to listen and consider the views of those who have interests and desires to present in connection with these developments. We do operate under the procurement laws of the United States in connection with contracting and where the work is done.

Senator HATFIELD. I read you well.

Thank you, Mr. Chairman.

APPRECIATION FOR WEBB SERVICES

The CHAIRMAN. Senator Holland?

Senator HOLLAND. Thank you, Mr. Chairman. Off the record.

(Discussion off the record.)

Senator HOLLAND. First, Mr. Webb, I join Senator Cannon—and I am sure others expressed similar feelings before I got here—in expressing my appreciation for you. I think you have done a fine job. I have not always been as complimentary as perhaps I should have been, but I have been trying to improve this program where I felt it should be improved and I am sure you have understood that some comment that may have sounded rather critical were more friendly than they sounded.

Mr. WEBB. Senator Holland, I would express to you personally what I did to the committee before you arrived—my deep appreciation of the consideration that you have given me—I believe that both in those areas where we have proceeded without having to go into vigorous discussion and those where we have had a vigorous discussion, both have been helpful to us in NASA and, I hope, in making the program stronger. So, I appreciate the interest you have taken and the way you have gone at making sure you have had a solid basis for your decisions.

APOLLO PROGRAM OBJECTIVE EMPHASIZED

Senator HOLLAND. Thank you, sir, and I fought for the program, as you know, pretty hard on the floor of the Senate and will continue to do so as long as I think it is being well run and I have no reason to think that we will find other than that situation under the leadership of Dr. Paine.

Now, a few questions.

First, I am glad to see that apparently you still are making Apollo at this time the real objective.

Dr. Paine, I note that in your self-imposed ceiling of \$3.85 billion, and in your budgeting of that, you are not reducing at all the authorization in this year's Act for the Apollo activities for 1969. You are leaving it at the full total of \$2,025,000,000, is that correct?

Dr. PAINE. Yes, sir.

Senator HOLLAND. I want to say what I have said sometimes here before, that I think this is a real challenge. I think that the regaining

of impetus that this whole program had at an earlier time depends in large measure right now upon how we meet this challenge and upon how well, how successfully, and how as nearly on schedule as possible the Apollo program is carried out. And I think that it is sound to put emphasis on the objective at this time. If there be long delays, if there even be failure in this project, I do not think that this whole program will be apt to regain the impetus and the general command of public approval which it had for a long time. I hope it will regain that impetus.

Now, the first thing is this. I notice that in the launch vehicle procurement budgeting you have cut down the figure from \$115.7 million which was the authorized figure to \$100.2 million. Just what in the way of cutting down your launch vehicle procurement for this year does that specifically involve?

Dr. PAINE. This is primarily in connection with our smaller launches of unmanned satellites which are outside the Apollo program, of course. This includes an item to delay the Sunblazer project.

Senator HOLLAND. The what?

Dr. PAINE. Delaying our Sunblazer project and the small scientific satellite program which allows us to defer the purchase of these launch vehicles. It reflects the deferring of our 21-day biosatellite mission and, therefore, release from the necessity for purchase of that vehicle, and an atmosphere Explorer satellite. It reflects a deferring of our Geos satellite, but it also has an additional item for putting in the Nimbus B2 launch, and there also is a certain amount of delay in the improvement program and in some managing and engineering support manpower, sir.

Senator HOLLAND. Now, what specific vehicles are cut back in production for 1969? That is what I want the record to show.

Dr. PAINE. The total involved in the original budget for Scout is being reduced by \$3.9 million to \$12.6 million. The Delta rocket procurement is being reduced from \$30.8 to \$24 million. The Agena rocket is being reduced from \$14 million to \$11.9 million. And the Centaur is being reduced from \$63 million to \$47.7 million. So that we have a total reduction from an original budget request of \$128.3 million to a \$100.2 million in our interim operating budget.

Senator HOLLAND. In any case, does this result in trouble between yourselves and your contractors who are building these particular vehicles?

Dr. PAINE. Well, I believe the word "trouble" would perhaps be too strong a word. I do not believe there is trouble, but this has, of course, required us to take a hard look at the production lines to maintain the efficiency with somewhat stretchout and delay; but looking at this we feel this is entirely feasible.

Senator HOLLAND. I notice that your voluntary budget of \$3.85 billion follows the advice that you received in August from the Bureau of the Budget that they thought that that would be about what you would have left after the reduction was made following the passage of the legislation in June, I believe it was, requiring reduction in expenditures. Has that amount remained constant in view of later action taken by Congress which has given priority to certain items of expenditure and has released them from reductions?

Dr. PAINE. Yes, sir. Up to the present time we have not had a change in that estimate.

Senator HOLLAND. This is based on information you received from the Bureau of the Budget?

Dr. PAINE. Yes, sir.

Senator HOLLAND. They still stand by this \$3.85 billion figure which they gave you in August?

Dr. PAINE. As an estimate, yes, sir.

Senator HOLLAND. Well, I am glad they are assigning that much priority to this program because they have got to find places to absorb the reductions which I have just referred to, and this will be more difficult because a good deal of money has been exempted by law from the expenditure limitation.

Now, the next thing is this. I notice on page 11 of your statement that there is a very material reduction in your tracking and data acquisition and that you end your statement on that matter by saying your plan of reduction provides full support for the Apollo schedule that you have outlined previously. Does that mean that tracking and data acquisition in connection with Apollo, is not affected in any way by this reduction?

Dr. PAINE. Absolutely, but I would like to ask Mr. Truszynski, who heads up this operation, to perhaps give you a more complete statement.

Senator HOLLAND. Well, I just want to be sure that in cutting back your tracking and data acquisition program you are not in any way cutting back those features of it that relate to the Apollo program.

Mr. TRUSZYNSKI. Yes, Senator Holland. And it is because we maintain the full support needed for Apollo that any reductions must be taken in the unmanned program support, and as a result, we will have to decrease the support of the unmanned satellite program with this kind of reduction.

Senator HOLLAND. All right. I notice also that in connection with the construction of facilities program which is shown on pages 11 and 12 of your statement, you show a very sizable reduction. In fact, Congress made a substantial reduction in that earlier. And you show where this will be applied.

