The National Space Program
Phase II: Implementation Of
The National Aeronautics And
Space Act Of 1958

A STUDY OF NASA'S FIRST TWO YEARS
OF OPERATIONS WITH EMPHASIS ON THE PROGRAMING & BUDGETING ASPECTS

AUGUST 1961
THE NATIONAL SPACE PROGRAM

PHASE II: IMPLEMENTATION OF

THE NATIONAL AERONAUTICS

AND SPACE ACT OF 1958

A Study of NASA'S First Two Years of Operations with Emphasis on the Programing and Budgeting Aspects by MARY STONE AMBROSE.

An advanced seminar report submitted in partial fulfillment of the requirements for the Degree of Master of Arts in Public Administration, The American University, June 1961, and approved by the School of Government and Public Administration. This study is reproduced for Government use. The views expressed in it are those of the author and do not necessarily represent the views of the National Aeronautics and Space Administration.

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"But most of all ... space research needs to draw upon an entire world for its ideas. Those ingenious insights into the real meaning behind a set of observed facts that lead to real advances in the understanding of our universe are not the prerogative of a single nation or group but come from every quarter of the world where men are seriously occupied with scientific research. So vast is the challenge of space research and so great is the promise to mankind in the way of increased knowledge and ultimate benefits that the world cannot afford to neglect or slight the opportunities that lie before it."

Dr. Hugh L. Dryden
"United States Mission to the United Nations"
Before the United Nations Ad Hoc Committee on the Peaceful Use of Outer Space—May 7, 1959
ACKNOWLEDGMENT

The two volumes of this study represent over two years of continuous research effort. From the time the writer presented her topic to the officials and employees of the National Aeronautics and Space Administration and the staff members of the several Space Committees in Congress, she has been given hearty support. The writer is most grateful for their cooperation and for permission to use their material to help make this study what she hopes will prove to be a fairly comprehensive coverage of the National Aeronautics and Space Act of 1958--its legislative history and implementation.

It is regretted that limitations of space prohibit a listing here of all the persons contacted who made significant contributions to the contents of this study. However, mention of some of the important contacts appears in the "Glossary of Interviews" of each volume.

Special thanks are due to Messrs. Jefferson D. Bates and Carl Schreiber of NASA, for their guidance and valuable comments and suggestions in reviewing the final drafts of the reports.

Finally, to Dr. Catheryn Seckler-Hudson, Dean, School of Government and Public Administration, The American University, the writer's sincere thanks for her patience and counsel.
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" Truly space experiments offer a whole new vista to scientists—and remember what science uncovers is eventually put to practical use by man. Our only question is as to whether the use is for practical good or practical evil. Let us make sure it is for the good of mankind by being certain it is the United States and its allies who lead in the development of space technology."

Dr. Harold C. Weber
Chief Scientific Adviser,
United States Army

The need for central direction and coordination of all phases of the Nation's outer space activities became apparent after the Soviet Union successfully launched Sputnik I on October 4, 1957. Shortly thereafter, the United States requirements in space science and technology were studied by the President's Science Advisory Committee, headed by Dr. James R. Killian. This Committee and the President's Advisory Committee on Government Organization recommended that a new agency be created to direct civilian space activities.¹ President Eisenhower recommended the

formation of such an agency in his Special Message to the Congress on April 2, 1958. After many weeks of intensive hearings during which the views of leading spokesmen for both the scientific community and the military Departments were obtained, Congress enacted Public Law 85-568, the National Aeronautics and Space Act of 1958, creating the National Aeronautics and Space Administration.

Recognizing the importance of space exploration for the future of the Nation, Congress established new standing committees to exercise legislative jurisdiction over aeronautics and outer space activities. The House Committee on Science and Astronautics was established on July 21, and the Senate Committee on Aeronautical and Space Sciences was established on July 24, 1958. These are the first entirely

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472 Stat. 426 (42 United States Code 2451, et seq.).

new parallel committees of both Houses of Congress to be established since 1892.6

This is the second and final report of a study of "The National Space Program." Phase I of this study covered the legislative history with emphasis on the public record of the events leading to the passage of the Space Act and a review of the major issues involved.7 This Phase II covers the implementation of the Space Act and is primarily a survey of the organization and functions of the National Aeronautics and Space Administration with considerable emphasis on the budgeting and programming aspects, during the first two years of its operations beginning October 1, 1958. This period was chosen to coincide with NASA's semi-annual report to Congress for the period ending September 30, 1960.8

The methods of research utilized in developing the material for this study are discussed in Phase I.9 As in


7Mary S. Ambrose, "The National Space Program, Phase I: Passage of the National Aeronautics and Space Act of 1958." This report was submitted by the writer in connection with an advanced course entitled, "Seminar in Organization and Management" at The American University, 1960.


9Ambrose, op. cit., Chapter I, p. 3.
Phase I, the writer\textsuperscript{10} has relied heavily on official source material, and to a lesser extent, on unofficial sources. Additional sources are included in the "Selected Bibliography" of this report.

The NASA faced a formidable task when it was created. At that time the United States had no organized national space program, although scattered efforts at space exploration had been made by the military departments, i. e., the Navy's Vanguard satellite project instituted in connection with the International Geophysical Year, and the Army's Explorer satellite program had emerged in an uncoordinated fashion. During the consideration and enactment of the Space Act, it was stressed that the responsibilities assigned NASA demanded facilities and capability far beyond that available within its predecessor agency, the National Advisory Committee for Aeronautics, and that the success of the civilian space program depended in a large measure on the ability of NASA to muster this additional competence as rapidly as possible.

The task of this new agency in its short life span has been three-fold.\textsuperscript{11} First, to acquire the existing space

\textsuperscript{10}The writer is a Procurement Specialist in the Procurement and Supply Division of Headquarters, National Aeronautics and Space Administration, Washington, D. C. The views expressed in this paper are hers alone and are not to be attributed to the NASA or any of her colleagues.

\textsuperscript{11}For an editorial on this subject, see "Our National Space Program" by Robert Hotz, \textit{Aviation Week}, reprinted from June 22, 1959 issue, p. 1.
research and development facilities necessary to carry out its responsibilities; and to organize programs already existing in the National Advisory Committee for Aeronautics, the Air Force's Air Research and Development Command, the Navy's Office of Naval Research, and the Army's Jet Propulsion Laboratory and Ballistic Missile Agency, into an integrated national space exploration program.

Second, to lay the basic research foundation for such a program on which the future specific development programs could be soundly based.

Third, to develop both short-range and long-range space goals. In the succeeding chapters, the writer will endeavor to examine and evaluate the progress made by NASA toward achieving its goals.

The following Chapter II covers the establishment of the NASA organization and some of the principal problems encountered in developing its capability to organize and direct the national space program. Chapter III depicts the NASA organization as it has evolved and highlights the multiplicity of its relationships with other organizations. Related to this are some of the significant supporting activities of the NASA covered by Chapter IV.

In Chapter V, NASA's program and budget for fiscal years 1959 and 1960 are discussed. Chapter VI is, in effect, a continuation of the preceding chapter; NASA's long-range
program and budget for fiscal year 1961 are discussed at some length.

Chapter VII deals with the statutory machinery provided for coordinating aeronautical and space activities in the Federal Government. In the closing chapter, the writer summarizes the salient points covered in this phase of the study and draws conclusions based on the research conducted and her day-to-day observations during the first two years of NASA's operations.
CHAPTER II

DEVELOPMENT AND GROWTH OF NASA SPACE CAPABILITIES

"The dynamics of the world make it impossible for us to consider any change as the final one. Organization begins to die at birth; and the mistake we make is to think 'that the world stands still while we are going through the process of a given adjustment. And it doesn't. . . .""

Dr. Catheryn Seckler-Hudson

I. TOP NASA EXECUTIVES APPOINTED

Section 202 of the National Aeronautics and Space Act of 1958 provided for the appointment by the President of an Administrator and a Deputy Administrator from civilian life to head the new space agency. On August 8, 1958, President Eisenhower nominated Dr. T. Keith Glennan, President-on-leave of the Case Institute of Technology at Cleveland, Ohio, to be the first NASA Administrator and Dr. Hugh L. Dryden, Director, National Advisory Committee for Aeronautics, to be the Deputy Administrator of NASA. A hearing was held

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before the Senate Special Committee on Space and Astronautics on August 14; and on August 15, 1958, the nominations were confirmed by unanimous vote of the Senate.\(^4\) Dr. Glennan and Dr. Dryden took the oath of office at the White House on August 19, 1958.\(^5\)

II. NASA ABSORBED NACA

Title III of the Space Act provided that the NASA should become operative ninety days after its enactment on July 29, 1958, or on any earlier date that the Administrator might determine. In fulfilling this requirement, Dr. Glennan issued "A Proclamation" on September 25, 1958, that stated in part: "I hereby proclaim that as of the close of business September 30, 1958, the National Aeronautics and Space Administration has been organized and is prepared to discharge the duties and exercise the powers conferred upon it. . . ."\(^6\)

In a message to NACA employees regarding the impending


transfer, Dr. Glennan observed that one of the ways of saying what would happen in the NACA transfer would be to quote from the legalistic language of the Space Act, but he preferred to state it in a different way: "I like to say . . . that what will happen September 30 is a sign of metamorphosis . . . that it is an indication of the changes that will occur as we develop our capacity to handle the bigger job that is ahead." Dr. Glennan concluded that this was "one of the most challenging assignments that has ever been given to modern man." 7

The Administrator shortened this ninety-day period of preparation by one-third, and the NASA became effectively operative on October 1, 1958. 8 By operation of law, the National Advisory Committee for Aeronautics thereupon ceased to exist, and all of its functions, powers, duties, property and personnel were transferred to the new agency.

The NASA inherited from its predecessor organization a staff of about 8,000 highly skilled scientists, engineers and supporting personnel; Headquarters office in Washington, D. C.; and five laboratories and field stations. The field

7 Glennan, op. cit., p. 3.

installations were: Langley Aeronautical Laboratory, Hampton, Virginia; Ames Aeronautical Laboratory, Moffett Field, California; Lewis Flight Propulsion Laboratory, Cleveland, Ohio; the High-Speed Flight Station at Edwards, California; and the Pilotless Aircraft Research Station, Wallops Island, Virginia. The value of these research facilities was estimated at $350 million. In addition the NASA inherited the comprehensive flight research program from the NACA. Thus, the NASA was provided an immediate capability in the various areas of aeronautical and space research.

III. OTHER PROGRAMS AND FACILITIES SHIFTED TO NASA

The NASA was founded on existing research organizations and programs. The National Advisory Committee for Aeronautics, a going concern for forty-three years, formed the nucleus of the new organization, as detailed above. The need for further expansion of NASA's capabilities in the space field was recognized by Congress in the passage of the

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9National Aeronautics and Space Administration, op. cit., p. 4.

Space Act in 1958. Under Section 302, the President was empowered to transfer to the NASA, over a period of four years, functions, activities and facilities of other Government agencies which primarily relate to its responsibilities. The President has exercised this transfer authority three times. These transfers are discussed in chronological order below.

Defense Department Space Projects Transfer

Prior to the passage of the Space Act, President Eisenhower requested the Department of Defense and the National Advisory Committee for Aeronautics to jointly review the aeronautical and space program of the Defense Establishment and recommend to him which projects should appropriately be placed under the direction of the new civilian space agency.

Whenever such transfer was made prior to January 1, 1959, the President was required to transmit to the House and Senate a full and complete report regarding the nature and effect of the transfer. After December 31, 1958, no transfers could be made under the authority of Section 302(c) until: "(1) a full and complete report concerning the nature and effect of such proposed transfer has been transmitted by the President to the Congress, and (2) the first period of sixty calendar days of regular session of the Congress following the date of receipt of such report by the Congress has expired without the adoption by the Congress of a concurrent resolution stating that the Congress does not favor such transfer." Public Law 85-568, 72 Stat. 426.

As a result of this review, President Eisenhower issued Executive Order No. 10783, on NASA's first day of operation, transferring several non-military projects from the Defense Department to NASA.\textsuperscript{13} Included under this Order were:

1. From the Navy: The original United States scientific earth satellite, Project Vanguard, with more than 160 civilian scientific personnel under the direction of Dr. John P. Hagen, Director of Project Vanguard of the Naval Research Laboratory in Washington, D. C.\textsuperscript{14} With this transfer, responsibility for the International Geophysical Year radio tracking network (Minitrack) passed to NASA.\textsuperscript{15} In addition, some 400 highly trained and experienced personnel in the field of space sciences, satellite applications, tracking, communications and data reduction were also transferred to NASA from the Upper Atmosphere Group of the Naval Research Laboratory.\textsuperscript{16}

\textsuperscript{13}23 F. R. 7643. The text of Executive Order 10783 is also contained in NASA Management Manual, General Management Instructions No. 1-3-1, October 13, 1959, Attachment A.

\textsuperscript{14}U. S. Congress, House, U. S. Aeronautics and Space Activities, January 1 to December 31, 1958, op. cit., p. 10.

\textsuperscript{15}"Agreement Between Department of Defense and National Aeronautics and Space Administration Regarding Transfer of Records, Property, Facilities and Civilian Personnel of Project Vanguard," NASA Management Manual, General Management Instructions No. 1-3-1, Attachment B.

\textsuperscript{16}U. S. Congress, House, Committee on Science and Astronautics, Transfer . . . to the National Aeronautics and Space Administration, Hearing on H. J. Res. 567, op. cit., pp. 23-24.
2. From the Air Force and the Advanced Research Projects Agency (ARPA) of the Defense Department: Five space probes and their instrumentation; three satellite projects calling for putting into orbit two inflatable spheres—one 12 feet in diameter, and the other 100 feet in diameter—and a cosmic ray satellite; and a number of engine research programs, including development of nuclear engines, fluorine engines, and a 1.5 million-pound-thrust, single-chamber rocket engine. 17

The Executive Order directed the transfer from the Defense Department appropriation to NASA appropriation for "Research and Development," a total of $117 million in connection with the Advanced Research Projects Agency ($59.2 million) and the Air Force ($57.8 million) projects being transferred. Transfer of funds in connection with Project Vanguard would be determined by the Director of the Bureau of the Budget. 18

In addition, the NASA needed to obtain, as rapidly as possible, competence in areas such as communications, guidance, electronics and experience in the operation of very large


18 Executive Order 10783, 23 F. R. 7643. See also, White House Press Release, October 1, 1958.
rockets and vehicular systems. 19

Jet Propulsion Laboratory Transfer

Shortly after Dr. Glennan reported for duty in September 1958, the NASA began surveying many of the existing facilities of other Government agencies throughout the country to determine whether or not there were available some of the capabilities that the agency needed. Visits were made to many of the military installations. It soon became apparent that if two of the Army's facilities or any part of them were made available, the NASA would gain very greatly in getting its program underway. These were the Jet Propulsion Laboratory at Pasadena and the Army Ordnance Missile Command complex at Huntsville. Early in October 1958, discussions were held between Defense Secretary McElroy, Deputy Defense Secretary Quarles and Dr. Glennan, and by mid-October a formal request was made by Dr. Glennan to Mr. McElroy asking for the transfer of a portion of these facilities to NASA. 20

On October 29, 1958, President Eisenhower held the second meeting of the National Aeronautics and Space Council to give preliminary consideration to the proposed transfer. 21


20 Ibid., p. 4.

21 U. S. Congress, House, Select Committee on Aeronautics and Space Exploration, The United States and Outer
Negotiations continued between the Department of Defense and NASA. However, it was reported that this request provoked strong protests from some officials in the Defense Department and the Department of the Army. Both were strongly opposed to giving up the facilities at the Redstone Arsenal in Huntsville and the Jet Propulsion Laboratory.\(^{22}\)

On December 3, 1958, President Eisenhower held the third meeting of the Space Council at which time a compromise was reached in the dispute between the Army and NASA. At this meeting, NASA and the Defense Department made formal recommendations to the President and the Space Council, which

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\(^{22}\) Edward Gemarekian, Staff Reporter, "Space Agency Faces Fight," The Washington Post and Times Herald, October 29, 1958, p. A16. Lieutenant General Arthur G. Trudeau, Chief of Army Research and Development, and Major General John B. Medaris, then Commander of the Army Ordnance Missile Command, regarded the proposal, if carried out, as "rather disastrous" and possibly "fatal" to the Nation’s missile progress. See "Army Fights Proposal to Transfer Its Space Experts to Civilian Agency," by Albon B. Hailey, Staff Reporter, The Washington Post and Times Herald, October 23, 1958, p. Al. Dr. Wernher von Braun warned that breaking up the Army missile team, which he headed, would seem "something less than prudent," when the national security and prestige demanded a unified effort for missile supremacy. In this regard, see "Von Braun Hits Plan to Shift Missile Team," The Evening Star [Washington], October 16, 1958, p. C-5. The Army's argument that the transfer of the von Braun team to the civilian agency would break up and destroy efficient working teams of specialists, engineers and technicians seemed to be unfounded. The proposed transfer would involve only changes in management and gradually a shift in the types of space projects. The teams would continue to use the same facilities at the Huntsville complex. The group would not be separated or transferred. See The Washington Post and Times Herald, October 29, 1958, p. A16.
were approved after a full and free discussion. The recommendations were: (1) that the Jet Propulsion Laboratory operated under contract to the Army by the California Institute of Technology be transferred to a similar status under NASA, and (2) that the Development Operations Division of the Army Ballistic Missile Agency at Huntsville not be transferred to NASA at that time, but would serve as a contractor for NASA on a cooperative basis.23

Following the unanimous recommendations of the Space Council,24 President Eisenhower transferred the functions, facilities and management of the Jet Propulsion Laboratory (JPL) from the Department of the Army to NASA by Executive Order 10793 on December 3, 1958.25 While the JPL was operated under contract, the property occupied and utilized by it in Pasadena was Government-owned. The Executive Order also shifted $4,078,250 from the Department of Defense Appropriations to NASA for execution of the JPL projects then in existence.26 The Order provided that:


25 23 F. R. 9405. For text of Executive Order 10793, see also NASA Management Manual, General Management Instructions No. 1-3-2, October 13, 1959, Attachment A.

26 Ibid.
In order to provide for the most effective utilization of scientific and engineering resources, the National Aeronautics and Space Administration shall to the extent permitted by its own programs and facilities provide research and development support at the Laboratory in respect of military matters to the Department of Defense.27

The Order further directed the Department of Defense and NASA to effect necessary administrative arrangements, including the appropriate transfer of records, in connection with the transfer of functions and property.28 In signing the Executive Order, President Eisenhower commented:

This decision is necessary in the national interest. It prevents unnecessary duplication and effects economies in space research and development. This development will enhance close cooperation between The National Aeronautics and Space Administration and the Department of Defense to the end that the peaceful use of space will redound to the benefit of all mankind.

I am gratified that the Department of Defense and National Aeronautics and Space Administration have reached agreements under which the National Aeronautics and Space Administration will use the unique capabilities of the Army Ordnance Missile Command, including the Army Ballistic Missile Agency, on a fully cooperative basis.29

On December 3, 1958, the date of the JPL transfer, an agreement entitled, "Cooperative Agreement on Jet Propulsion Laboratory Between the National Aeronautics and Space Administration and the Department of the Army," was signed by the

27Executive Order 10793, Section 3, 23 F. R. 9405.
28Ibid.
NASA Administrator and the Secretary of the Army. This agreement defined the policies and procedures to be followed in effecting the details of the transfer.30 Under this agreement the Army would continue during calendar year 1959 to contract for and fund and manage the Sergeant guided missile program and one or two other small programs that were underway at the Laboratory. It was expected that the Army activities would be largely phased out during 1959 and as of January 1960, the entire operation would be under NASA management. Meanwhile, NASA would have full responsibility for all of the supporting research at the Laboratory.31 Dr. Glennan pointed out the advantages of the JPL transfer to his agency were to "avoid the building of a very large and expensive laboratory and the employing in a very competitive market of a sizable number of highly qualified scientists and engineers."32

**NASA-Army Agreement on ABMA**

On December 3, 1958, NASA and the Department of the Army also concluded an agreement under which the Army Ordnance

30 For text of this agreement, see National Aeronautics and Space Administration, First Semiannual Report to the Congress, October 1, 1958-March 31, 1959, op. cit., Appendix H, pp. 81-84. See also NASA Management Manual, General Management Instructions No. 1-3-2, op. cit., Attachment B.


32 Ibid., pp. 2-3.
Missile Command (AOMC) and its subordinate organizations would be "continuously responsive to NASA requirements." The Army Ballistic Missile Agency (ABMA) at Huntsville, Alabama, would carry out certain NASA projects. Under the agreement, the Commanding General, AOMC, would be responsible for scheduling the space and missile activities under his jurisdiction to meet the priority requirements of NASA "in a manner consistent with overall national priorities." The purpose of the agreement was to assist in the "effective utilization of the scientific and engineering resources of the country by fostering close cooperation among the interested agencies in order to avoid unnecessary duplication of facilities."

Under the agreement NASA established at the Huntsville facility, an office composed of a small technical staff to provide technical direction for NASA projects assigned to the ABMA. However, the Army retained the ownership and management of that facility.

33"Cooperative Agreement on Army Ordnance Missile Command Between the National Aeronautics and Space Administration and the Department of the Army," dated December 3, 1958. For the text of this agreement, see National Aeronautics and Space Administration, First Semiannual Report to the Congress, October 1, 1958-March 31, 1959, op. cit., Appendix I, pp. 85-87.

34Ibid., p. 86.


36Ibid., p. 36.
Joint NASA-Defense Department Press Conference

On the afternoon of December 3, 1958, a joint press conference was held by Deputy Secretary of Defense Quarles and NASA Administrator Glennan at NASA Headquarters in Washington. In his opening statement, Dr. Glennan noted that the conference was called to provide information relating to the "so-called" problems that had been discussed in the press for some time, which had been resolved "very amicably" he thought between the Department of Defense and NASA.37

Dr. Glennan explained that, while he was satisfied with the cooperative agreement with the Army under which the ABMA would be responsive to NASA needs and expected it to be a useful and productive arrangement,38 he noted some serious shortcomings inherent in such arrangement from the NASA point of view:

... It isn't exactly as satisfactory as one might like because we are under this arrangement less able to build into our own staff the people at ABMA. That is, we are going to do an increasingly large proportion of our work with industrial organizations, universities, and to do this we must have people on our staff who are able to plan the kind of programs that we want to undertake, and people who can evaluate the kind of results we get from the contracts that we do let.

It is a little difficult to have that sort of contract monitoring done by another contractor. So to that extent we are going to spend the next year, if you will,

37 See "Proceedings of Press Conference by Dr. Glennan and Quarles . . .," *op. cit.*, pp. 2-3.

determining whether it is possible to do it effectively or not.

You could imagine, I suppose, that in some of our work, where we utilize Air Force facilities or Air Force boosters, if we had an Army ABMA man as our contract monitor there, there might be some raised eyebrows. I am not sure about this but I am told that this could happen.\textsuperscript{39}

Mr. Quarles stated that from the Defense standpoint, "... it seems to me that this is an eminently satisfactory arrangement. It points toward the same kind of close working relationship with NASA that we have had with NACA."\textsuperscript{40} He pointed out that he had every expectation that the arrangement would also be good from a national standpoint.\textsuperscript{41}

**ABMA's Future Uncertain**

Retention of the Huntsville facility appeared to be at least a temporary victory for the Army. However, the question whether the Army Ballistic Missile Agency should remain in the Army or be transferred to NASA had not been conclusively resolved. This controversial issue was discussed extensively during subsequent Congressional hearings.\textsuperscript{42}

\textsuperscript{39}Ibid., pp. 14-15. \textsuperscript{40}Ibid., p. 28. \textsuperscript{41}Ibid., p. 29.

The situation was that there had been no real decision in the matter, but it was merely deferred or taken under advisement for a year. Dr. Glennan expressed his disappointment in the transfer matter before joint hearings held by the Senate in January 1959. When queried as to whether the issue could be reopened, Dr. Glennan testified:

We asked for the transfer of the Division of Development of ABMA to NASA's management. In discussions with the Army it was agreed that such a transfer was not in the best interests of all concerned, since it was said to be crippling to the ability of the Army to discharge their obligations in the missile program, and I believe that the missile program has priority ahead of the space program. We therefore came to an agreement which was reduced to writing.

The Secretary of Defense and myself presented this to the President and to the Space Council, and in that agreement there was provision for a review of the operation of the agreement by the end of the year.

To me this means that I have the opportunity, and I shall certainly avail myself of the opportunity, if I think I need it, to ask again for the transfer of this agency, if it seems important.\(^4\)\(^3\)

The fate of the von Braun team and Saturn, the large rocket engine that it was developing, remained uncertain. There was a popular query as to whether or not there was a

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\(^4\)\(^3\) U. S. Congress, Senate, Committee on Armed Services and the Committee on Aeronautical and Space Sciences, *Missile and Space Activities*, Joint Hearings, *op. cit.*, p. 169.
military application for large rocket boosters. The issue was heading for a showdown when Defense Secretary McElroy decided in September 1959 that the major military role in outer space would be assigned to the Air Force. Apparently this was a move to achieve some semblance of order out of the garbled military space program. Under this directive, the Air Force would take over responsibility for the development and launching of large space boosters for the Defense Department.44

The President's Decision

Finally, on October 20, 1959, President Eisenhower met with officials concerned with the missile and space programs, but not through the "medium" of the National Aeronautics and Space Council, to discuss the possible reassignment of the ABMA and the Saturn project. Those invited to attend included: Defense Secretary McElroy, Deputy Defense Secretary Thomas S. Gates, Dr. Glennan, Dr. Dryden, Dr. Herbert F. York, Dr. George Kistiakowsky, Elmer Staats, and White House staff members.45

On the following day, October 21, 1959, President

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Eisenhower announced his intention to transfer, subject to Congressional approval, the ABMA Development Operations Division to NASA. At the same time the work being carried on by that Division on the Saturn booster would also be transferred to NASA control. In effect, these two vital decisions took the Department of the Army out of space work, except in a supporting role such as the work done by the Signal Corps in connection with communications satellites. Concerning this action, the President issued a statement to the effect that the von Braun team could best serve the national interest in our space effort as an integral part of the NASA. The President's statement made it clear that this action was designed to consolidate in one agency, NASA, the development of all high-thrust launch vehicles.

This was a significant recognition of the importance of outer space exploration in the total national effort. Otherwise, the Saturn project could not have survived as a part of the military program, since the necessary military use or justification was lacking. This contemplated transfer ended what had been about a full year of study as to whether

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46 Ibid.
the Army or NASA should carry on the development of super-booster space vehicles.

Background for the transfer arrangements leading up to the President's decision was contained in a joint memorandum from Dr. Glennan and Acting Secretary of Defense Thomas S. Gates, on October 21, 1959, in which both of them concurred and proposed that the Saturn project be transferred to NASA, and that NASA assume the responsibility for development of future large launch vehicle systems.\footnote{Memorandum for the President, Subject: "Responsibility and organization for certain space activities," in U. S. Congress, House, Committee on Science and Astronautics, \textit{Transfer of the Development Operations Division} \ldots \textit{op. cit.}, p. 28.} It was stated in the memorandum that at present there was no clear-cut military requirement for super booster vehicle systems. On the other hand, future manned and unmanned space exploration for scientific and peaceful purposes could only be attained through the use of booster vehicle systems of very high thrust. The memorandum also recommended the transfer of the ABMA Development Operations Division from the Army to NASA. President Eisenhower approved the recommended action on November 2, 1959.\footnote{\textit{Ibid.}, pp. 29-30.}

Accordingly, on October 22, 1959, General Lyman L. Lemnitzer, Army Chief of Staff, and Army Secretary Wilber M. Brucker issued a joint statement assuring the nation that
they would make every effort to effect the transfer expeditiously, smoothly, and with an absolute minimum of interference with all military and space efforts.50

On October 23, 1959, a joint press conference was held by NASA Associate Administrator Richard E. Horner and Dr. Herbert F. York, Director of Defense Research and Engineering, to shed a little light on the President's announcement. Mr. Horner pointed out that the contemplated transfer of the ABMA Development Operations Division and other organizational elements of the ABMA was an extremely complex administrative matter. There were the questions of support on the one side and the continuance of the Army programs that were involved, but he felt confident that a satisfactory agreement could be worked out.51 He stated that by virtue of the transfer NASA would have a much larger in-house capability and a larger organization. Mr. Horner also noted that NASA did not request the transfer this time but thought it was initiated by the Defense Department.52

At this conference Dr. York reiterated the decision that there was no real clear-cut military requirement for the

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50Ibid., p. 3.
52Ibid., p. 16.
Saturn program. He conceded that it became "evident that we can do much better with regard to getting heavy payloads up by relatively modest upgradation of the ballistic missiles plus more optimum upper stages."\textsuperscript{53} However, Dr. York stated that if the Defense Department had a future need for a super-booster, that is one in the Saturn class, they would go to the NASA to get the booster.\textsuperscript{54}

**Army-NASA Agreement to Implement the Decision**

The Department of the Army and NASA thereafter executed an agreement, under the date of November 18, 1959, establishing objectives and guidelines for implementing the President's decision to accomplish this transfer.\textsuperscript{55} With guidelines established, NASA and Army teams worked day and night to formulate a detailed agreement which NASA Administrator Glennan, Deputy Defense Secretary Douglas and Army Secretary Brucker approved on December 16 and 17, 1959. This agreement served as the basis for the President's transfer plan to Congress.\textsuperscript{56}

\textsuperscript{53}Ibid., p. 14. \quad \textsuperscript{54}Ibid., p. 9.

\textsuperscript{55}"Agreement Between the Department of the Army and NASA on the Objectives and Guidelines for the Implementation of the Presidential Decision to Transfer a Portion of ABMA to NASA," executed on November 18, 1959, and signed by Army Secretary Wilber M. Brucker and NASA Administrator T. Keith Glennan, in Washington, D. C. For the text of this agreement, see U. S. Congress, House, Committee on Science and Astronautics, *Transfer of the Development Operations Division* . . . *op. cit.*, pp. 30-32.

\textsuperscript{56}Ibid., p. 3.
President Submits Transfer Plan to Congress

On January 14, 1960, President Eisenhower submitted to Congress a detailed plan to transfer the Development Operations Division of the Army Ballistic Missile Agency to NASA, and requested Congress to allow it to take effect.\(^5^7\)

This proposal was submitted pursuant to Section 302 (c)(2) of the Space Act, which requires that any such transfer made pursuant to this authority will become effective sixty days after its submission to Congress, unless Congress adopts a concurrent resolution opposing the transfer. This plan was the first such transfer proposal submitted by the President to Congress since January 1, 1959, when Section 302(c)(2) of the Act became applicable.