I note that in two instances this will be applied to the Kennedy Space Center in that you will not proceed with the alteration and rehabilitation of Launch Complexes LC-34 and LC-37.

Does this mean that they will be delayed only for the time being, or does it mean you found that you will not need those alterations and additional construction?

Dr. PAINE. These are modifications that we will eventually have to put into place to cover the launches required as part of our Apollo applications program; but the delay in the start of our Apollo applications program has allowed us to defer the expenditure.

Senator HOLLAND. These launch complexes related in no way to the original Apollo program, but only to the Apollo applications which come later.

Dr. PAINE. Those two complexes are for the Saturn IB flights, that is correct.

Mr. WEBB. I think, Senator, we ought to be sure this is understood. If the next flight this month is successful on the Saturn IB, we will suspend flying Saturn IB's. It may be that we will have trouble with the Saturn V. We might have to use the IB's in the Apollo program.

If so, we will be using these complexes as they are now and only after that use in the Apollo program would we proceed to modify them for the Apollo applications program.

Senator HOLLAND. Then, this is a suspension of alteration and rehabilitation rather than a decision to not go forward at all with those alterations and rehabilitations?

Dr. PAINE. That is right. Merely in connection with the scheduling delay.

Senator HOLLAND. And again, to make sure of this, this does not in any way apply to the Apollo program?

Dr. PAINE. That is correct. With the modification that Mr. Webb put in that should we have to move back to Saturn I-B launches in connection with the major Apollo program, then we would be using Launch Complex 34 which we will be using next week.

Senator HOLLAND. Now, I think the record ought to reconcile a little more fully part of the statement of Mr. Webb and part of your own statement, Dr. Paine. Mr. Webb said that the interim operating plan "does not include keeping production lines open to meet future needs or to hold experienced teams together. Instead, in most instances its thrust is to hold together small cadres of able men and women," and so forth.

Your own statement which appears on page 16 would indicate that there is to be very little reduction in the personnel involved. I think the main point is found in this statement: "This plan"—meaning your plan that you have adopted—"requires a 1,661 reduction in planned civil service employment and a slightly larger reduction in man-years of support such as contract efforts. We hope that this reduction can be accomplished primarily through attrition"—that means as people retire or die or resign to go elsewhere—"with possibly a few selective RIF's. I believe that it represents the maximum reduction in disruption to the work force feasible without unacceptable consequences."

It seems to me that Mr. Webb's earlier statement indicates a much more serious disruption than your statement indicates. I think the record should be made very clear on this, because really if the reduction which you contemplate on personnel is not going to seriously affect your going forward with the program that is one thing. If it does seriously affect it, I think we ought to know that fact and know how it affects it, and I find it a little difficult to reconcile these two statements.

Mr. WEBB. Senator Holland, let me say that my statement is an overall one related to the fact that in the last several years we have spent between 90 and 95 percent of our funds outside NASA; 90 to 95 percent of our funds did not go to cover the administrative operations area that Dr. Paine was discussing. So, many of the teams that I am referring to are those out in industry who are coming downward at a rapid rate.

The expenditure levels we are forecasting in this interim operating plan are \$350 million lower than the President projected last January. Dr. Paine's statement is primarily related, and he will speak for himself on this, to the in-house NASA competence that is now receiving a large input of work from these industry teams that have done their work and are now disbanding. But the end result of their work is flowing into the NASA establishments for test, checkout, and flight.

Senator HOLLAND. Well, do you mean by that that the reduction in personnel is going to apply very largely in the case of the contractors as to their teams that they have built up and not to NASA's own teams?

Mr. WEBB. Well, that is one way of saying it, but I do not believe that is a fair way to present the picture as it really exists. I think the important part of what we are saying is that the people who could have proceeded on from the experimentation and test in the developmental phase of NERVA will be phased down unless we put in a flight-weight engine program: that those teams who have been building the Saturn IB and the engines for the Saturn IB and assembling those under our supervision will be phased down. If we do not put in new work, the people in NASA that supervise this work in the program now and have to take the responsibility for the launch of those vehicles in the program—and also for the launch of those in storage which will be launched in the future—are still required.

Senator HOLLAND. Well, I think this point needs to be amplified because Dr. Paine makes it rather clear, and I will read this again: "We hope this reduction can be accomplished primarily through attrition with possibly a few selective RIF's," and that would not indicate a critical reduction in personnel at all so far as NASA employees are concerned and yet as I understand your statement now, you think there will be critical reduction in the potentiality to turn out certain of these important new programs which will take place in the contractor's teams.

Mr. WEBB. Our responsibility under the law and the programs we have been presenting for a number of years has been to increase the competence of the United States for work in aeronautics and space. That is roughly the language of the law.

Now, we have chosen the method of using industry to perform a very large percentage of this. We have regarded the strength in industry and in universities as a part of the national base.

My statement that we are cutting these teams down and not holding them together but holding only small cadres together refers more to this base where 90 percent of the money goes now and up to 95 percent did go in previous years.

Senator HOLLAND. This base—you mean the universities and the contractors?

Mr. WEBB. Yes, sir. And other forms of laboratories. You have the Jet Propulsion Laboratory, for instance, where we are not holding together the teams that have done work in the past and could have gone on into, say, Voyager. We are reducing the teams—we are holding small cadres together but not the whole team that could do a job. We will have to build the team back up again from these nucleus units in the cadres.

Senator HOLLAND. The Jet Propulsion Laboratory is a federally operated operation, is it not?

Mr. WEBB. No. It is a contractor operated laboratory. It is the one we have that we inherited from the Army, operated by California Institute of Technology.

Senator HOLLAND. Well, I am not sure that I understand the situation yet, but I still interpret Dr. Paine's statement to indicate no serious disruptions as far as Federal employees are concerned. Am I right or wrong in that?

Dr. PAINE. I believe to clarify this, Senator Holland, that the difference has been the fact that in the latter part of my statement I was referring to the Federal Civil Service employees. Mr. Webb was talking about total numbers of people involved in the NASA effort.

I could give you a few numbers on this. We had planned in our budget this year to reduce the total number of people in the United States employed in NASA programs, either inhouse or in the contractor, university, JPL type operation, from some 270,300 last year down to 235,000 this year. In our interim operating budget, in order to get down to the \$3.85 billion level, we have been forced to take the total, all people, down to 215,000.