In the Presidential message accompanying the transfer plan, the President commented:

I have concluded that it is in the best interest of the Nation to take another step at this time—to provide NASA with an organization capable of and equipped

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\(^{57}\)For the text of the President's transfer plan and special message to Congress, see U. S. Congress, House, Committee on Science and Astronautics, Certain Transfers from the Department of Defense to the National Aeronautics and Space Administration, Message from the President of the United States Relative to Making Certain Transfers from the Department of Defense to the National Aeronautics and Space Administration, House Doc. No. 297, 86th Congress, 2d Session, reproduced in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of von Braun Team to NASA, Hearing before the NASA Authorization Subcommittee on H. J. Res. 567, February 18, 1960 (Washington: Government Printing Office, 1960), pp. 75-78.
for developing and operating large space vehicle boosters and conducting related research. This can be done by transferring to NASA the Development Operations Division of the Army Ballistic Missile Agency and certain supporting personnel. At the same time it is recognized that the Army must continue to be able to discharge its responsibilities for development of missile systems. The transfer plan forwarded herewith is designed to accomplish these purposes.58

House Joint Resolution 567

In response to the President's message, Congressman B. F. Sisk of California introduced House Joint Resolution 567 on January 21, 1960, "To effect immediately the transfer of the Development Operations Division of the Army Ballistic Missile Agency to the National Aeronautics and Space Administration." The purpose of the Resolution was to waive the sixty-day waiting period, with regard to this particular transfer.59

After holding its hearing,60 the House Committee on Science and Astronautics reported House Joint Resolution 567

58 Ibid., p. 76.


60 U. S. Congress, House, Committee on Science and Astronautics, Transfer of the Development Operations Division... op. cit.
favorably on February 4, 1960. In its report, the Committee explained that early adoption of the Resolution would add impetus to the transfer effort. The measure was passed by the House on February 8, 1960.61

The Senate Committee on Aeronautical and Space Sciences held a hearing on House Joint Resolution 567 on February 18, 1960.62 This Committee noted that as passed by the House, the measure referred to the plan taking effect immediately. This raised the question of interpretation, since the detailed plan formulated by the Army and NASA called for the actual transfer to take place on or about July 1, 1960. The Senate Committee observed the opinion expressed earlier by the Department of Defense on this Resolution transfer in a letter to the Chairman of the House Committee on Science and Astronautics on February 4, 1960. In this letter, Army Secretary Wilber M. Brucker said:

... Since the apparent purpose of House Joint Resolution 567 is to give early congressional approval


62U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit.
to the transfer plan submitted by the President and since it is not intended to interfere by forced acceleration with the orderly transition planned for July 1, 1960, the Department of the Army, on behalf of the Department of Defense, expresses no objection to the adoption of the resolution.63

On this point, Mr. Albert F. Siepert, Director of the Office of Business Administration, NASA, told the Senate Committee on Aeronautical and Space Sciences that:

... Rather than make an abrupt shift from Army to NASA control, both parties are prepared to take the time to work out details thoroughly before making the official shift of personnel. For this reason many of the personnel shifts and fiscal adjustments are scheduled to begin at the start of the next fiscal year on July 1.

... The NASA has noted with appreciation Representative Sisk's resolution (H. J. Res. 567) to expedite favorable action on the transfer plan. This resolution has already passed the House. Its adoption by the Senate at an early date would remove any lingering employment uncertainties for those now connected with the Development Operations Division or those whom NASA seeks to recruit among the administrative and plant support groups now attached to other elements in the Redstone Arsenal organizations.64

Also, in this connection, Major General August Schomburg, Commanding General, Army Ordnance Missile Command, testified before the Senate Committee on Aeronautical and Space Sciences as follows:

... We are now in the management saddle. If NASA wants to maintain complete and effective control, the

63U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Report No. 1142, op. cit., pp. 3-4.

64Ibid., p. 4.
best way is to leave it running as it is until the first of July, and then start the change at the beginning of the fiscal year.

Army support only starts to taper at that time. Right after the first of July we will still be doing most of the things for them as we are now. It will taper off sharply in the fiscal control area. But they are going to have to take over a great deal that would be in the area of support, and we will be helping right up until the end of the calendar year on that.65

The Senate Committee on Aeronautical and Space Sciences reported House Joint Resolution 567 on February 26, 1960, amended to "authorize" the immediate transfer of the ABMA Development Operations Division to NASA. In its report, the Committee commented:

Thus, even though, passage of this resolution cannot actually accelerate the transfer plan, the committee is reporting the resolution, with clarifying amendments, to waive the remaining period of time required by the National Aeronautics and Space Act of 1958 so as to dispel any possible fears that personnel involved in such transfer may have that the plan would be disapproved by the Congress.66

No further action was taken by the Senate on the measure, and the transfer became effective on March 14, 1960, or sixty days after the President submitted his proposal to Congress, in accordance with the provisions of existing law.

Summary of the Army-NASA Transfer Plan

The following is a summary of the detailed plan developed by the Army and NASA which the President's transfer

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65 Ibid., p. 5.  
66 Ibid.
plan would bring into effect and the manner in which this plan would be implemented. 67

**General Concepts.** The plan provided for transfer to NASA of personnel, equipment, and facilities of the ABMA Development Operations Division 68 and of pertinent supporting organizations in sufficient numbers and quantities to furnish NASA with a substantially independent operating research and development organization and competence. At the same time the plan recognized and provided for the "continued performance by the Army of its mission." Two methods were utilized to accomplish these objectives. One was by providing for the continuation of services to the Army by the

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67 This transfer plan was jointly developed by the Department of the Army and NASA in accordance with the agreement between NASA and the Department of Defense dated October 21, 1959, approved by the President on November 2, 1959, and a supplementary agreement between the Department of the Army and NASA dated November 16, 1959 relative to the transfer of the Development Operations Division of the Army Ballistic Missile Agency to NASA. See U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit., p. 65.

68 The Development Operations Division was one of the four divisions in the Army Ballistic Missile Agency. This Division contained most of the technical and scientific personnel that were directly related to the space vehicle development program. The supporting personnel for this Division was largely in other divisions of ABMA and to some extent in other organizations of the Army Ordnance Missile Command. See "Proceedings of the Press Conference held Jointly by Mr. Richard E. Horner of NASA and Dr. Herbert F. York of the Defense Department," op. cit., p. 6. See also, U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit., pp. 53-54.
group transferred. The other was by providing for retention by the Army of competence "for continuing weapons system management." Basic to the plan was the concept of phasing responsibility and operations so as to preclude the dislocation or disruption of on-going military and space programs. 69

Personnel. The Development Operations Division included approximately 4,200 civilian employees. However, in order to enable the Army to maintain its weapons system management capability as many as 350 personnel of the Division would be offered an opportunity to stay with the Army. 70

Approximately 250 enlisted military personnel within the Division would be phased out over a period of time. 71

Generally speaking, the new NASA Huntsville facility would be locally self-sufficient. In order to accomplish this and to avoid unnecessary duplication of facilities, the plan provided for the transfer of 815 supporting personnel from other Army organizational elements at the Redstone

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69U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit., p. 65.

70NASA would replace these 350 persons in two ways: By recruitment from the outside or by conversion to civil service of certain military specialist personnel after their enlistments have terminated. U. S. Congress, House, Committee on Science and Astronautics, Transfer of the Development Operations Division . . . Hearing, op. cit., p. 36.

71Ibid., p. 5.
Arsenal that had been furnishing services to the Development Operations Division. While this number represented only about two-thirds of the 1,200 supporting personnel that NASA would eventually require at this facility, this action was in recognition of the Army's personnel needs to maintain and carry out its continuing mission in the ballistic missile and other ordnance programs. The proposed staffing of the Huntsville facility is shown below.

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<th>PROPOSED STAFFING--HUNTSVILLE FACILITY</th>
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<td>Present Development Operations Div.</td>
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<td>Administrative &amp; Technical Supp't</td>
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<td>4,213</td>
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*Now supplied by Army Ordnance Missile Command, primarily from ABMA and Redstone Arsenal.

The plan called for the transfer to NASA of any super-grade positions then allocated to key employees of the von

72 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit., p. 65.

73 The source of this information is found in U. S. Congress, House, Committee on Science and Astronautics, Transfer of the Development Operations Division . . . Hearing, op. cit., p. 36.
Braun team who transferred to NASA. Some eighteen positions were involved, ranging from $15,375 to $19,000 per annum. NASA would be able to allocate to the Huntsville facility an additional twenty-one "excepted" positions authorized to NASA under Section 203(b)(2) of the Space Act.74

**Responsibility for Administrative Services.** The NASA would assume responsibility for management control functions such as personnel, planning, fiscal and budgeting; and functions involving immediate services to the technical teams, such as procurement and supply, maintenance of facilities and equipment, and physical security.75 These services which NASA would build up as its own capability are shown on the left of the chart, Figure 1. On the right, station-wide functions such as perimeter security, foundry and utility services will be supplied to the NASA organization by the Army on a reimbursable basis.76 These represented the kinds of services for which large capital investments had already been expended. It would be therefore costly and impracticable for NASA to duplicate the facilities needed to supply these services.77

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<th>Performed by NASA</th>
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<td>Management Control</td>
<td>Utility Services</td>
</tr>
<tr>
<td>* Accounting</td>
<td>* Water</td>
</tr>
<tr>
<td>* Budgeting</td>
<td>* Sewage</td>
</tr>
<tr>
<td>* Personnel</td>
<td>* Electric Power</td>
</tr>
<tr>
<td>Procurement and Supply</td>
<td>* Boiler Plant Operation</td>
</tr>
<tr>
<td>Maintenance of Buildings &amp; Grounds</td>
<td>Perimeter Security</td>
</tr>
<tr>
<td>Office Services</td>
<td>Access Roads</td>
</tr>
<tr>
<td>* Mail and Messenger Services</td>
<td>Technical Library</td>
</tr>
<tr>
<td>* Transportation</td>
<td>Railroad Maintenance and Switching Services</td>
</tr>
<tr>
<td>Security and Guard Services</td>
<td>Fire Protection</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
</tr>
<tr>
<td>Facilities Engineering</td>
<td></td>
</tr>
</tbody>
</table>

**FIGURE 1**

PROVISION OF ADMINISTRATIVE SERVICES

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Land and Facilities. Under the transfer plan NASA would be granted the use of approximately 1,200 acres of land at the Redstone Arsenal encompassing virtually all the land and facilities then utilized by the Development Operations Division. This aggregated some $100 million in value, $14 million of which was located at the Atlantic Missile Range at Cape Canaveral, Florida. The facilities at the Cape will be shared by the Army and NASA to insure that the requirements of each organization are met. The Pershing and Saturn complexes under construction there will be assigned to the Army and NASA, respectively. Figure 2 shows the extent of the facilities to be transferred to NASA.

Transfer Timing and Funding. The plan contemplated transfer to NASA of the personnel of the Development Operations Division, effective July 1, 1960. After careful study the Army and NASA mutually agreed that this was the optimum

78Under the plan, the Army would grant to NASA a long-term non-revocable, and renewable use permit for the agreed upon land and facilities at the Redstone Arsenal. U. S. Congress, House, Committee on Science and Astronautics, Effecting Immediate Transfer of the Development Operations Division . . . Report No. 1240, op. cit., p. 4.

79U. S. Congress, House, Committee on Science and Astronautics, Transfer of the Development Operations Division . . . Hearing, op. cit., pp. 5 and 39-40. At Cape Canaveral, the ground rules are that facilities fixed to the ground belong to the Air Force. Although title is vested in the Air Force, these facilities will be assigned for NASA's use. Ibid., p. 4C.
### FACILITIES

**APPROX. AMTS.**

<table>
<thead>
<tr>
<th>Land</th>
<th>1,200 acres</th>
</tr>
</thead>
</table>

### STRUCTURES & EQUIPMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering &amp; Administration</td>
<td>460,000 Sq Ft</td>
</tr>
<tr>
<td>Laboratories</td>
<td>320,000 Sq Ft</td>
</tr>
<tr>
<td>Shops</td>
<td>620,000 Sq Ft</td>
</tr>
<tr>
<td>Storage</td>
<td>240,000 Sq Ft</td>
</tr>
<tr>
<td><strong>TOTAL GROSS SPACE</strong></td>
<td>1,640,000 Sq Ft</td>
</tr>
<tr>
<td><strong>No. of Buildings</strong></td>
<td>98</td>
</tr>
<tr>
<td><strong>No. of Test Stands, Pits, Etc.</strong></td>
<td>69</td>
</tr>
</tbody>
</table>

### JOINT USE WITH ARMY

- Saturn River Dock
- Army Test Facilities
- Army Airfield
- Hq Admin. (Temporary Use)
- Antenna Test Area
- Army Test Track
- Various Storage Facilities
- Quick-Look Antenna Site
- Launch Emplacement
- Specified Cape Canaveral Facilities

**FIGURE 2**

**ARMY-N.A.S.A. TRANSFER OF**

**DEVELOPMENT OPERATIONS DIVISION (ABMA)**

**AT HUNTSVILLE, ALABAMA**

*Includes $14 million at Cape Canaveral, Florida.*

target date from the standpoint of program and budget transition, since it would be the beginning of a new fiscal year. Transfer of supporting personnel would largely occur on or before July 1, 1960, in order that NASA would be able to furnish administrative support for the von Braun group upon its transfer.  

80

The unobligated funds and the unexpended funds for major contracts in the Saturn program would be transferred to NASA. The plan contemplated full assumption by NASA of the managerial and funding responsibilities and functions as of July 1, 1960. Beginning fiscal year 1961, NASA would secure on a reimbursable basis, the services to be provided by the Army within the Redstone Arsenal complex. Work performed by NASA on military weapons systems for the Army would also be on a reimbursable basis.  

81

Reaction to Transfer of the von Braun Team

Throughout the hearings on House Joint Resolution 567, there was considerable testimony from various Defense Department witnesses to the effect that they were never at any time pressing for the transfer of the team headed by Dr. von Braun; however, since the decision had been made by

80Ibid., pp. 3 and 5.  
the President, it was accepted and full cooperation was being given to effect this transfer expeditiously and with a minimum of disruption to important military and space activities. "Our objective," testified Army Secretary Brucker, was "to effect the transfer without losing a day in our national space effort." He admitted that the contentions the Army made originally in support of retaining the von Braun team were no different from what they were in October 1959, but that many events had occurred since that time in anticipation of the transfer, besides, of course, the Presidential directive. Mr. Brucker assured the House Committee on Science and Astronautics that Dr. von Braun had expressed not only a willingness but also a desire to see the transfer occur because of his great interest in the Saturn program.

After his retirement from the Army, Major General J. B. Medaris, former Commander, Army Ballistic Missile Agency, aired his views on the transfer before the House Committee on Science and Astronautics on February 18, 1960:

In the area of political competition for control of resources, the Army has done the only thing it could do. When one is forced into making a choice from a bundle of bad choices, he must take the least objectionable...

82 U. S. Congress, House, Committee on Science and Astronautics, Transfer of the Development Operations Division... Hearing, op. cit., p. 3.
84 Ibid., p. 12.
one. The transfer of the Von Braun group to NASA is the unfortunate culmination of a long series of such dilemmas. At the end, the Army faced a Solomon's choice: First, by the assignment of the space vehicle development, production, and launching mission to the Air Force, and secondly, the Army's total inability to secure from the Department of Defense sufficient money or responsibility to do the Saturn job properly, we found ourselves then in the position of either agreeing with the transfer of the team, or watching it be destroyed by starvation and frustration.85

As to the NASA, Dr. Glennan stated that he believed the transfer was in the best interest of the nation and it would contribute to the strengthening of the national space program. He noted that "During the past year, ABMA contributions to NASA space programs have been characterized by dedicated teamwork and cordial relationships," and he looked forward to the new relationship with "real enthusiasm."86

Impact of the Transfer on NASA Organization

With the transfer of the Huntsville facility, NASA would acquire a unique and demonstrated capability in the

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area of space vehicle development. On November 18, 1959, a memorandum of understanding for operation of the Saturn program, pending formal transfer to NASA, was approved by NASA and the Department of Defense. Under this agreement NASA assumed the technical direction of the Saturn vehicle systems, with advice and assistance of a committee composed of representatives from NASA and the Defense Department. The Defense Department exercised administrative management for NASA. This was an interim management arrangement until the Development Operations Division of ABMA was formally transferred to NASA.

The transfer of the Huntsville facility and its integration into the NASA organization was facilitated by some adjustments in NASA's structure and redefinition of its previous mission assignments. These will be discussed in


88 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Transfer of Von Braun Team to NASA, Hearing, op. cit., pp. 50-51. For an excellent presentation of this transfer made by Mr. Albert F. Siepert, Director of the Office of Business Administration, NASA, before the NASA Authorization Subcommittee, see Ibid., pp. 49-74. For a similar presentation by Mr. Siepert, see U. S. Congress, House, Committee on Science and Astronautics, Transfer of
the following chapter which is concerned with the details of NASA's functions and the organizational structure through which they are carried out.

CHAPTER III

NASA--ITS ORGANIZATION AND FUNCTIONS

"The best leader does not ask people to serve him, but the common end. The best leader has not followers, but men and women working with him. When we find that the leader does less than order and the expert more than advise, subordinates--both executives and workers--will respond differently to leadership. . . ."

Mary Parker Follett

I. NATIONAL GOALS IN SPACE ACTIVITIES

The goals of the NASA are spelled out effectively in the National Aeronautics and Space Act of 1958.¹ In its "Declaration of Policy and Purpose," Congress declared that "it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind." (Section 102(a)). The Congress then declared that the aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of several stated objectives, which are paraphrased for the purpose of brevity as:

1. Expansion of human knowledge of phenomena in the atmosphere and in space;

2. Improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

3. Development and operation of space vehicles for a number of purposes, including sending living organisms

through space;

4. Establishment of long-range studies of potential benefits to be gained for mankind through space activities;

5. Preservation of the role of the United States as a leader in aeronautical and space activities for peaceful purposes;

6. Interchange of information between the civilian and military agencies to the end that maximum effectiveness of discoveries be available for defense as well as for peaceful purposes;

7. Cooperation by the United States with other nations in the performance of research conducted under the Space Act and in peaceful application of the results of such research; and

8. The most effective utilization of scientific and engineering resources of the United States in achieving these goals, thereby avoiding unnecessary duplication of effort, facilities and equipment.\footnote{Ibid., Section 102(c). See also, "Address by NASA Administrator T. Keith Glennan at the Wright Day Dinner, Sheraton-Park Hotel, Washington, D. C.," on December 17, 1958, p. 5.}

II. GENERAL PLAN OF ORGANIZATION

To carry out the responsibilities assigned to it under the Space Act, NASA has divided its activities into six major programs: (1) Space Flight Programs, (2) Launch
Vehicle Programs, (3) Advanced Research Programs, (4) Life Sciences Programs, (5) Business Administration, and (6) Technical Information and Educational Programs. The agency is organized on a decentralized basis. The Headquarters offices are concerned with overall management of NASA's total research and development program, including the planning, monitoring and evaluation of the program; integration of the work of the various field installations; coordination of NASA's efforts with those of the Department of Defense and the military services; and the preparation and defense of the NASA budget. The responsibility and authority for technical management of the specific research and development

3 The NASA organization is based largely upon recommendations of the McKinsey & Company, a management consulting firm, which conducted a study of NASA's functions, responsibilities, and operations. The McKinsey recommendations were given extensive review by the NASA staff before adoption. "MEMORANDUM from the Administrator" (Subject: NASA Organization) to NASA employees dated January 30, 1959. Also, Report of the McKinsey & Company, Inc., Organizing Headquarters Functions, National Aeronautics and Space Administration, December 1958, Parts I and II.

4 "Introductory Remarks" by NASA Administrator T. Keith Glennan in NASA-Industry Program Plans Conference, July 28-29, 1960, National Aeronautics and Space Administration, p. 4. These Proceedings contain the complete texts of all the papers presented at the First NASA-Industry Program Plans Conference held in Washington, D. C., on July 28-29, 1960, except for the deletion of classified information contained in some of the slides shown at the Conference. The purposes of this Conference were to provide industrial management an overall view of NASA's program and to establish an adequate basis for future conferences to be held at the various NASA field installations. Ibid., p. i.
projects included in the various programs have been largely delegated to the NASA space flight and research centers in the field.

III. NASA HEADQUARTERS

The focal point of the organization is NASA Headquarters, Washington, D. C. Located there are the Office of the Administrator and his staff, the Office of Space Flight Programs, the Office of Launch Vehicle Programs, the Office of Advanced Research Programs, the Office of Life Sciences Programs, the Office of Business Administration, and the Office of Technical Information and Educational Programs.5

The Space Act established the positions of Administrator and Deputy Administrator of the NASA.6 The Deputy Administrator assists the Administrator in discharging his responsibilities under the Space Act, and acts for him in his absence. The activities of the NASA have been logically distributed among the six directors of the major program areas which are covered in detail below.

Staff Offices of the Administrator

The following six staff offices report directly to the Office of the Administrator, as shown in Figure 3:

5Figure 3 depicts the organizational structure of NASA.

6Section 202 of the Space Act.
1. Assistant Administrator for Congressional Relations,
2. General Counsel,
3. Office of Program Planning and Evaluation,
4. Office of Public Information,
5. Office of International Programs, and
6. Inventions and Contributions Board.

These offices furnish staff assistance within their respective areas of responsibility and authority.  

Office of the Associate Administrator Established

Early in 1959 it was apparent that the increasing outside demands on the time of the Administrator and Deputy Administrator made it extremely difficult for these two officials to direct the internal affairs of the new agency adequately. A study showed that nearly three-fifths of their time was claimed by activities outside the agency in contacts with other Government agencies; discussions with the President, representatives of the Executive Office or the National Aeronautics and Space Council; conferences with representatives of the scientific community; meetings with industry representatives; and dealings with other external groups. The study revealed that only one-third of their time

7 For functions and authority of these offices, see National Aeronautics and Space Administration, NASA Management Manual (Washington: NASA Headquarters), Part I, Chapter 2.
had been available to devote to directing the internal operations of the NASA. 8

Accordingly, on June 1, 1959, Dr. Glennan established the Office of the Associate Administrator and appointed Mr. Richard E. Horner as the first Associate Administrator, pursuant to Section 203(b)(2) of the Space Act permitting the Administrator to employ ten persons within the salary range of $19,000 to $21,000. The Associate Administrator is primarily responsible for assisting the Administrator and Deputy Administrator in the over-all management of NASA operations. Perhaps the closest analogy to this role is that of the general manager in an organization such as the Atomic Energy Commission. 9

The Directors of the Offices of Space Flight Programs, Launch Vehicle Programs, Advanced Research Programs, Life Sciences Programs, Business Administration, and Technical Information and Educational Programs were made directly responsible to the Associate Administrator. Two staff offices,


the Office of Program Analysis and Control, and the Office of Reliability and Systems Analysis, were established in the Office of the Associate Administrator on January 1 and March 10, 1960, respectively. The functions of these Offices are to review and evaluate NASA research activities in terms of vehicle reliability, program balance, and progress in achieving established goals. ¹⁰

Program Direction Offices

Under the supervision and coordination of the Associate Administrator are six major offices or directorates that plan, integrate, and manage NASA programs.

Office of Space Flight Programs. Formerly the Office of Space Flight Development, ¹¹ this Office is charged primarily


¹¹ As indicated in the previous chapter, the transfer to NASA of the Development Operations Division of the Army Ballistic Missile Agency broadened the launch vehicle program and made it possible to centralize at the Huntsville facility major responsibility for the bulk of launch vehicle system development and operation. A NASA reorganization announced on December 8, 1959 to become effective on January 1, 1960, divided space flight development responsibilities to place emphasis on launch vehicle development. Instead of a single office for space flight development, two operating units were established at NASA Headquarters. An Office of Launch Vehicle Programs was created for developing and launching
with the responsibility for (1) mission planning (satellites and space probes); (2) payload design and development; (3) in-flight research and operation; (4) development of tracking, communications, and data reduction systems; (5) tracking and obtaining data from satellite and space probes; and (6) launching sounding rockets and obtaining and interpreting information from them. It directs and coordinates the operations of the Goddard Space Flight Center, Greenbelt, Maryland; the Wallops Station (Virginia); and the Jet Propulsion Laboratory at Pasadena, California. 12

This Office directs Project Mercury, and is responsible for acquiring and maintaining world-wide Minitrack, Mercury, and Deep Space tracking and data acquisition networks. Under the reorganization, Assistant Directors were appointed for: Program Planning and Coordination, Space


Flight Operations, Lunar and Planetary Programs, Satellite and Sounding Rocket Programs, and Applications and Manned Flight Programs.¹³

**Office of Launch Vehicle Programs.** This Office is responsible for developing launch vehicles and for the associated vehicle launch operations, including: (1) development of propulsion systems, (2) design and procurement of launch vehicles and associated controls, and (3) NASA launch operations at the Atlantic Missile Range, Cape Canaveral, Florida, at the Pacific Missile Range, Point Arguello, California, and at other launch sites. This Office directs and coordinates activities of the George C. Marshall Space Flight Center (Huntsville facility), and the NASA Launch Operations Directorate at Cape Canaveral, Florida. The Director, Office of Launch Vehicle Programs, is assisted by Assistant Directors for Vehicles, Propulsion, and Launch Operations.¹⁴

It is the responsibility of the Office of Launch Vehicle Programs to provide the transportation (launch vehicles) for the spacecraft that are utilized in NASA space

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explorations. The development of the spacecraft, which are the payloads for the launch vehicles, is the responsibility of the Office of Space Flight Programs. Obviously, there must be very close cooperation and coordination between these two offices.  

Office of Advanced Research Programs. The activities of this Office differ from those of the Offices of Space Flight Programs and Launch Vehicle Programs in that its primary mission is research in fields underlying the technology of aeronautics and space. The function of the Office of Advanced Research Programs is to plan and conduct basic and applied research to support space activities and, in addition, to provide research assistance to civil and military aeronautical activities in the same manner as did the predecessor organization--NACA. The small staff of this Office is organized under three Assistant Directors who are responsible for research programs in (1) power plants, (2) aerodynamics and flight mechanics, and (3) structures and operating problems.

16Formerly the Office of Aeronautical and Space Research.
See also U. S. Congress, House, Committee on Science and Astronautics, Second Semiannual Report of the National
The research is performed at the research centers acquired from the NACA (Langley, Ames, Lewis, and Flight Research Centers). These Centers for program integration and policy guidance purposes report to the Director, Office of Advanced Research Programs. This research is supplemented through research grants and contracts with industrial and educational and non-profit institutions.18

Office of Life Sciences Programs. This Office formed the fifth major division of NASA covering the fields of medicine, biology, and psychology. Until the establishment of the Office of Life Sciences Programs on March 1, 1960, this segment of activity was not fully represented in NASA's program.19 In establishing this Office, the Administrator followed the recommendation of the NASA's Bioscience Advisory Committee.20 In a report submitted on January 25, 1960 to


18 Ibid.


20 In July 1959 a NASA Bioscience Advisory Committee, chaired by Seymour S. Kety, Director of Clinical Science Laboratory, National Institute of Mental Health, Bethesda,
Dr. Glennan, the Committee observed: "Somewhat paradoxically, NASA, which does have a clearly defined mission to put and maintain men in space, has essentially no existing capability for studying the biological and medical problems involved." 21

The primary objectives of the Office of Life Sciences Programs are: (1) the implementation of manned space flight and exploration, and (2) the conduct of biological investigations related to extraterrestrial environments, including the search for extraterrestrial life. This Office will direct research in the fields of biotechnology (integration of men and machines), space medicine and behavioral sciences, and space biology carried out in NASA research centers and by contracts and grants with other Government agencies, industry, universities and other nonprofit organizations. The initial phase of the organization of this Office is underway and program planning has begun. The staff functions are organized into four general categories: (1) Bioscience, (2) Bioengineering, (3) Grants and Contracts, and (4) Life

Maryland, was formed to recommend long-range plans relative to research and development in United States space-related life sciences. This ad hoc Committee dissolved after submitting its report to the NASA Administrator. NASA News Release No. 60-135 dated March 1, 1960, op. cit., p. 1.

21 U. S. Congress, House, Committee on Science and Astronautics, Third Semiannual Report of the National Aeronautics and Space Administration, House Doc. No. 454, op. cit., p. 119. For the membership of the NASA Bioscience Advisory Committee and the text of its report, see Ibid., pp. 154-169.
Sciences Research Center. Plans are being developed by this Office for a NASA Life Sciences Research Facility to provide in-house capability. 22

Office of Business Administration. This Office was among the first to be organized in October 1958. In support of NASA technical activities, the Office of Business Administration supervises and directs the functions relating to: (1) accounting and auditing of NASA operations, (2) budgetary planning, formulation and execution, (3) development of overall NASA staffing requirements, (4) personnel administration, (5) procurement and supply activities, (6) security administration, (7) industrial safety activities, (8) research grants and contracts, (9) administrative services, (10) organization of NASA activities, including surveys to appraise the effectiveness of operations, and (11) management of real property and the coordination of NASA facility requirements. 23

Office of Technical Information and Educational Programs. This is the newest of the program offices established on May 30, 1960 primarily to develop and direct


23 For functions and authority of the Office of Business Administration, see National Aeronautics and Space Administration, NASA Management Manual, op. cit., Part I, Chapter 2, General Management Instructions No. 2-1-8, effective December 23, 1959.
technical information and educational programs designed to implement pertinent requirements under the Space Act. This Office maintains programs for the dissemination of NASA-originated technical information to the Atomic Energy Commission, the Defense Department, the Department of Commerce, and other Government agencies and public and private organizations, when appropriate.⁴

The following functions were consolidated within this Office: technical information (formerly under the Office of Business Administration); translations (formerly under the Office of Advanced Research Programs); history, motion pictures, exhibits, and reports (formerly under the Office of Public Information); and the Youth Program (see Chapter IV).⁵

Research Advisory Committees

On July 1, 1960, the NASA Administrator established eleven Research Advisory Committees to provide technical advice and assistance to the Director of the Office of

⁴ For the complete functions of this new office, see Ibid., General Management Instructions No. 2-1-13, effective May 30, 1960.