Senator HOLLAND. That is a reduction from 270,000.

Dr. PAINE. From 270,300.

Senator HOLLAND. To 215,000.

Dr. PAINE. Yes, sir.

Senator HOLLAND. Obviously then, since you say that Civil Service personnel will be reduced only 1,661, and that largely through attrition, it is quite obvious that your principal reduction is in the universities and the contractors.

Dr. PAINE. Well, this primarily, of course, reflects the completion of much of the equipment fabrication and the construction of facilities, which we have had in the past. As the equipment is now coming off these production lines and into the NASA shops for launch from Cape Kennedy, after testing at Mississippi test, as the people who built it phase out.

Senator HOLLAND. Well, your construction of facilities program is largely finished, is it not?

Mr. WEBB. Yes, sir. About 40,000 workers have been released out of NASA's construction program as it was finished, Senator.

Senator HOLLAND. And your data acquisition and tracking program has largely been completed, has it not?

Dr. PAINE. No, sir.

Mr. WEBB. Completed so far as construction except for those units that we have spelled out in this plan, but the operation of the network is now a major problem. And we are being restricted from building up the kind of operating capability for the units we have already built that we feel would be important. We are under a very austere budget so far as the best utilization of this network in which we have made the capital investment.

Senator HOLLAND. Well, that is what I have been thinking, and I was a little fearful that this statement that you put in here would indicate a very minimum effect upon your operating capacity and I wanted the record to show a little more clearly that you are being seriously hurt, though not in the places mentioned specifically by Dr. Paine in that part of his statement that I have referred to.

The fact is that your operation overall is being greatly hurt by this reduction in the amount of money available this year. Is that true or not true?

Dr. PAINE. Yes, sir; I should certainly make that clear. The reduction of 3,000 people since July 1967 at a time when our flight responsibilities are increasing has indeed meant a very deep cut for us. This, of course, is a 10-percent reduction.

Mr. WEBB. And one of the real problems, Senator Holland, that I think you have felt yourself in some of these important areas is that

as you fail to build the capability you really need to launch Saturn V's, as you operate on a very austere basis, as good people cannot quite see the future, you have an even greater problem because you begin to produce uncertainty among your best people. This is a problem and I think you are correct to put your finger on it.

Senator HOLLAND. Well, I think that the record here should show that you are being greatly hurt by the heavy reduction in the money available, as I understand is the fact, and I was fearful that the record did not show that.

Dr. PAINE. Yes, sir. I would certainly confirm that statement. It has one other effect that personally to me has been of some concern and that is that we are now having some rather major difficulties bringing the new young people into our program. When we are faced with reductions it tends to hit the young people and I am concerned about this aspect of our personnel balance.

Senator HOLLAND. Thank you, Mr. Chairman.

NERVA FUNDING

Mr. GEHRIG. Dr. Paine, the budget plan that you presented to the committee today is the same as the earlier plan of September 8 except that it shows an additional \$7 million for the Nuclear Rockets Program and consequently, a higher total budget by \$7 million.

Has this been discussed with the Bureau of the Budget and does the Bureau of the Budget agree that the Nuclear Rockets Program ought to have \$7 million more?

Dr. PAINE. They have discussed with us this additional \$7 million which we have wished to put in here. They are aware of this but we do not have approval, of course, for our interim operating plan and, therefore, the \$7 million is merely an alteration of the plan for which we do not have approval.

Mr. GEHRIG. When they approve the plan, do they approve each individual program or just approve the plan in toto?

Dr. PAINE. Well, they are simply concerned at the moment with the total plan. At the same time, they are quite interested in the detailed structure and we do have discussions with them on the subsystems.

Mr. WEBB. They give their approval on the total plan on the basis of their examination and understanding of the individual items in the plan, but once they agree to the plan, including the individual items, they tend to leave you some flexibility with respect to what you do. But the amount that they included in the total plan is related to their evaluation of how well you have done your work on the individual items in the plan and this device you are referring to permits us to go to them and say we need this extra \$7 million and require concentrated attention on that need.

Senator CANNON. Mr. Chairman, will you yield? Have you had an indication that they approve your initial plan plus this additional \$7 million?

Mr. WEBB. We have had an indication that they are not objecting to our presenting to the committee the plan that we are presenting here today, but with no commitment of any kind on their part that they will convert this interim plan into a final plan on this basis.

Senator CANNON. Well, I do not imagine you would be here before the committee presenting a plan unless you had a fairly good feel that the plan was going to be approved.

Mr. WEBB. Yes, Senator Cannon, but until you get the signature on the dotted line, you may find that they have to find \$50 million somewhere and come back to us for part of it or something. So, it simply cannot be considered final until it is finally acted on.

Senator CANNON. When do you anticipate that you will have final approval?

Mr. WEBB. As soon as the President has signed the bill and we can then proceed to detailed discussions with them. As early as the Bureau of the Budget would meet with us and I would assume it would be almost within 24 or 48 hours after the President signs the bill because we are urging them to give us final approval. We are already over 3 months into the year.

Senator CANNON. Thank you, Mr. Chairman.

NUCLEAR ROCKETS PROGRAM

Mr. GEHRIG. Mr. Chairman, I have a number of other questions on the Nuclear Rockets Program that I would like to just put in the record to be answered at this point.

(The questions and answers submitted follow:)

Question 1. How will the additional \$7 million affect the activity at the various governmental and industrial locations participating in the program? How many additional people will be required?

Answer. Approximately half the funds will be associated with the NERVA technology testing at the Nuclear Rocket Development Station in Nevada. These funds will allow more thorough testing of the XE engine and allow the retention of an estimated 300 additional personnel of Aerojet-General, Pan American and Edgerton, Germeshausen and Grier who were scheduled for layoff by the spring of 1969.

The balance of the money will be used for retaining Aerojet-General personnel at Sacramento to support the extended technology testing to proceed with NERVA I design, and some fabrication and test of NERVA I hardware. Approximately 100 personnel which can now be retained by Aerojet-General in Sacramento were scheduled to be laid off by the end of 1968.