Advanced Research Programs, in the following areas:26

1. Fluid Mechanics
2. Aircraft Aerodynamics
3. Aircraft Structures
4. Aircraft Operating Problems
5. Control, Guidance, and Navigation
6. Materials
7. Chemical Energy Systems
8. Nuclear Energy Systems
9. Electrical Energy Systems
10. Missile and Space Vehicle Aeronautics
11. Missile and Space Vehicle Structures

Their specific functions are to assist the Administrator in formulating and coordinating research programs for NASA and other agencies; recommending research problems to NASA for investigation; reviewing research in progress by NASA and other agencies; and serving as a medium for interchange of data on research investigations in process or proposed.27

Special Advisory Committee on Life Sciences

On October 27, 1958, the NASA Administrator established conclusion

26NASA Management Manual, Part I, Chapter 2, General Management Instructions No. 2-5-2, effective July 1, 1960. Late in 1958, the NASA Administrator established thirteen new Research Advisory Committees. After a year of operation, a staff survey was made of these committees and it was considered desirable to reconstruct them for more effective operations, thus reducing the number to eleven. Interview with Miss Catherine Wheeler, Assistant for Technical Committees, NASA Headquarters, on April 7, 1961.

a Special Advisory Committee on Life Sciences to act in a consulting capacity on matters connected with human factors, medical and allied problems of the agency's manned space vehicle program. Dr. W. Randolph Lovelace II, of the Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico, was appointed Chairman of the Committee. Its role has been primarily that of an advisory panel for Project Mercury.28

**NASA Committee on Long-Range Studies**

On May 18, 1959 NASA announced the formation of the NASA Committee on Long-Range Studies to study the social-political aspects of space activities. The Committee was established pursuant to Section 102 of the Space Act, which calls for "The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes." The function of the Committee is to deal with the non-technical aspects, such as the international, legal, economic and social effects of space exploration. Mr. John A. Johnson,

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NASA General Counsel, was named Chairman of the Committee.29

IV. NASA FIELD INSTALLATIONS

The execution of NASA in-house research and development programs is accomplished at ten Government-owned and operated facilities and one Government-owned, contractor-operated, laboratory. The geographic location of NASA installations is indicated on the map, Figure 13, in Appendix B.

NASA Research Centers

Organizationally, NASA has continued the former laboratories of the National Advisory Committee for Aeronautics as a group under the Director, Office of Advanced Research Programs. NASA research centers conduct a broadly based program of basic and applied research in aeronautics and space fields. Chief areas of research include: Propulsion systems, aerodynamics and mechanics of flight, structural materials and operating problems.30

Langley Research Center, Hampton, Virginia. The Langley Research Center is the oldest and the largest of the


research centers. The Space Task Group set up for Project Mercury is housed at this Center, although it is not organiza­tionally a part of Langley. Many of the Center's research facilities are being utilized in support of Project Mercury. In this connection, Langley has the responsibility for estab­lishing tracking stations and monitoring contracts for the Mercury range. While the major part of Langley's effort is in basic research, with increased emphasis on space problems, this Center continues to do aeronautical research. The main areas of work at Langley include research in the aerodynamics of reentry vehicles, structures and materials for missile and space vehicles application, continuing work in aircraft aerodynamics and structures, and fundamental research in plasma physics.\textsuperscript{31}

\textbf{Ames Research Center, Moffett Field, California.} Ames was established in 1940 by the NACA as a second aeronautical research laboratory. However, since 1948 this Center has been engaged in space research as well. Ames devotes most

of its efforts to research in gas dynamics at extreme speeds, automatic stabilization, guidance and control of space vehicles, space environmental physics, and full-scale research on problems relating to vertical take-off and landing craft. In support of Project Mercury, Ames is conducting wind tunnel and piloting studies and electronic simulator experiments. Tests are being conducted in Ames' wind tunnels on various types of craft, including the Dyna-Soar and other hypersonic (Mach Number 5 and over) configurations. In addition, research is being directed toward new methods of increasing aerodynamic efficiency.

Lewis Research Center, Cleveland, Ohio. The Lewis Center is primarily responsible for research relating to propulsion and power generation for space vehicles. Emphasis has rapidly shifted from research primarily on air-breathing

32 The term "Mach Number" means the ratio of the speed of a traveling body to the speed of sound in the medium traversed. The speed of sound varies from approximately 750 miles per hour at sea level to about 650 miles per hour at extremely high altitudes, varying somewhat with air temperature. See "Glossary of Space Terms" in U. S. Congress, House, Committee on Science and Astronautics, Authorizing Appropriations to the National Aeronautics and Space Administration, House Report No. 361 to accompany H. R. 7007, 86th Congress, 1st Session (Washington: Government Printing Office, 1959), p. 39.

power plants to rockets. The research effort is divided into five major areas: Air-breathing engines, chemical rocket engines, nuclear rocket engines, electrical propulsion systems, and power generation systems. Lewis also conducts research on materials, lubrication and wear and instrumentation. Lewis Center is responsible for the operation of a station at the former Plum Brook Ordnance Works near Sandusky, Ohio. Located at this station are the Plum Brook Research Facility, a 60-megawatt (thermal) reactor for nuclear system research, and a Rocket Research Facility for studying components and systems.34

Flight Research Center, Edwards, California. Much smaller in size than the other research centers, but unique and highly specialized, is the NASA Flight Research Center located in the Mojave Desert on the edge of Rodgers Dry Lake. The 75-square-mile flat surface makes an ideal testing ground for research aircraft.35 In September 1959 NASA reoriented its aeronautical flight research program. Most of the

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aeronautical flight research formerly conducted at the Langley, Ames and Lewis Research Centers was concentrated at the Edwards facility. The reasons for the reorientation were to conduct high-speed test operations away from populated areas and congested airlines, and the economy which should result in centralization.\textsuperscript{36}

This Center is responsible for full-scale flight research including such areas as aerodynamics, hot structures, operating problems and the mechanics of flight in the atmosphere. Personnel here are engaged nearly full-time on operating and flight testing the X-15 manned research airplane designed to experience the characteristics of space flight for a duration of a few minutes. (See Figure 14 in Appendix B.) Tests should yield new data at extreme altitudes and speeds. Its success represents a first and significant step toward ultimately putting man into outer space. Another specialized research program involves technical direction for research instrumentation and participation in the flight program of the joint Air Force-NASA Dyna-Soar I.\textsuperscript{37}

\textsuperscript{36}Simultaneously, the name of the Edwards station was changed to reflect its mission. Previously called the "High-Speed Flight Station," the facility was redesignated as the NASA Flight Research Center on September 22, 1959. NASA Release No. 59-225, NASA Headquarters, September 27, 1959. U. S. Congress, Senate, Committee on Government Operations, Organization of Federal Executive Departments and Agencies, Report No. 20, \textit{op. cit.}, p. 42.

\textsuperscript{37}National Aeronautics and Space Administration, \textit{Selling to NASA}, \textit{op. cit.}, p. 21. See also, "The U. S. Space
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U. S. Congress, Senate, Committee on Government Operations,
Organization of Federal Executive Departments and Agencies,
Report No. 20, op. cit., p. 42.

37 National Aeronautics and Space Administration,
Selling to NASA, op. cit., p. 21. See also, "The U. S. Space
NASA Space Flight Centers

The acquisition of the Huntsville facility made possible the division of primary space flight responsibilities among the Marshall and Goddard Space Flight Centers and the Jet Propulsion Laboratory. Activities of the five field facilities whose work relate primarily to space flight and space sciences and their applications are summarized below.

Goddard Space Flight Center, Greenbelt, Maryland.
This is the only new organization the NASA has formed. On a 550-acre tract of land assigned to NASA from the Department of Agriculture reservation near Beltsville, the Goddard Space Flight Center is under construction with completion scheduled for late 1961. President Eisenhower named this Center in honor of the late Dr. Robert H. Goddard, American pioneer in rocketry. Pending completion of the permanent facilities, Goddard personnel are housed in several buildings in the Washington area and at the Langley Research Center.38

This is the first major installation in the United States that is devoted entirely to the investigation and exploration of outer space. This Center has primary

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responsibility for the conduct of earth satellite programs, including scientific investigations, practical applications and manned flight; and all communications, tracking, and data reduction relating to satellite programs. In addition, the sounding rocket programs are assigned to this Center.39 Goddard reports to Dr. Abe Silverstein, Director of the Office of Space Flight Programs.

George C. Marshall Space Flight Center, Huntsville, Alabama. The transfer of the Development Operations Division facilities and personnel from the Army Ballistic Missile Agency to NASA was completed on July 1, 1960, forming the NASA's Marshall Space Flight Center. On September 8, 1960, President Eisenhower dedicated the Center in honor of the late General George C. Marshall. With personnel of 5,500, the Marshall Center is the largest NASA center and is the only one equipped to carry out a launch vehicle program from concept through testing. This Center is primarily responsible for design and development of all launch vehicle systems, and for NASA launch operations at the Atlantic and Pacific Missile Ranges. This includes development of guidance

systems, testing, and modifications to assure their reliable operation. Marshall will conduct, as assigned, research and development in such areas as advanced propulsion and guidance systems. Major General Don R. Ostrander, the Director of the Office of Launch Vehicle Programs, has the Headquarters responsibility for this activity. ⁴⁰

Jet Propulsion Laboratory, Pasadena, California. This Government-owned laboratory, operated for NASA under contract by the California Institute of Technology, is responsible for mission planning and development of spacecraft (payloads) for lunar and interplanetary exploration; and for operation of the Deep Space Tracking Network. The control center for the Deep Space Network is located at the Jet Propulsion Laboratory (JPL). This laboratory has a staff of about 2,400 engaged in NASA program. Research at JPL is administered through eight technical divisions and covers a broad spectrum of activities in the fields of chemistry, propulsion, aerodynamics, guidance, physics, communications, mathematics,

and related fields.\textsuperscript{41} JPL reports to the Office of Space Flight Programs.

\textbf{Wallops Station, Wallops Island, Virginia.}\textsuperscript{42} NASA has expanded this former NACA Station into an $18$ million facility manned by a staff of approximately $300$ people. It provides a second base for satellite launchings and otherwise contributes to greatly increased space science needs. Sounding rockets and Scout vehicles are being launched from the Wallops range facilities. Facilitating the expansion and permitting a large savings in costs was the Navy's decision to disestablish the $2,400$-acre Naval Air Station at Chincoteague, Virginia, by June 30, 1959. Agreement to transfer the Chincoteague Station to NASA at that time was reached by Navy Secretary Gates and NASA Administrator Glennan on January 24, 1959.\textsuperscript{43}

Located on the Atlantic coast of Virginia is a complete

\begin{itemize}
\item \textsuperscript{42} Formerly designated as the Pilotless Aircraft Research Station.
\end{itemize}
local tracking and telemetry system. Wallops Station, composed of facilities on Wallops Island and the inactivated Chincoteague Naval Air Station on the mainland, is a unique launching complex. Wallops instrumentation permits data gathering for research in aerodynamics and for development and proof testing of various components and techniques to be utilized in the launching of space vehicles from major ranges such as the Atlantic and Pacific Missile Ranges. The Station reports organizationally to the Office of Space Flight Programs.

**NASA Launch Operations Directorate, Cape Canaveral, Florida.** Concurrent with the establishment of the George C. Marshall Space Flight Center, NASA established a Launch Operations Directorate to coordinate and schedule all the agency's launchings at the Atlantic Missile Range, Cape Canaveral, Florida, and at the Pacific Missile Range, Point Arguello, California. The Launch Operations Directorate also assumed the responsibility to assist the Army with its Redstone, Jupiter, and Pershing rocket programs. The Directorate reports directly to the Marshall Space Flight Center. Its headquarters is located at Cape Canaveral. 45

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NASA Western Operations Office

Liaison responsibility for NASA contract activities located at or west of Denver, Colorado is centered at the Western Operations Office, Santa Monica, California. This Office provides liaison on the West Coast for industry, universities, and research organizations on one hand, and for NASA Headquarters and field installations on the other. The Western Operations Office administers NASA contracts (including the Jet Propulsion Laboratory contract), performs technical monitoring and liaison on NASA contracts or projects, and keeps NASA Headquarters advised on technical developments and capabilities in the area. It performs associated security, auditing, and legal and patent services. The Director of this Office reports directly to the Associate Administrator.46

V. SCIENTIFIC COOPERATION BETWEEN NASA AND OTHER AGENCIES

Since civilian space technology is so thoroughly interwoven with other technologies and with military and political considerations, it is imperative that NASA work with a number of other organizations. Moreover, the need

for joint use of facilities such as propulsion systems or launching sites, as well as the efficient utilization of the nation's limited resources and personnel, has created the necessity for maximum cooperation and coordination between NASA and all other agencies engaged in space-related activities.\textsuperscript{47}

Figure 4 is a chart graphically drawn to indicate the general areas of cooperation between NASA and other Federal activities.\textsuperscript{48} Some of the more important relationships with other Government agencies are elaborated upon below.

**Department of Defense**

Since October 1, 1958, a number of major activities relating to space programs have been transferred from the Defense Department to the NASA. During this period the Department of Defense and NASA worked closely to effect the


\textsuperscript{48}The information shown in Figure 4 was extracted from the chart in U. S. Congress, Senate, Committee on Armed Services and the Committee on Aeronautical and Space Sciences, Missile and Space Activities, Joint Hearings before the Preparedness Investigating Subcommittee, 86th Congress, 1st Session, January 29 and 30, 1959 (Washington: Government Printing Office, 1959), p. 163. See also, U. S. Congress, Senate, Special Committee on Space and Astronautics, Final Report, Report No. 100, op. cit., p. 11.
smooth transition of these activities from the military to the NASA. The Army and Air Force particularly have carried out activities for NASA in providing boosters, booster systems, and launching activities. Channels of communication and cooperation between the Pentagon and the NASA have existed at every level of the organization.\footnote{49} A notable coordinating link with the Defense Establishment is the NASA-DOD Space Science Committee, chaired by Dr. Homer E. Newell, Jr., of the NASA. Program information relating to the life sciences is included in the deliberations of this body.\footnote{50} A newly established medium to coordinate activities of common interest is the Aeronautics and Astronautics Coordinating Board. The Department of Defense and NASA are represented equally on the Board. The organization of the Board includes a number of panels.\footnote{51}

The X-15 manned research aircraft is a notable example.

\footnote{49}U. S. Congress, Senate, Committee on Armed Services and the Committee on Aeronautical and Space Sciences, \textit{Missile and Space Activities}, Joint Hearings before the Preparedness Investigating Subcommittee, \textit{op. cit.}, p. 164.


\footnote{51}NASA Management Manual, Part I, Chapter 2, General Management Instructions No. 2-3-10, effective September 13, 1960. The Aeronautics and Astronautics Coordinating Board is discussed further in Chapter VIII of this report.
of cooperative relationships with the military services. The X-15 research program has been a joint project of the NASA, the Air Force and the Navy, and dates from 1952 when the NASA's predecessor organization, NACA, directed its laboratories to study the problems likely to be encountered in space flight. The services and NACA met in 1954 and drew up a memorandum of understanding. This test vehicle is the latest in a series of experimental airplanes and it was the NACA's first attempt to study the possibilities of space flight. 52 Another cooperative research program is the Dyna-Soar, a winged space glider. This is an Air Force-NASA joint effort to construct and test a manned, maneuverable space vehicle which has the objective of exploring the atmosphere at speeds from the speed of the X-15 research plane, which is several times the speed of sound, up to and including orbital speeds. NASA is contributing the research services to this project.53

In the management field, NASA has entered into agreements with the Army, Navy and Air Force whereby these military Departments perform certain field services for NASA, such as


the administration of NASA contracts as may be requested.54

A further discussion of the relationships between NASA and
the Defense Department is found in Chapter VII, dealing with
the formal machinery established by the Space Act to coordinate
civilian and military responsibilities in aeronautical and
space activities.

Weather Bureau, Department of Commerce

The Weather Bureau works with the Department of Defense
and the NASA in meteorological experiments involving the use
of satellites and sounding rockets. It also serves these or­
ganizations as consultant on meteorological problems. NASA
provides the funds for the meteorological satellite work of
the Bureau, and close coordination is maintained between
these two agencies. A Joint Meteorological Satellite Advisory
Committee composed of representatives of the Defense Depart­
ment, the NASA and the Weather Bureau coordinates civilian
and military requirements. The Bureau coordinates with these
agencies in planning and conducting sounding rocket research
on radiation, winds, and other phenomena of the upper atmos­
phere. The Bureau has participated in several of the weather
satellite experiments, including Tiros I.55

54Current agreements between NASA and the three military
Departments are found in NASA Management Manual, Part I,
Chapter 2.

55U. S. Congress, House, Committee on Science and
Astronautics, U. S. Aeronautics and Space Activities,
Department of State

The State Department participates in NASA's international cooperation activities. Major activities of the State Department have included negotiations to place on a more permanent basis many of the tracking stations established in connection with the International Geophysical Year; to establish new stations for tracking deep space probes; and to establish special tracking network for monitoring the Mercury capsule.56

Also, through the State Department, the United States participated in, and strongly supported, the work of the United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space which was established by the General Assembly in 1958, and which met at the United Nations Headquarters in 1959. The work of this Ad Hoc Committee represented the first international effort to make a comprehensive survey of the opportunities and problems that may arise out of the peaceful exploration and use of outer space.57 (A further discussion of the relationships between the State Department and NASA

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56 Ibid., p. 30.
57 Ibid., p. 28. Dr. Hugh L. Dryden, NASA Deputy Administrator, has served as Alternate Representative of the United States to the United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space.
Smithsonian Institution

The Smithsonian Astrophysical Observatory, Cambridge, Massachusetts, under the sponsorship of NASA (by NASA grant), has the technical direction of the Baker-Nunn Optical Tracking Network. The Observatory is the recognized world communications center for optical observations of satellites; and it has regularly received and analyzed the observations, and calculated and distributed predictions of the time and place of the expected satellite passage. In addition, it has directed the activities of over 250 "Moonwatch" teams of satellite observers. (For more details, see Chapter VI.)

Atomic Energy Commission

The relationship here is close, since NASA is interested in developing nuclear powerplants for space travel. The NASA and the Atomic Energy Commission are jointly engaged in a cooperative program for developing nuclear power and propulsion systems for space application. The two major types of nuclear systems believed suitable for sending heavy payloads into outer space are (1) the nuclear heat-transfer

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58 Ibid., p. 45. See also National Aeronautics and Space Administration, U. S. Aeronautics and Space Activities, January 1 to December 31, 1960 (Third Annual Report on the Nation's Activities and Accomplishments in the Aeronautics and Space Fields), op. cit., p. 65.
rocket, and (2) the electrical propulsion system that will utilize a nuclear reactor to generate electricity for power. Project Rover and Project SNAP are the two concepts for obtaining nuclear rocket propulsion and nuclear generated auxiliary electric power systems for spacecraft, respectively. These two projects are joint endeavors of the AEC and NASA.59

(For more details on these joint projects, see Chapter VI.)

The joint AEC-NASA Nuclear Propulsion Office was recently established to coordinate and consolidate nuclear propulsion activities of the two agencies. Mr. Harold B. Finger, Chief of Nuclear Propulsion for NASA, is the Manager of the joint Office. The Deputy Manager is Mr. Milton Klein, formerly the Assistant Manager for Technical Operations of the AEC's Chicago Operations Office. The Office is staffed by employees drawn from both the NASA and AEC and is located at the AEC Headquarters at Germantown, Maryland.60

United States Information Agency

The United States Information Agency (USIA) has the


responsibility for world-wide dissemination of information on both civilian and military space activities of the United States. Information for release is obtained from the NASA, Atomic Energy Commission, Department of Defense and other Federal agencies participating in the aeronautics and space fields. The USIA utilizes a number of communications media to accomplish this task, including pamphlets, news releases, magazine reprints, photographs, radio, television, motion pictures, and exhibits. It translates into foreign languages where necessary. For example, during 1960 USIA prepared and transmitted over 250 news and feature stories, totalling over 100,000 words, on American space activities during 1960. Approximately 175 of these stories concerned the activities of NASA; the balance covered military satellites. In addition, the United States space activities were featured theme on the Voice of America broadcasts during 1960, in the forms of special events, scripts, and newscasts, prepared for use abroad both in English and in foreign languages. Newscasts carried detailed accounts of launchings. Failures were also reported briefly and factually. Wherever possible, the peaceful purposes of American space launchings were emphasized. 61

National Science Foundation

The National Science Foundation conducts a basic research support program in many areas of science. This involves grants for space-related basic research programs of common interest to NASA. The NASA coordinates with the Foundation so that the policies of the two agencies are not at variance. Major program coordination is by the Foundation Director, and the NASA Administrator through the National Aeronautics and Space Council, of which both are members. Technical coordination is achieved through the Space Science Board of the National Academy of Sciences, which is jointly supported by the Foundation and NASA. Coordination at the working level is effected by the Headquarters' staffs of NASA and the Foundation.62

National Academy of Sciences and the Space Science Board

The National Academy of Sciences, with support from the National Science Foundation, directed the United States participation in the International Geophysical Year Program. The Space Science Board was established by the National Academy of Sciences in June 1958 in response to both national and

international interests in basic research. It is intended to be advisory and consultative. Domestically, the Board serves in an advisory capacity to Federal agencies having executive responsibilities in the space science field. These agencies are the NASA, the National Science Foundation and the Department of Defense. Internationally, the Board, as the Academy's agent, provides for cooperation with scientists of other nations, working through the Committee on Space Research (COSPAR) of the International Council of Scientific Unions (ICSU). The Board membership serves as chairmen of some 15 specialized committees encompassing the various scientific disciplines and areas of activity associated with the country's space science program. The Board and its committees are comprised of about 150 leading scientific specialists.63

NASA has supported the Space Science Board and COSPAR as one of the channels for effecting international participation in the nation's space science program. The committees of the Board work with NASA as committees on scientific disciplines, reviewing NASA's space science program. In evaluating the Board's relationship with NASA, Dr. Glennan

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said that it "brings to us the opinions and advice of the total scientific community in the development of our underlying space science program."64

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CHAPTER IV

SUPPORTING ACTIVITIES

"In this and like communities, public sentiment is everything. With public sentiment, nothing can fail. Without it, nothing can succeed. Consequently he who molds public sentiment goes deeper than he who enacts statutes or pronounces decisions. He makes statutes and decisions possible or impossible to be executed."

Abraham Lincoln

The overall national space program involves various supporting activities. This chapter will highlight some of the more important continuing activities which contribute substantially to the successful accomplishment of NASA technical programs.

I. PERSONNEL

Personnel Strength

A major policy question has been the size to which NASA should be permitted to grow in terms of staff and in-house capability.¹ Dr. Glennan has stated on various occasions that the NASA staff should be kept to the level no greater than that required to "plan the space exploration program and to organize, contract for, and monitor its implementation."

¹The term "in-house" capability, sometimes referred to as the arsenal concept, is used herein to denote work that is done at NASA installations, as opposed to the work that is done by private contractors.
To achieve this effectively, a certain minimum amount of in-house research and development is absolutely essential, and qualified personnel must be attracted to and retained in the program. How much research and how much in-house capability in program management is sufficient? These are questions to which NASA has been giving continuing attention.\(^2\) This is how the situation stands at the present.

As of July 1, 1960, NASA's personnel strength stood at 16,840, including about 2,400 employed by the Jet Propulsion Laboratory (JPL) operated under contract to NASA. The additional 2,200 personnel yet to be employed at the Goddard and Marshall Space Flight Centers will bring an estimated total in-house employment level to about 19,000 people. Current plans call for stabilizing NASA's employment at approximately this level after completing the staffing of the Goddard and Marshall Centers.\(^3\) Table I shows distribution of NASA personnel by type and installation.

**Recruiting Scientific Personnel**

The advent of the space age has created many new fields of science and engineering. Recruiting to fill these jobs


\(^3\)Ibid., pp. 3-4.
### TABLE I

**NASA STAFFING BY TYPE AND INSTALLATION AS OF AUGUST 15, 1960***

<table>
<thead>
<tr>
<th>Installation</th>
<th>Number of Employees on Duty</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Approved Complement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excepted</td>
<td>Class. Act</td>
<td>Military</td>
<td>Wage Board</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>NASA Headquarters</td>
<td>89</td>
<td>494</td>
<td>12</td>
<td>13</td>
<td>608</td>
<td>704</td>
</tr>
<tr>
<td>Langley Center</td>
<td>37</td>
<td>1717</td>
<td>11</td>
<td>1445</td>
<td>3210</td>
<td>3220 **</td>
</tr>
<tr>
<td>Ames Center</td>
<td>21</td>
<td>754</td>
<td>16</td>
<td>640</td>
<td>1431</td>
<td>1440</td>
</tr>
<tr>
<td>Lewis Center</td>
<td>28</td>
<td>1465</td>
<td>11</td>
<td>1231</td>
<td>2735</td>
<td>2736</td>
</tr>
<tr>
<td>Flight Center</td>
<td>7</td>
<td>200</td>
<td>3</td>
<td>204</td>
<td>414</td>
<td>416</td>
</tr>
<tr>
<td>Goddard Center</td>
<td>36</td>
<td>1338</td>
<td>10</td>
<td>136</td>
<td>1520</td>
<td>2000</td>
</tr>
<tr>
<td>Wallops Station</td>
<td>1</td>
<td>120</td>
<td>--</td>
<td>155</td>
<td>276</td>
<td>300</td>
</tr>
<tr>
<td>Marshall Center</td>
<td>37</td>
<td>3071</td>
<td>--</td>
<td>2059</td>
<td>5167</td>
<td>5505 **</td>
</tr>
<tr>
<td>Western Office</td>
<td>1</td>
<td>38</td>
<td>--</td>
<td>--</td>
<td>39</td>
<td>46</td>
</tr>
<tr>
<td><strong>NASA TOTAL</strong></td>
<td>257</td>
<td>9197</td>
<td>63</td>
<td>5883</td>
<td>15,400</td>
<td>16,373**</td>
</tr>
</tbody>
</table>


** Does not include Jet Propulsion Laboratory authorized complement of 2,400. Includes six authorized for Pacific Missile Range office.
remains a primary problem for the NASA, since relatively few qualified applicants have been available for scientific jobs. NASA's recruiting efforts have encompassed the country for qualified applicants through contacts with colleges and universities; classified ads in newspapers, scientific journals, and trade publications; and distribution of publications and brochures setting forth employment and training opportunities offered by the agency.\(^4\)

**Youth Program**

NASA maintains liaison with high schools throughout the country. The National Science Teachers Association and the National Aviation Educational Council distribute NASA's material on aeronautics and space written to appeal to high school science students. NASA has replied individually to many inquiries from young people concerning educational prerequisites for careers in aeronautics and space. Providing this material to high schools conforms with the mandate for wide dissemination of information contained in the Space Act, and "may motivate potential university science students to

favor NASA employment after college graduation."^5

Training Programs

NASA develops the abilities of its personnel through three formal training programs. Other programs are being planned.

Graduate Study Training Program. This is a program sponsored by NASA under which its employees may enroll at colleges and universities in graduate courses directly applicable to their work or to positions for which they are preparing. The Government pays the tuition and fees. 6

College Cooperative System. About 175 university and college students alternate work and study each year under the NASA College Cooperative System. Generally, after about five years the students receive their degrees. They have also worked about two years for NASA. While no commitments are made, about 80 per cent of the students accept employment with NASA after graduation. 7


^7Ibid.
Apprentice Program. NASA sponsors an apprentice training program aimed at developing highly skilled craftsmen. The program calls for a minimum of four years of classwork and on-the-job training. Upon successful completion, employees receive journeymen's certificates approved by the Department of Labor and accredited by the State in which the training program is given. 8

II. NASA PROCUREMENT SYSTEM

Legal Framework of NASA's Procurement System

Under Section 203 of the Space Act, NASA was granted broad powers to develop, construct, test, and operate space vehicles and to make contracts for the conduct of its work with corporations, individuals, Government agencies, and others. The Space Act also made applicable to NASA the policies and procedures for the making of contracts contained in the Armed Services Procurement Act of 1947, as amended, and codified under Chapter 137 of Title 10 of the United States Code. Thus, the NASA and the Department of Defense are governed by the same procurement statute and to a great extent deal with the same segment of American industry.

In spite of this similarity, there are a number of differences between the statutory authority available to NASA and to the military departments that have an effect on the

8Ibid.
procurement process in NASA's dealings with industry. The most serious differences that have not been corrected to date are those that relate to NASA's statutory patent policy, which will be covered later, and NASA's lack of authority to indemnify research and development contractors against unusually hazardous risks. Such indemnification authority has been available to the military since 1952. NASA sought amendments in the Space Act during the 86th Congress to liberalize its patent policies along the lines followed by the Department of Defense, and to extent the indemnification authority to the NASA. Unfortunately, the proposed amendments were not enacted and therefore have lapsed.9

Soon after NASA became operative, Dr. Glennan announced that the NASA's procurement and contracting regulations would conform in every practicable way to the Armed Services Procurement Regulation (ASPR). He further noted:

This decision should be welcomed by potential NASA contractors since industry has become quite familiar with the ASPR in the past ten years. They will not be required to learn how to operate under widely divergent NASA regulations, nor will this change procedures for those contractors now engaged in projects which have recently been transferred from the Department of Defense to NASA.10

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NASA has promulgated a substantial portion of its procurement regulations in the *NASA Management Manual*\(^{11}\) for internal use. An agreement was reached between the Administrator of General Services Administration and the NASA Administrator that NASA procurement regulations having public application would be published in Chapter 18, Title 41 of the *Code of Federal Regulations*, as part of the Federal Procurement Regulations System.

**Procurement Operations Decentralized**

NASA procurement activities are organized on a decentralized basis, with policy direction and review by NASA Headquarters. With a few exceptions, e.g., grants and contracts for basic and applied research which are made at Headquarters by the Office of Research Grants and Contracts, almost all of the purchases and contracts are placed by the procurement offices at the various field installations responsible for technical project management.

The Procurement and Supply Division at Headquarters is principally a staff office where procurement and supply policies and procedures are determined; review and approval of the larger contracts are made; and other staff functions are performed, including field reviews to determine compliance with NASA policies and regulations. Related to the procurement

\(^{11}\)Part II, Chapter 18.
program are staff responsibilities for supply functions such as inventory management, transportation, priorities and allocations, determination of material requirements, and the utilization and disposal of Government property.\textsuperscript{12}

**Methods of Procurement**

In general, procurement is accomplished by advertising for competitive bids, particularly where the supplies, materials, equipment, services, or construction work can be clearly defined in specifications and drawings. Award of a fixed-priced contract is made to the lowest responsible bidder in such cases. However, in the procurement of research and development work where definite specifications cannot be drawn, procurement is made by negotiation with qualified firms. Most of NASA's larger contracts are in the field of research and development for such items as launch vehicles, spacecraft or components, where cost is very uncertain. The cost-plus-a-fixed-fee type of contract is generally used for such procurements.\textsuperscript{13}

However, use of the negotiation method does not preclude competition. It is the policy of NASA under negotiated


procurements to encourage the widest competition for research and development work, by inviting all qualified firms to submit detailed proposals. The detailed technical and cost proposals submitted are evaluated by NASA technical and procurement staffs to determine the best overall proposal in accordance with prescribed procedures, which are described below.

**Source Evaluation and Selection Procedures**

NASA has established procedure for major systems procurement. There are three main elements of this procedure: preparation of a procurement plan, the use of a Source Evaluation Board, and the development of a Reliability Program.