Question 2. A few days ago a \$12 million contract extension with Pan American for support work on the Nuclear Test Station was announced. How is this contract funded?

Answer. The contract is funded on an annual basis. AEC funding is used initially with NASA subsequently reimbursing AEC for its share.

Question 3. How much from the AEC?

Answer. Approximately \$8,600,000.

Question 4. From what part of the AEC budget does this come?

Answer. Approximately \$8,000,000 from AEC Operating Expenses and approximately \$600,000 from Capital Equipment.

Question 5. How much from NASA?

Answer. Approximately \$3,400,000.

Question 6. From what part of the NASA budget does this come?

Answer. NASA R&D. Approximately \$1,550,000 from the NERVA Budget Line Item and \$1,850,000 from the NRDS Operations Budget Line Item.

Question 7. What will you use as a booster for the NERVA if the Saturn V is not continued?

Answer. The NERVA engine is a key element in our capability for the future exploration of space and, because of the lead times involved, will not be available for use until the late 70's, extending into the foreseeable future. While in past discussions we have often described its use in a third stage of the Saturn V, it can be used advantageously as an upper stage for any booster in the Saturn V-size

class. In addition, substantial performance gains are possible if NERVA is used to propel payloads assembled in orbit which are boosted by smaller vehicles. Various studies indicate that the engine also may have utility in an upper state for some new medium booster between Saturn I and Saturn V in size. As we have testified, it is our hope that the Fiscal Year 1970 budget can support continuation of production of the Saturn V after the fifteenth vehicle. Even if Saturn V production cannot be continued, we believe that the nation will need a launch vehicle of the Saturn V class in the future, and design and development of such a vehicle would occur with the capabilities of the NERVA state in mind.

Question 8. Will the AEC be doing any NERVA I engine development work?

Answer. In accordance with the AEC-NASA Interagency Agreement, the AEC is responsible for funding the reactor portion of the NERVA I development effort. In FY 1969, this work includes NERVA I flight reactor design, component fabrication, and component testing. Fuel element developmental work directed at the NERVA I reactor performance will also be continued.

LAUNCHING FOR COMSAT

Senator HOLLAND. I would like to follow up the question on Comsat. Is there any question on responsibility as between NASA and Comsat, any question of liability?

Mr. WEBB. The legal responsibility, the risk rests with Comsat. We launch at their risk. We have an obligation to do a good job in launching; but the legal liability and the risk is for the account of Comsat and will not be a charge against our budget.

APOLLO SUPPORT BY CONGRESS

Mr. GEHRIG. Dr. Paine, on page 7 of your statement you say that reductions in Research and Development and Administrative Operations funding has greatly reduced your flexibility to cope with the problems in the Apollo program.

I wonder if you could explain that statement a little more, particularly in light of the action of Congress in consistently supporting NASA's funding requests for the Apollo program.

Dr. PAINE. Mr. Gehrig, this is the type of backup effort that we have in our R. & D. program to take care of the unexpected additional requirements for R. & D. activity that may be raised.

An excellent example of this is the so-called POGO effect that we encountered in Apollo 6, where we were able to assemble a substantial team from our Marshall Space Flight Center for the solution of this very difficult problem because we had them available doing other R. & D. kind of work. They could be reassigned very quickly to come up with a solution to the problem.

This is the kind of activity I am talking about here.

Mr. WEBB. I think it not amiss, Mr. Gehrig, to also point out that when you use words such as "Congress consistently has supported the Apollo program," you must "add at a minimum level." We have clearly indicated in every budget that the basis on which we were going forward, with this support by Congress, was one that did not take into account unusual risks and happenings and was, in effect, based on success in all of these efforts.

Mr. GEHRIG. What I am thinking of, the Congress has always authorized and appropriated almost the total amount for the Apollo program that the agency has requested, including this year when very deep cuts have been made in other parts of the program.

Mr. WEBB. And so has NASA, under the general pattern of a large unspecified cut in appropriations, also provided funds into Apollo, but it has also been very clear that the funding was related to success

on the various operations and did not include, for instance, a return to test flights on the Saturn IB should we not be able to make the shift to the big rocket after this next flight.

So, I think it is a little bit too oversimplified to say Congress has consistently supported Apollo and that our present concern over the thinness of the funding is not related to the problem of congressional action as well as of Executive action.

Mr. GEHRIG. But, there is no instance of when the Congress has not supported that program.

Mr. WEBB. That is right.

Mr. GEHRIG. If you would have included these funds for further testing the Saturn IB the Congress would have had an opportunity to consider this. As it was, it was not in there.

Mr. WEBB. It has had to be considered in terms of the total problem related to a balanced program which met all the needs. We have never cut Apollo, nor has Congress, below an acceptable limit based on success; but we have always indicated that the funding was thin and it is getting thinner. And the problems we have had with POGO and other problems means that it is now thinner than it has been in any time in the last 3 years.

I think that Dr. Paine is close to what the record ought to show.

Dr. PAINE. I think we have the specific numbers here, Mr. Gehrig, if you are interested. The sum total from 1969 back to 1961 of the President's budget messages have totaled some \$17,725.8 million. The allocation of the appropriations for this same period of time totaled some \$17,231.3 million. The net change is some \$494.5 million.

Mr. WEBB. And in the process of going through those years, we have informed you that we were proceeding from a previous plan of stage testing to all-up testing which meant that the risks on an individual flight and the problem of organizing to conduct the flight were greater. So, we have not had the funds to proceed except in a manner that would permit us, within the total budget, to do this lunar landing within this decade and on an all-up systems test basis. So, the excruciatingly painful period of all-up testing on the Saturn V is yet ahead of us.

STATUS OF LUNAR MODULE

Mr. GEHRIG. What today is the status of the lunar module and is it anticipated there will be any delay in the Apollo program due to the recently announced change in the injector for the lunar module ascent engine?

Dr. PAINE. I think I could best answer this by asking Mr. Mathews to give you a statement on that.

Mr. MATHEWS. Mr. Gehrig, the status of the lunar module is as follows: It was the last element to be developed in the chain of Apollo capability as we proceeded down the road to lunar missions. Just as for the other hardware elements, in the initial stages certain difficulties existed in bringing equipment aboard and getting the Lunar Module into flight configuration.