**Procurement Plan.** The contracting officer makes a detailed outline of the method under which award of the proposed contract is expected to be made. The Procurement Plan usually provides for use of a Source Evaluation Board. Generally, before requests for proposals are distributed, interested companies are invited to attend a briefing session on the proposed contract requirements and are given an opportunity to ask questions. Requests for proposals are then sent to those firms that are considered to have the required experience, facilities and capabilities to successfully perform the contract. Of course any company, whether originally requested to submit a proposal or not, may submit
a proposal. 14

Source Evaluation Board. Use of the Source Evaluation Board is appropriate for competitive negotiated procurement for research and development. So far in choosing a contractor for large research and development contracts, NASA has utilized a Source Evaluation Board procedure. The current regulation provides, in part, that when the estimated cost of the contract will exceed $1 million or when the initial contract will evolve into follow-on phases, all of which will total more than $1 million, a Source Evaluation Board will be appointed to evaluate the proposals. 15 Here is how the procedure operates.

Before the proposals are opened, the Board establishes certain criteria as a basis for evaluating and assigning weights to each point. The Board is composed of NASA scientific and technical personnel familiar with the technical requirements of the proposed procurement, and one or more representatives of the NASA business management staff. There


15 National Aeronautics and Space Administration, NASA Management Manual, Part I, Chapter 2, General Management Instructions No. 2-4-3, effective February 1, 1961, prescribes procedures for the establishment and operation of Source Evaluation Boards, and for the appointment of members there-to. See also, NASA-Industry Program Plans Conference, July 28-29, 1960, op. cit., p. 112.
is generally a Technical Committee and a Business Management Committee also appointed, which do most of the detailed work in their respective fields. Firms that submit proposals are given an opportunity to make an oral presentation before the members of the Board and its committees. Generally, the Board and committees collectively spend several weeks in completing their evaluation. The primary point considered in the selection is technical superiority. The Board may be convened either at NASA Headquarters or at the field installation awarding the contract. The Board reports its findings to the NASA Administrator, if at Headquarters, or to the Director of the NASA Center, if in the field. The Administrator or the Director of the Center makes the final selection of the firm with whom the contract will be negotiated.\footnote{16}

Reliability Program

In its request for proposals from industry, NASA specifies a system reliability goal and requires competing firms to indicate in their proposals how it will be accomplished. NASA may also employ a reliability contractor as consultant during the evaluation of the proposals and as monitor during the equipment development.\footnote{17}


\footnote{17}National Aeronautics and Space Administration, \textit{Fourth Semiannual Report to Congress} \ldots \textit{op. cit.}, pp. 202-203.
The question of reliability has been a serious problem for NASA. Many thousands of items must go into a single space vehicle launching. Each must perform properly or jeopardize the success of the mission. For example, if a component fails in a launch, the entire mission is lost which may cost millions of dollars. Greater reliability is necessary to reduce the number of launch vehicle failures. Mr. Abraham Hyatt, Deputy Director, Launch Vehicle Programs, stressed this need when he said:

The basic point is that the reliability of such a vehicle system depends to a large measure on the quality of the subsystems and components. Each diode, valve, power supply, guidance system, etc., must have nearly perfect reliability. Only through simplification, proper design, rigorous prototype testing, and outstanding quality-control procedures can sufficiently high reliability be attained. ¹⁸

Board of Contract Appeals

A three-man Board of Contract Appeals was established on June 25, 1959 to adjudicate disputes and appeals that may arise from NASA contracts. Mr. Paul G. Dembling, Assistant General Counsel, serves as Chairman of the Board. ¹⁹


Small Business Participation in NASA Procurement

It is the policy of the NASA that small business firms be given the opportunity to participate in supplying its procurement needs to the fullest extent possible, consistent with the purposes of the Space Act. To implement this policy, small business specialists have been appointed at each NASA Center for consultation with small business representatives and to assure that small business firms get an equitable share of NASA procurement dollars.20

In furtherance of the NASA small business program, the NASA and the Small Business Administration have jointly been developing procedures for executing the policies governing small business firms set forth in the Small Business Act and the Space Act. The procedures cover such areas as screening of proposed procurement actions for small business participation, and small business subcontracting programs under NASA contracts. From October 1, 1958 through June 30, 1960, NASA awarded contracts totaling $45 million to small business firms, or about 17 per cent of the total dollar value of procurement awarded directly to business firms during that period. The effect of subcontracting by prime contractors with small

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business firms for component parts, raw materials and services is not reflected in these figures.\footnote{National Aeronautics and Space Administration, Procurement and Supply Division, NASA Procurement, October 1, 1958 to June 30, 1960 (Washington: NASA, 1960), p. 5.} A system for obtaining statistics on subcontracting to small business is being developed by NASA.

**Overall Program and Placement**

In fulfilling its mission, NASA contracts wherever practicable for the skills and capabilities of industry, Government organizations, and educational and other non-profit institutions. NASA research centers conduct a broadly based program of applied and basic research in aeronautics and space fields. They commit little money in the support of basic research outside the centers, except to universities and other non-profit institutions in the way of research grants and contracts. However, this is not the case with the development of space flight vehicles. In time, NASA expects to place with industry, the responsibility for larger segments of individual launch vehicles and spacecraft programs and for systems engineering and management of projects. Dr. Glennan has predicted that substantial amounts will be committed to industry for "advanced technological developments—improvements in the state-of-the-art in the fields of propulsion, guidance and control, telemetry, and the like."
It has been estimated that over 75 per cent of NASA's budget will be expended through the contract route.\textsuperscript{22} This seems now like a conservative figure.

During the first twenty-one months of its operation, NASA's procurement, on an obligation basis, totalled approximately $550 million. Of this amount, $262 million (48 per cent) was awarded directly to business firms; while $23 million (four per cent) was placed with educational or other non-profit institutions; and $204 million (37 per cent) was placed with other Government agencies. It is estimated that approximately 80 per cent of the funds transferred by NASA to other Government agencies was, in turn, obligated by those agencies to industrial firms. The remaining $61 million (11 per cent) was obligated under the contract with the Jet Propulsion Laboratory of the California Institute of Technology.\textsuperscript{23}

The $550 million in obligations resulted from about 71,000 individual procurement actions. In terms of actions, 94 per cent was placed directly with business, one per cent with educational and other non-profit institutions, and five per cent with or through other Government agencies.\textsuperscript{24}

\textsuperscript{22}NASA-Industry Program Plans Conference, July 28-29, 1960, \textit{op. cit.}, pp. 4-5.

\textsuperscript{23}Procurement and Supply Division, NASA Procurement, October 1, 1958 to June 30, 1960, \textit{op. cit.}, p. 4.

\textsuperscript{24}Ibid.
Procurement by type of contractor is shown graphically in Figure 5.

As noted above, approximately $204 million or 37 percent of NASA's procurement program was placed with or through other Government agencies, mainly, the Department of Defense for boosters. This reflects NASA's policy to avoid duplication of effort and to achieve the most economical and efficient utilization of Government resources. NASA buys through the Defense Department items for which the military departments, because of their own program, can most economically contract from industry.25

III. NASA PATENT PROGRAM

The objectives of the Patent Program are to carry out NASA's responsibilities under the National Aeronautics and Space Act of 1958 (Public Law 85-568, 72 Stat. 426), other statutes, and executive orders relating to patents for inventions made in performance of NASA contracts and inventions made by NASA employees; and to provide legal assistance on patent matters involved in NASA's procurement program.26

25 Ibid., p. 5.

PROCUREMENT BY TYPE OF CONTRACTOR

OCT. 1, 1958 — JUNE 30, 1960

OBLIGATIONS ($550 MILLION)

- Business: 48%
- Govt. Agencies: 37%
- JPL: 11%
- Educational & Nonprofit: 4%

NUMBER OF ACTIONS (71,000)

- Business: 94%
- Govt. Agencies: 5%
- Educational & Nonprofit: 1%

FIGURE 5
Office of General Counsel

The Office of General Counsel is responsible for conducting the NASA Patent Program. The program consists of the following four elements:27

1. Establishing patent activities and responsibilities at NASA Headquarters and NASA field installations.

2. Developing and promulgating contract provisions and regulations as required by Section 305 of the Space Act, and as will otherwise facilitate administration of patent matters for NASA.

3. Protecting inventions as to which the Administrator acquires an interest by obtaining reports thereof and by causing to be filed patent applications thereon; assisting the Administrator in making determinations as to title to inventions; processing of claims of infringement and petitions for waiver of patent rights; and reviewing patent applications transmitted by the United States Patent Office under Section 305 (c) of the Space Act.


Legal Assistance on Patent Matters. Legal assistance on patent matters is provided by the Office of the Assistant

27 Ibid.
General Counsel for Patent Matters at NASA Headquarters and patent counsel assigned the Goddard and Marshall Space Flight Centers, the Langley and Lewis Research Centers, and the Western Operations Office, which also advises the Ames and Flight Research Centers. While the field patent counsels are responsible to the General Counsel in NASA Headquarters for professional performance, they are under the administrative jurisdiction of the field installation directors. 28

**Implementing Patent Regulations Promulgated.** Interim regulations providing policies and procedures for waiver of patent rights under NASA contracts were published in the *Federal Register* (24 F. R. 1644 et seqq.) on March 5, 1959. Public hearings were held by NASA on May 18, 1959 on these regulations. The criticism was predominantly directed at the Space Act itself, particularly Section 305 (a) which requires for the first time that the Government take title to all inventions developed during the course of a contract unless waived by the NASA Administrator. Representatives appearing at the hearings urged that the interim regulations (Section 1201.304-2) be changed to shift the burden of proof for providing a *prima facie* case for a waiver from the contractor to NASA. They also stated that since the Government is to take title to inventions in certain areas,

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industry should be given a clearly defined yardstick for determining the benefits and more specifically, the consequences that would arise from entering into a contract with NASA. On the basis of the testimony given at the hearings, these interim regulations were superseded by revised Patent Waiver Regulations published in the Federal Register (24 F. R. 8788 et seq.) on October 29, 1959.

Section 305 of the Space Act has been further implemented through the issuance of regulations entitled, "Patent Provisions for Contracts," on May 5, 1959 (24 F. R. 3574 et seq.), and amended on August 14, 1959 (24 F. R. 6615).

Role of the Inventions and Contributions Board

Section 305(f) of the Space Act provided for the establishment of an Inventions and Contributions Board "by the Administrator within the Administration." On December 4, 1958, Dr. Glennan established such a Board within the NASA. The Board operates pursuant to the authority of, and in accordance with, the provisions of Section 305(f) and.

Section 306 (Contributions Awards) of the Space Act.\textsuperscript{30}

The functions of the Board are two-fold: (1) Evaluates all contributions received and recommends to the Administrator the granting of monetary awards to persons making contributions of significant value in the conduct of aeronautical and space activities; and (2) With respect to the waiver of property rights in inventions, reviews the findings of fact that are prepared in each case by the Assistant General Counsel for Patent Matters, considers the petition for waiver of rights filed by the contractor, and recommends to the Administrator for or against the requested waiver, or for a waiver in an extent different from that requested. Hearings on petitions for waivers are granted upon request of the contractor. Rules and regulations relating to awards for scientific and technical contributions required under Section 306 of the Space Act were published on February 13, 1960 (25 F. R. 1312 et seq.). The waiver of patent rights

\textsuperscript{30}Mr. Robert E. Littell, Assistant to the Director, Office of Advanced Research Programs, is Chairman of the Inventions and Contributions Board; Mr. Paul G. Dembling, Assistant General Counsel, is Vice Chairman; and Dr. James A. Hootman is Secretary. U. S. Congress, House, Committee on Science and Astronautics, Third Semiannual Report of the National Aeronautics and Space Administration, House Doc. No. 454, \textit{op. cit.}, pp. 132; 146. See also, Address "Awards for Contributions under the National Aeronautics and Space Act of 1958," by Paul G. Dembling before the Federal Incentive Awards Association, Washington, D. C., June 17, 1959, p. 3.
function has had a great impact in procurement matters.  

Controversial Patent Policy

Under Section 305 (Property Rights in Inventions) of the Space Act, NASA is required to acquire title to certain inventions developed by contractors in the performance of work under NASA contracts, except that the Administrator may waive title if he regards such waiver as being in the public interest.

These patent provisions are unique, in that the legislation established for the first time in the history of the United States Government broad statutory criteria that shall govern the division of rights between a contractor of the United States and the Government in all inventions that might be made in the performance of work under such a contract.  

This policy requires a significant departure from the traditional patent policy of the Federal Government and has provoked much concern in and out of Government. 

31 Joint interviews with Messrs. Ray M. Harris and Gayle Parker, loc. cit. In this connection, see "Waivers of Title to Inventions and the NASA Inventions and Contributions Board," an Address by Paul G. Dembling, Vice Chairman of NASA Inventions and Contributions Board, for the Briefing Conference on Government Contracts Sponsored by the Federal Bar Association and the Bureau of National Affairs, Inc., Philadelphia, on February 13, 1959.


33 See especially, Wilson R. Maltby, "The National
Representatives of industry and the Patent Bar have voiced considerable dissatisfaction with the patent provisions of the Space Act. While these provisions were patterned after those of the Atomic Energy Act, there is one basic difference. NASA Assistant General Counsel for Patent Matters, Gerald D. O'Brien, has pointed out this difference:

Under the requirements of the Atomic Energy Act, only those inventions which are useful in the production or utilization of special nuclear material or atomic energy are specifically affected. The Atomic Energy Commission is not required by law, nor would it be required under present policy, to acquire the exclusive rights in those inventions which would, in fact, become the exclusive property of the Government under the patent provisions of the Space Act. ... 34

The basic problem is "who should own the patents?"

While no attempt is made here to discuss the technical aspects of this problem, the general consensus is that because of the circumstantial nature of the criteria established, prospective contractors are unable to determine in advance (although they may in contracts with AEC) what inventions or what proportion of inventions, likely to be made under a NASA contract, may or may not become the exclusive property of the


Government. Generally, such inventions made in the performance of a NASA contract will become the exclusive property of the Government unless the NASA Administrator elects to waive the Government's rights to such inventions. The granting of this authority to the Administrator to waive all or any part of the Government's rights is certainly an extraordinary responsibility and it was an important task to develop policies governing such waivers that would carry out the intent of Congress to confer such authority upon the Administrator. Thus, it was the waiver authority of the NASA Administrator and the regulations issued under this authority that has become the "backbone" of NASA patent policy.35

In the field of patents, NASA must operate under statutes and policies which are at odds with those of the Department of Defense, taking title to inventions produced under its research and development contracts, while the Department of Defense requires only a royalty-free license to use inventions developed under its research and development contracts. NASA draws largely upon the same segments of American industry for its research and development work in aeronautical and space fields as does the Defense Department, and frequently with the same contractors at the same time. In fact, many space contracts are jointly sponsored by the

Defense Department and NASA. Because NASA's patent policies and procedures must necessarily differ from those of the Defense Department, the disposition of title to inventions many times depends on whether the source of the funding is from the Defense Department or NASA appropriations. Noting the contrast with the policy of the Defense Department, Dr. Glennan declared NASA's position in the matter as follows:

Two such contrary patent policies, followed by Government agencies working in closely-related fields of research and development, can be detrimental to the kind of cooperation that we must have from industry, if our joint effort is to go forward with effectiveness and dispatch. We are well aware of the attitude of industry toward this question.

On the other hand, it must be recognized that these rules are written into the law, and we cannot ignore them. The Administrator of NASA has authority to waive these patent rights, but only if his judgement tells him that such an action is clearly in the public interest. . . .

In due course, I feel sure that the Congress will want to review the whole subject of our patent requirements. Meanwhile, we are going to make every effort to administer the legal provisions in the patent field fairly and objectively, and with due regard for the interests of both Government and industry.