The first full system Lunar Module was delivered down to the Cape last June. It has gone through its altitude chamber tests with very good performance, actually over and above that which we had anticipated.

The Lunar Module No. 4, which is the second full system Lunar Module was accepted the day before yesterday for delivery. So, we do feel that program now is coming into phase with the rest of the program.

After delivery of Lunar Module 3, the first full system Lunar Module, to the Cape, certain difficulties were encountered in the early phases of the checkout and this produced a decision that we could accomplish more in the first manned Saturn V flight (Saturn 503) by removing the Lunar Module from that flight and carrying on the flight with the rest of the equipment.

Naturally it is true the earlier we can start maturing systems in flight the better off we are, and there is the fact that we did remove the Lunar Module, but this particular approach does allow us to get flight experience on the other major elements of the system, and I do feel it was the best plan under the circumstances.

Mr. GEHRIG. Well, what are the principal problems on the Lunar Module?

Mr. MATHEWS. The principal problems that were encountered early in this test period were related to what we call electromagnetic interference. I do not want to say this was the sole source of difficulties nor were they extremely larger than expected, but this sort of problem is the result of testing many systems in combination with each other and the interaction between electronic systems that did have to be cleared up. It is somewhat of a cut and try type of activity.

Those problems have been pretty well solved at this point in time.

Mr. GEHRIG. Is there any problem with the rendezvous radar system on the Lunar Module?

Mr. MATHEWS. The rendezvous radar was one of the systems that did have this class of problem. In the configuration that was initially delivered to the Cape, the rendezvous radar was over sensitive to noise inputs. This problem has been analyzed, has been isolated, and corrective action has been taken.

I would not say we will not have further problems with the rendezvous radar, but that particular problem has been taken care of and we do not know of any additional problems right at the moment.

Mr. GEHRIG. How is the weight of the Lunar Module now?

Mr. MATHEWS. The weight of the Lunar Module is adequate for the lunar mission. This aspect is something we have had to watch all the time, and we are continuing to watch.

There have a number of weight reduction programs. This is another class of activity that tends to eat into our funding margins. We have adequate weight margins for the lunar missions starting with Lunar Module No. 5. Lunar Module No. 6 has been provided with further weight reduction modifications.

Mr. GEHRIG. Now, with respect to the new injector, does the Lunar Module ascent engine have to go through a full qualification test with this new injector?

Mr. MATHEWS. No. This is a case where you do exercise engineering judgment as to what portions of the previous test programs are applicable. The injector is just one part of the engine. The combustion chamber, the nozzle, the expansion cone, the valving for the engine, all these parts are all common and have been previously qualified.

Now, there are certain all-up types of qualification tests, for instance, of a thermovacuum nature, that will be undertaken on the engine with the Rocketdyne injector.

Mr. GEHRIG. Is the Lunar Module now the pacing item in the program?

Mr. MATHEWS. Yes. I think you can say that, certainly as far as hardware elements are concerned, the Lunar Module has been the constraint on our next flights. The decision to delete the Lunar Module from the 503 mission has given us some schedule margins. This action allows the Lunar Module to get into flight configuration before we deliver it. It allows it to come down to the Cape with some margins for checkout over and above the normal margins in terms of now assigning Lunar Module No. 3 to the Saturn 504 flight. So, in summary, what we have done is we have picked up some margins.

Now, we are going to try our best to hold those margins on the Lunar Module as a result of these reassignments, so that we have a good orderly approach to the checkout and flying of subsequent vehicles.

The CHAIRMAN. I apologize for having to leave. I have some arrangements and I cannot wait longer.

MANNED SPACE FLIGHT PROGRAM

Mr. GEHRIG. Mr. Chairman, I have a number of other questions about the manned space flight program which, with the permission of the committee, I will insert in the record to be answered at a later time. (The questions and answers submitted are as follows:)

Question 1. Dr. Paine, NASA will build 14 Saturn IB launch vehicles. Five of these will be used for the Apollo Program, three in the AAP, which will leave six Saturn IB launch vehicles in the inventory.

What do you see as the disposition of these six launch vehicles?

Answer. If further Saturn IB launches in the Apollo program are unnecessary, the allocations would be as follows:

Apollo, 5; Apollo Applications, 9.

In Apollo Applications, the 9 Saturn IB's could be used as indicated below:

- 2—Saturn I Workshop (dual launch).
- 2—Apollo Telescope Mount (dual launch).
- 1—Revisit.
- 2—Backup Saturn I Workshop.
- 2—Backup Apollo Telescope Mount.

If the backup Workshop or ATM launches are not needed, the remaining Saturn IB vehicles could be used for logistic or revisit purposes with later earth orbital spacecraft.

Question 2. Last year before the Committee Mr. Webb said that he believed that the Saturn V would not be used for near-earth orbital operations and that near-earth orbital operations with men are dependent upon the Saturn IB; that if the Saturn IB was phased out you would have to have something in place of it.

In the area of manned flight, does NASA see a continuing near-earth orbital program after the three-mission AA Program that is discussed in Dr. Paine's statement?

Answer. The current Apollo Applications Program consists of three missions made up of two dual-launch and a single-launch mission. These flights will utilize five Saturn IB launch vehicles. In addition, four Saturn IB launch vehicles have been designated as backup hardware to support the two dual missions. There is presently no firm additional requirement for Saturn IB launch vehicles or their equivalent; however, follow-on missions are now being studied, and these could involve a requirement for additional Saturn IB's or substitute launch vehicles for launch and/or resupply. The possibility of using a Saturn V for near-earth orbital missions in the 1970's is also being studied.

Question 3. Does the phasing out of the Saturn IB make it more likely that NASA will have a requirement later on for the intermediate launch vehicle?

Answer. Not necessarily; it depends upon NASA's future mission requirements and upon the type of intermediate vehicle that is chosen. The launch vehicle one usually denotes by the term "intermediate" puts 100,000 pounds into orbit and provides a different kind of service than the Saturn IB. If such a vehicle could be downrated to 40 to 50,000 pounds payload in low orbit, it could replace the Saturn IB, but would be selected only if its cost were competitive.

Question 4. What is the earliest date in your judgment that NASA would need the intermediate booster of around 100,000 payload?

Answer. NASA might need an intermediate booster in the 1974-1975 period to put a six to nine man space laboratory into earth orbit, if such a project is authorized. This job could be done by a Saturn V launcher, but an intermediate vehicle might be more economical, especially if its development cost were low and if there were other uses for it.

Question 5. Dr. Paine, so that we may fully understand the meaning of discontinuing the Saturn V, will you please tell us how much it has cost to develop this vehicle?

Answer. The cost of developing the Saturn V launch vehicle and its associate F-1 and J-2 engines is approximately \$4.9 billion. This amount includes all costs not associated with the recurring hardware production and ground test costs for the fifteen flight vehicles. As was reported in February 1968, the average unit cost of producing and testing a Saturn V launch vehicle for the Apollo program is \$186 million.

Additionally, the total national investment in facilities, tooling, and equipment for the Saturn V launch vehicle is approximately \$1.3 billion. This includes an investment of \$825 million in LC-39 and associated facilities at Kennedy Space Center; and a \$286 million investment at Mississippi Test Facility.

Question 6. How much of this investment will be lost if, in fact, Saturn V production is not continued?

Answer. If production of Saturn V is not continued beyond the fifteen launch vehicles now on order, the direct return for the investment would, of course, be limited to those fifteen vehicles. However, the national goal of creating a capability to launch Saturn V class payloads into orbit will be achieved with these fifteen vehicles and, in that sense, none of the investment would be "lost". As we have indicated, it is our hope that production of the Saturn V can be continued, if it is, the national investment would be amortized over more launch vehicles. While some of the facilities and skills which have been created by this investment are unique to the Saturn V, much of what has been achieved is applicable to many other courses of action which the nation may follow and it is clear that every effort would be made to devote these facilities and skills to other ends. To the extent that this was not possible, then the investment could be considered lost.

Question 7. For the record, would you supply the current best estimate of the total cost of the Apollo Program and include discussion on how the actions you have had to take on the Apollo Applications Program affect this cost. Your tabulation and discussion should show how the total cost is affected by run-out costs that you might not otherwise have if the AAP could move forward at a higher level.

Answer. Information was supplied to the Committee on Aeronautical and Space Sciences on Feb. 27, 1968, which estimated the total cost of the Manned Lunar Landing Program to be \$23.896 billion.

We are presently experiencing increased cost rates in Apollo. The magnitude of these increases is under review. We are currently assessing the amount of funding required to complete the Apollo program, and we will be in a position to provide detailed cost estimates in our presentations on the FY 1970 Budget.

COST OF REVISED 1973 MARS MISSION

Mr. GEHRIG. With respect to the Lunar and Planetary Program, what is the estimated cost now of the revised 1973 Mars mission?

Dr. PAINE. I would like to ask Dr. Naugle to address himself to that.

Dr. NAUGLE. Mr. Gehrig, we are still working on the final definition of the 1973 mission. We are trying to do as much as we can with the funding available in fiscal year 1969 and the time available between now and the launch date in 1973 to accomplish the scientific objectives we have laid down for this mission.

Present cost estimates for spacecraft and support vary between about \$320 million and the \$385 million that we told the Senate about last spring when we were testifying.

Mr. GEHRIG. In the new mission, as I understand it, the lander part of the mission will be scaled down somewhat from what we had been given earlier.

Dr. NAUGLE. The lander may have to be scaled down. It depends upon the resources that we will have available to us in fiscal year 1970 and later years as to precisely what we will be able to accomplish.

We still hope to be able to accomplish the minimum scientific objectives that the Space Science Board planetary panel, chaired by Dr. Gordon MacDonald, recommended last spring.

Mr. GEHRIG. What launch vehicle are you now intending to use for the Mars 1973 mission?

Dr. NAUGLE. We are still planning to use a Titan launch vehicle for the 1973 mission.

Mr. GEHRIG. That would be the Titan III launch vehicle?

Dr. NAUGLE. Yes.

MERCURY-GRAND TOUR MISSIONS

Mr. GEHRIG. I have some additional questions having to do with the Mercury swing-by mission and the grand tour mission that I would like to put in the record at this point.

The CHAIRMAN. Without objection it is so ordered.

(The questions and answers submitted are as follows:)

Question 1. What is the status of "swing-by" and "grand tour" mission planning to Mercury and Jupiter respectively to take advantage of the favorable opportunities which will present themselves in the 1970's?

Answer. Studies are being conducted of missions to Mercury in 1973 using a swing-by of Venus and multiple outer planet swing-bys (the "Grand Tour" mission) in the 1976-1979 time period. These studies include consideration of scientific objectives as well as trajectory, mission, and spacecraft design studies. In addition, advanced technology effort of appropriate spacecraft and instrumentation subsystems is underway. Current efforts are consistent with the potential launch dates noted above.

Question 2. If we do not take advantage of these opportunities, when do we get the chance again?

Answer. Venus-Mercury swing-by opportunities have been identified in 1973, in 1975 with an extra mid-course correction, and then not again until 1981. The Jupiter-Saturn-Uranus-Neptune Grand Tour Swing-by opportunities exist in 1976, 1977, 1978, and 1979. The 1976 opportunity requires a dangerously close swing-by at Jupiter, while launch energy requirements and trip times are undesirably high in 1979. Thus, 1977 and 1978 are the favorable opportunities. The Grand Tour opportunity to all four planets does not appear again for 179 years.

Question 3. Do you think that the Soviets are likely to pass up these opportunities?

Answer. It is very difficult to predict the Russian plans. However, since 1960 they have missed very few opportunities. While multiple planet missions require very advanced guidance techniques, and the US is believed to be more advanced in this technology, the recent Soviet circumlunar flight attests to their potential to perform swing-by missions.

FAILURES IN SPACE APPLICATIONS PROGRAM

Mr. GEHRIG. Now, I have some questions with respect to the space applications program. As you know, there have been a number of failures recently in the applications satellite program, the Nimbus B and the ATSD, and in, of course, the Intelsats 3 which is somewhat related to this and they were all booster failures, as I understand it.

Do you have any indication at this time that these failures could be related?

Dr. NAUGLE. Mr. Gehrig, I would like to make a brief statement on those failures.

We are naturally quite concerned about the three launch vehicle failures recently experienced by OSSA launch vehicles. We have reviewed the available facts relating to each failure to determine if there are any areas of commonality which might indicate a chronic deficiency in our launch vehicle management, policies, procedures, or practices. The data available to date fails to reveal any obvious commonality. These abnormalities appear to be unassociated failures of launch vehicles with good overall records and excellent records immediately prior to the recent incidents, as indicated in the following summary.

These same vehicles were 97 percent reliable in 1966 with 27 successes in 28 launches and 91 percent reliable in 1967 with 29 successes in 32 launches. To date in 1968, there have been 14 launches completed with 11 successes or a reliability of 78 percent.

The Delta launch vehicle used in the Intelsat III-A launch held the operational record of 25 consecutive successes prior to the Intelsat III-A launch. Its last failure in 1965 interrupted a string of 22 consecutive successes. Its overall record is 54 successes in 58 attempts.

The Atlas Centaur, prior to the ATS-4 launch, has been 100 percent successful since it became operational in 1966. All seven successes were for the Surveyor program. Five successful two-burn missions had been achieved by this vehicle prior to the ATS-4 launch, which differed only in the length of coast prior to the second burn.

The NASA Thor Agena mission success record from the Western Test Range was also 100 percent with eight successes in eight attempts. In this ninth attempt, the Thor booster, successful in over 125 NASA and USAF flights, failed due to an error in assembly and checkout of a yaw rate gyro.

As previously stated, with three different vehicles concerned, there appears no obvious relationship between these failures. We are continuing to examine nontechnical areas such as morale, personnel competence, and quality control for general deterioration or lowering of standards. There is no evidence that any of these concerns has occurred.

Mr. GEHRIG. Mr. Chairman, I understand there is a vote and you must go.

Senator CANNON (now presiding). That is right.

APPLICATIONS SATELLITE PROGRAM

Mr. GEHRIG. I have a number of other questions on the applications satellite program, on the space power program, and on administrative operations which I will put in the record with your permission.

Senator CANNON. Very good.

(The questions and answers submitted are as follows:)

Question 1. When do you anticipate that you will be able to go forward with your Earth Resources Technology Satellite and what kind of funding are we talking about for this program?

Answer. We are proceeding with in-house studies and design effort in FY 1969 and anticipate supporting these studies with contractual effort using a portion of the FY 69 funding authorization. We expect to be technically prepared to proceed into Phase D efforts (final hardware design, development, fabrication, test, launch and post-launch operations) early in FY 1970, assuming favorable Executive and Congressional action on our FY 1970 budget submission. Our current estimate for funding requirements for a two-satellite project including the study effort and launch vehicles is \$47.7 million.

Question 2. Who will be responsible for operating this satellite once it is developed?

Answer. The Earth Resources Technology Satellite (ERTS) is an experimental satellite. NASA will be responsible for post-launch operations of the satellite as well as its development. We are working closely with the user agencies (Departments of Agriculture, Commerce, Interior and Navy) to jointly establish requirements for data formatting, data storage, and data retrieval. As in other applications programs, the user agencies will play the major role in analysis and later utilization of the data obtained from these R&D satellites. NASA and the user agencies will jointly and cooperatively evaluate the performance in orbit of these satellites.

Question 3. Have any steps been taken to see that the operation of this satellite is properly coordinated among the various agencies that would have an interest in the data that it will collect?

Answer. In order to insure that the development and the operation of this satellite project are properly coordinated among the various agencies, a formal Earth Resources Survey Program Review Committee (ERSPRC) chaired by NASA was established on July 15, 1968. The membership of this Committee is as follows:

NASA—Dr. John E. Naugle (Chairman).
 NASA—Mr. Leonard Jaffe.
 Dept. of Agriculture—Dr. Ned D. Bayley.
 Dept. of Interior—Dr. William T. Pecora.
 Dept. of Commerce—Dr. Robert M. White.
 Dept. of Navy—Dr. Robert A. Frosch.
 NASA—Mr. J. Robert Porter (Secretary).

This Committee, which has met twice so far, is responsible for:

- (a) Reviewing and analyzing the total program in Earth Resources Survey, including any substantive issues which may arise;
- (b) providing advice and recommendations to NASA concerning the current and future responsiveness of the NASA Research and Development Program to user agency requirements;
- (c) providing advice and recommendations to user agencies aimed at achieving maximum integration of requirements and a coordinated national program.

SPACE POWER PROGRAM

Question 4. What is your current objective for the SNAP-8 project?

Answer. The overall long-range objectives of the OART SNAP-8 program are to provide the technology leading to the ultimate development of a long-life (10,000 hours or longer), reactor space power system suitable for manned and unmanned applications in the 30-100 KWe range and to develop the technical and management knowledge necessary for the effective and economic design, development, and evaluation of long-life reactor dynamic systems, including those aspects associated with the operation of a dynamic power conversion system with a reactor.

The current objectives for the SNAP-8 technology project are to conduct limited performance and endurance tests on SNAP-8 components and a bread-board power conversion system and to solve any life-limiting deficiencies found such as in the boiler and turbine as a basis for evaluating whether we can eventually meet the life objectives of the program.

All three system pumps (NaK, lubricant, and mercury) have now successfully passed 10,000 hours without any life-limiting deficiencies. The other components,

particularly the boiler and turbine, are not as far advanced. We have reached past the 2500-hour mark for the first improved boiler and turbine, and we are striving to increase the endurance of these components as much as possible by the end of FY 1969. We are also striving to achieve, as an interim goal and by the end of FY 1969, a 2500-hour endurance test of the first breadboarded power conversion system located at Aerojet-General.

In addition to the work at Aerojet, the Lewis Research Center is investigating the dynamic behavior of a SNAP-8 power conversion system which has been designed specifically for this purpose. These dynamic tests are also expected to be completed by the end of FY 1969.

Question 5. When will this be achieved?

Answer. The current goals of the SNAP-8 project will be essentially completed by the end of FY 1969, as more fully detailed in the answer to Question 1. The overall goals of the SNAP-8 project will require several more years of work.

ADMINISTRATIVE OPERATIONS

Question 6. On June 10th of this year the Senate passed H.R. 15856, the NASA FY 1969 authorization bill, cutting the Administrative Operations to \$603 million—the same figure as passed by the House and which is a cut of about \$45 million below the request. Therefore it was clear on that date that this amount could not be increased by a conference between the House and the Senate nor could the appropriation be more than \$603 million. On May 31, 1968, NASA had 33,202 on-board employees. Yet on August 31, after the \$45 million cut, NASA has 34,023 employees.

In the face of the Congressional action, why hasn't NASA taken some steps to reduce the number of personnel in the Agency?

Answer. NASA took immediate action to reduce employment upon passage of the NASA authorization by the House and before the action of the Senate. On May 16, Centers were placed on essentially an employment freeze, with Centers generally being permitted to replace only 25% of the vacancies occurring after May 13, when the employment of permanent civil service personnel was 32,291. Exceptions to the freeze were allowed for the conversion of contractor personnel at Goddard Space Flight Center, 127 positions, and for requirements at the Manned Spacecraft Center and Kennedy Space Center. As a result of actions taken, the actual employment at the end of the fiscal year was 32,471, as opposed to the prior plan of 32,669. The controls on employment have been in effect continuously since May, and employment in permanent positions has decreased to 32,142 on September 21, with incremental reductions planned to reach a level of 31,186 on June 30, 1969.

The increase in total employment between May 31, 1968, and August 31, 1968, is a result of the summer employment program which is particularly planned to provide for disadvantaged youths. The composition of the May 31 and August 31 total employment is as follows:

	May 31	Aug. 31	Difference
Full-time permanent employees.....	32,309	32,269	-40
Temporary employees.....	893	1,754	+861
Total.....	33,202	34,023	+821

As of September 21, the total employment has decreased to 32,998, a reduction of 1,035 from August 31, of which 127 were in permanent positions and 908 in the summer program.

Question 7. A recent NASA report to the Congress on NASA employment as of June 30, 1968, reflects a decrease from 1967 of 932 general schedule employees and 678 wage board employees for a total decrease of 1,610.

Conversely, NASA employed in jobs excepted from Civil Service by the Space Act of 1958, as amended, has increased 37 from 349 to 386.

How do you account for this increase in high level employment in a period of program leveling, if not a reduction in overall program activity?

Answer. The apparent increase of 37 from 349 to 386 in positions under section 203(b)(2) of the National Aeronautics and Space Act of 1958, as amended, is attributable to the fact that, although NASA employment levels have been decreasing, the qualitative demands of NASA's research and development pro-

grams continue to place a requirement to promote and recruit personnel of outstanding capability and talent. NASA's requirements for these "excepted" positions and personnel are subject to continuing assessment and scrutiny by agency top management. This assessment is carried out by the senior line management officials as well as the close surveillance and decision processes of the NASA Executive Personnel Board.

The 37 positions are within the fixed number authorized for NASA and were established only after screening and ranking 100 highest priority positions. Excepted positions are used for positions involving major responsibilities including:

Outstanding Individual Scientists and Engineers.

Branch Chiefs Levels, primarily scientists and Engineers.

Division Director Levels.

Project Management Levels.

Assistant Center Directors and Above.

Assistant Administrator Levels and Above.

Question 8. Dr. Paine, on page 29 you say that NASA will have reduced its actual employment by approximately 3,000 since July 1967. The information furnished the Committee (see pocket statistics) shows that as of July 31, 1967, NASA had 36,143 on-board personnel and on July 31, 1968, NASA had 34,606 on-board personnel, a reduction of only 1,537.

Would you please explain the discrepancy.

Answer. The statement referred to reductions in employment in permanent positions from the high point of 34,126 as of July 31, 1967, to the planned total of 31,186 on June 30, 1969. This is a net reduction of 2,940 occupied positions. The pocket statistics represent total employment of 36,143 on July 31, 1967, which included 2,017 temporary employees, while the July 31, 1968, total included 2,212 temporary employees. The temporary employment is historically at a high level in July and August because of the employment of disadvantaged youths and other summer employment groups, and drops back to the 800-900 range the remainder of the year. The permanent employees decreased by 1,732 in this time period, and an additional reduction of 1,208 is planned by the end of FY 1969.

Question 9. Over the past year NASA's budget has gone down about a billion dollars. Why does it take the same number of personnel in headquarters to run a \$3.85 billion budget as it did a \$5 billion budget?

Answer. The Headquarters personnel complement is related to the complexity of the mission requirements and the in-house involvement, more than the dollar volume of the programs. However, current Headquarters staffing plans call for a reduction of about 9% by the end of fiscal year 1969 as compared to the end of fiscal year 1967, the last year that showed an appropriation in the area of five billion dollars. This reduction in personnel is consistent with the reduction NASA-wide and reflects the continuing need to retain in-house management capability over the programs which were initially funded in earlier years but which are now becoming operational.

Question 10. For FY 1969 the Office of Space Science and Applications requested \$538.2 million for research and development. The amount programmed for OSSA is \$439.5 million, about a \$100 million reduction. However, OSSA's Administrative Operations budget has actually increased \$100,000 between the request and the planned budget, from \$79.5 to \$79.6. Would you please explain this?

Answer. The budget request of \$79.5 million consists of \$70.6 million for the Goddard Space Flight Center (GSFC) and \$8.9 million for Wallops Station. The planned budget/operating plan consists of \$69.1 million for GSFC and \$8.8 million for Wallops totaling \$77.9 million. This comparison represents a \$1.6 million reduction from the budget request. However, the planned budget/operating plan amount of \$79.6 million referred to by Mr. Gehrig includes an additional \$1.7 million for the NASA Pasadena Office, a component field activity of OSSA Headquarters.

The budget request for the NASA Pasadena Office is included in the Agency's total Headquarters Administrative Operations budget request for FY 1969.

Senator CANNON. That concludes what you have? Very well. The meeting will be adjourned, and thank you very much for being here.

(Thereupon, at 12:30 o'clock p.m. the committee adjourned, subject to the call of the Chair.)