Because of the mounting criticism from industry and the professions, and because the NASA had had some experience with the practical application of these controversial patent

36Ibid., p. 102.

provisions, Representative Overton Brooks, Chairman of the House Committee on Science and Astronautics, appointed a special Subcommittee on Patents and Scientific Inventions in August, 1959. He appointed Representative Erwin Mitchell as Chairman. The Subcommittee conducted initial background hearings on proposed revisions in Section 305 of the Space Act. It made an intensive study of the space research patent problem.\(^{38}\)

Witnesses came from all parts of the country to give their testimony. They primarily represented industry, departments and agencies of the Executive branch of the Government, and the legal profession. Many of the witnesses presented prepared studies and some included proposed changes in the patent provisions of the Space Act. NASA proposed that Section 305 of the Space Act be repealed and that there be enacted in its place a new Section 305 designed to give the Administrator: (1) discretion to prescribe contract provisions governing the rights to inventions developed under NASA contracts, and (2) authority to waive the United States' contract rights to title in an invention, provided the Government retained an irrevocable, non-exclusive, non-transferable

royalty-free license to the invention.\textsuperscript{39}

The Subcommittee found that the critics regarded the existing patent provisions "as a step away from those constitutional requirements which are designed to protect the interests of the inventor as well as foster the open publication of inventions." The Subcommittee further noted that the critics expressed particular concern since the Space Act patent requirement was the third time since World War II in which Government ownership of inventions had been dealt with by law. The other such instances were the passage of the Atomic Energy Act of 1946, as amended in 1954, under which the United States asserts ownership of inventions; and the enactment of the National Science Foundation Act of 1950, which gives discretion to the Foundation's Director as to the disposition of rights in inventions and patents.\textsuperscript{40}

The Subcommittee was unanimous in its determination that a change in the patent section of the current law was necessary, but it was not unanimous in its opinions as to the best way to effect the desired changes.\textsuperscript{41} In its report to the House Committee on Science and Astronautics, the Subcommittee drew the following conclusions: \textsuperscript{42}

1. The patent provision (Section 305) of the Space Act "is tending to complicate and retard the conduct of the

\textsuperscript{39}\textit{Ibid.}, pp. 9 and 11.\textsuperscript{40}\textit{Ibid.}, p. 6.\textsuperscript{41}\textit{Ibid.}, p. III.\textsuperscript{42}\textit{Ibid.}, p. 28.
American space program."

2. The patent provision of the Space Act should be amended along the lines recommended by NASA.

3. A statement of congressional intent should be incorporated as a part of the legislative history of the amendment which would provide specific guidelines for its administration and would also provide sufficient flexibility to avoid hampering of the space program.

4. Amendment of the Space Act patent section should be accomplished immediately, "independently of such subsequent legislation as may be planned to standardize the patent policies of all Government agencies."

Thus, the Subcommittee did the groundwork on this extremely complicated and technical matter. The full committee considered this matter in the course of its deliberations on H. R. 9675, an Administration bill, to make several revisions in the Space Act, including changes in the patent provisions. A discussion of the proposed revisions is found in Chapter VII of this report.

IV. PUBLIC AND TECHNICAL INFORMATION

The Space Act stipulated that the NASA shall "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results there- of." (Section 203(a)(3)). NASA accomplishes this policy objective by a broad public and technical information program.
Public Information

The NASA furnishes information on its activities through a variety of media. This has been accomplished primarily through press releases to the news media; press briefings and conferences; addresses of key officials and scientists before business, civic, and scientific associations, both here and abroad; and symposiums.43

NASA has maintained a round-the-clock press center in Washington Headquarters during major space experiments. Provisions are made to enable the press to cover launchings at the Atlantic Missile Range; and press conferences have been held where top NASA officials and scientists explained the experiments and answered questions from representatives of the press. Information on the agency's activities is also disseminated through NASA's semiannual and annual reports to the Congress; through television and motion picture productions; exhibits; and the periodic inspections at NASA field installations, which are attended by the press, scientists, representatives of industry, Congressmen, Government officials, and visiting scientists and officials from other countries.44


Technical Information

NASA disseminates technical information arising from its scientific investigations through various media, including oral presentations by NASA scientists before professional societies, such as the American Rocket Society, and the Institute of the Aeronautical Sciences; articles and papers in scientific and technical journals; and technical publications, which are made available to organizations and individuals interested in aeronautics and space, and other scientific fields. Also, unclassified publications may be purchased by the general public.\(^45\)

V. INTERNATIONAL COOPERATION IN SPACE ACTIVITIES

Space exploration is inherently international in character. Congress wrote into the Space Act that one of the objectives of NASA should be "Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof..." (Section 102(c)(7)). In keeping with this policy, Dr. Glennan made it clear on December 7, 1959 this nation's desire for international cooperation in

space activities by offering the services of the United States global tracking network in support of any manned space flight program of the Soviet Union. 46

Office of International Programs

In response to the Congressional mandate, the NASA Administrator established the Office of International Programs, headed by Mr. Arnold W. Frutkin, who was formerly an official of the United States National Committee for the International Geophysical Year. The functions of this office are to coordinate United States non-military research and development in aeronautical and space matters with similar work carried on by other nations and international organizations, and to furnish necessary supporting services for NASA's international activities. In carrying out these functions, NASA maintains close liaison with the State Department through whom all formal international agreements are negotiated, and with other Federal agencies concerned in space activities and with the scientific community. NASA also consults and cooperates with the Space Science Board of the National Academy of Sciences and through it with the International Committee on Space Research (COSPAR), which is continuing

the activities in this sphere formerly carried on under the International Geophysical Year (IGY). 47

**NASA International Programs**

To carry out its statutory obligations and operational requirements, NASA is engaged in a wide range of international programs and activities. It is convenient to distinguish four basic types of activity in which NASA is participating: (1) operational cooperation in tracking and telemetry, (2) exchange of information, (3) exchange of personnel, and (4) joint programs. 48

**Operational Cooperation.** The far-flung activities of NASA help to broaden scientific interest, contribution and participation in the conquest of space. This program involves the acquisition and operation of tracking and telemetry stations and services needed to meet operating requirements for a world-wide tracking range. The operation of this global range indicates how widespread NASA international

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48 Unless otherwise indicated, the discussion of these international programs in this paper is based on two addresses: "Progress in International Cooperation in Space Activities," by Dr. Hugh L. Dryden, ibid.; and a Statement by Arnold W. Frutkin, Director, Office of International Programs, NASA, before the Members of the Inter-American Defense Board, Washington, D. C., on February 16, 1960, NASA Release No. 60-124, February 16, 1960.
activities have already become. In all, some nineteen countries or political entities are participating in these network arrangements. This subject is covered in detail in Chapter VI of this report.

**Exchange of Information.** NASA continues in effect the launching announcements and data exchanges that were instituted during the IGY. The announcements are made routinely within a few hours through the press and through a special world communications net (AGIWARN) giving orbital characteristics, kinds of instrumentation, satellite or payload weight, and experimental missions. Results of the experiments are published in recognized scientific journals and distributed also through the World Data Centers. NASA is also extensively participating in scientific symposiums which, Mr. Frutkin has stated, in many ways represent the "life-stream of international scientific exchange."

**Exchange of Personnel.** One of the most effective means of exchange of information and experience is through the exchange of scientific personnel. Exchange of such personnel may be utilized to provide training and for joint participation in cooperative programs. In order to provide foreign students an opportunity to develop their interests and potentials for space research, NASA has established a number of postdoctoral and senior resident research associate-ships at its own laboratories, administered by the National
Joint Programs. Another step in international cooperation is the joint effort of two or more countries in the design of space experiments and in the preparation of payloads for satellites, rockets, and space probes. On March 14, 1959, NASA authorized the National Academy of Sciences delegate to COSPAR to convey an offer on behalf of the United States to launch individual experiments or complete satellite payloads prepared by scientists of all other nations.

Significant progress has been made in this direction. Within the framework of NASA's offer, two programs of this type have been developed and others are under way. On February 15, 1960, NASA announced that arrangements had been concluded for a joint satellite project with Canada to study the ionosphere by means of a sweep frequency topside sounder satellite. The cooperative United States-Canadian experiment is planned for 1961.\footnote{NASA Release No. 60-122, February 15, 1960.}

The other cooperative scientific satellite program is with the United Kingdom. Under this undertaking, it was tentatively agreed that NASA would launch, by means of the Scout or other launch vehicle, perhaps three satellites instrumented by Britain scientists over a two-to-four-year period. These experiments will involve the studies of the
ionosphere, solar radiation, cosmic radiation, electron density, and temperature. The first British satellite will be launched from Wallops Island by a Scout vehicle in the summer or fall of 1961.

In conclusion, science is certainly an international language. The organization of space interest in other countries is in the initial stages, and programs have not yet matured. Nevertheless, in addition to the United States, Soviet Russia, Britain and Canada, six other nations are known to have established national space committees—Belgium, France, Australia, Italy, Japan and Sweden. Interest in cooperative space programs has been expressed informally by scientists from other countries. Due to the very substantial outlay required for the support of the more ambitious space programs, there should be widespread interest in international cooperation. On this point, Dr. Dryden has commented:

... We, in NASA, are convinced that every possible effort should be made to secure the cooperation of other nations. The task of space exploration is global in nature; it requires large resources; and its needs are better matched by the resources of the whole world than by those of one nation.50

International Cooperation Through the United Nations

Perhaps the most significant exchange of information

and experience will occur at the proposed United Nations Conference on the Peaceful Uses of Outer Space. NASA is making preparations to play a central role in this undertaking.

In December 1959, the United Nations General Assembly (by unanimous resolution), decided to convene in 1960 or 1961, under the auspices of the United Nations (UN), an international scientific conference of interested UN members and members of specialized agencies for the exchange of experience in the peaceful uses of outer space. NASA was designated as the executive agency for the United States responsible for planning, coordinating and directing the United States' participation in the International Conference on the Peaceful Uses of Outer Space; and for maintaining the necessary liaison with the UN, the State Department, the United States Information Agency and other organizations in connection therewith. To carry out this assignment, NASA established the Office for the United Nations Conference on January 29, 1960, under the Office of the Deputy Administrator. Dr. John P. Hagen, formerly Chief of NASA Vanguard Division, was appointed the Director of this Office.\textsuperscript{51}

The Conference is tentatively scheduled for 1961. However, the time, place, and agenda have not been agreed upon by the UN.
"Budget or program execution should be regarded as a separate stage in the decision-making process since, even in a budget for as short a period as a year, it is impossible to prescribe what is to be done with complete specificity or to provide for all contingencies. The objectives of the budget can be more nearly achieved if there is some discretion exercised in the execution of the budget than if it is followed slavishly. . . ."

Arthur Smithies

I. NACA-NASA FISCAL YEAR 1959 REGULAR APPROPRIATION

Prior to the passage of the National Aeronautics and Space Act of 1958\(^1\) creating the National Aeronautics and Space Administration, authorizations and appropriations for construction of aeronautical and space research facilities had been made to the National Advisory Committee for Aeronautics (NACA). Public Law 85-617 (H. R. 11805) was approved by the President on August 8, 1958, authorizing construction by the NACA of aeronautical research facilities in the amount of $29,933,000 for fiscal year 1959.\(^2\)

Pursuant to the above authorization, the Independent

\(^1\)Public Law 85-568, 72 Stat. 426.

Offices Appropriation Act, 1959, Public Law 85-844 (H. R. 13856), appropriated funds for the National Advisory Committee for Aeronautics, and transferable to the NASA, in the amount of $78,100,000 for salaries and expenses, and $23 million for construction and equipment, or a total of $101,100,000.\(^3\)

On July 31, 1958, Senator Johnson of Texas introduced S. 4208, a bill to authorize appropriations to the NASA for construction and equipment. The bill authorized appropriation of $47,800,000 for acquisition or condemnation of real property, for plant and facility acquisition, construction or expansion, and for other items of a capital nature.\(^4\) The Senate Report (S. Rept. 2076) accompanying S. 4208 made the following statement:

Under the policy guidance of the National Aeronautics and Space Council, headed by the President, the new National Aeronautics and Space Administration has been invested with the awesome responsibility of carrying out the provisions of the Space Act. It is necessary, therefore, for NASA immediately to expand its activities as a first step in fulfilling this important mandate. This will require, among other things, the construction of new research and operational facilities

\(^3\)While the $23 million appropriated for construction and equipment appeared to be $6,933,000 less than the amount authorized, it actually represented a cut of $3,220,000 since the balance of $3,713,000 (representing a portion of the authorization for Langley Research Center) was appropriated in Public Law 85-352, the "Second Supplemental Appropriation Act, 1958." Ibid., pp. 13 and 74; also U. S. Congress, House, Committee on Science and Astronautics, A Chronology of Missile and Astronautics Events, House Report No. 67, 87th Congress, 1st Session (Washington: Government Printing Office, 1961), p. 185.

\(^4\)U. S. Congress, Senate, Special Committee on Space and Astronautics, Final Report, Report No. 100, op. cit., p. 73.
to enable NASA to seek solutions to pressing scientific problems which continually arise as the body of space knowledge and technology expands. It would be difficult to overestimate the significance of such research facilities in the proper execution of the task.5

On August 1, 1958, the Senate passed S. 4208. Following public hearings, the House Select Committee on Aeronautics and Space Exploration approved H.R. 13619 (a companion measure to S. 4208) on the same day. On August 4, 1958, the House passed S. 4208 and tabled H. R. 13619. Senate Bill 4208 was signed by the President on August 14, 1958, becoming Public Law 85-657. The Act authorized construction by the NASA in the full amount of $47,800,000.6

The appropriation for this authorization was contained in H. R. 13450, the Supplemental Appropriation Bill, 1959, and approved by the President on August 27, 1958 as Public Law 85-766.7 In reporting out H. R. 13450, the Senate Appropriations Committee made the following statement in its report (Senate Report 2350):

The committee considered a supplemental estimate in Senate Document No. 112 in the amount of $125 million for space activities and functions to be undertaken by this new agency pursuant to the National Aeronautics

5Ibid., p. 13.

6Ibid., pp. 73-74; also U. S. Congress, House, Committee on Science and Aeronautics, A Chronology of Missile and Astronautic Events, House Rept. No. 67, op. cit., pp. 53-54, 185.

7U. S. Congress, Senate, Special Committee on Space and Astronautics, Final Report, Senate Rept. No. 100, op. cit., pp. 14, 74.
and Space Act of 1958. . . . In addition, $117 million is to be provided by transfer from the Department of Defense and $294 million will be used in 1959 by the Department of Defense on space activities which are primarily military in nature; for a total of $536 million of 1959 funds directly applicable to space programs. Furthermore, the committee understands the former National Advisory Committee for Aeronautics will continue to function as the research branch of the new agency and funds are available for that work in 1959 in the amount of $101,100,000.

The Senate Appropriations Committee pointed out that it would take some time to plan properly for the new civilian agency, and accordingly recommended appropriations in the following amounts, as compared with the estimates for new appropriations:

<table>
<thead>
<tr>
<th></th>
<th>Supplemental Estimate</th>
<th>Amount Recommended</th>
</tr>
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<tbody>
<tr>
<td>Salaries &amp; Expenses</td>
<td>$7,000,000</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td>$70,200,000</td>
<td>$35,000,000</td>
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<tr>
<td>Construction &amp; Equipment</td>
<td>$47,800,000</td>
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<tr>
<td>Total</td>
<td>$125,000,000</td>
<td>$75,000,000</td>
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</table>

The Committee further stated that in the event additional funds were needed after the first of the year, it would be glad to consider such request. However, "In the meantime, the committee feels that planning for the space projects center can be deferred until a later submission." 10

When the appropriation was debated on the floor of the Senate, Senator Johnson, the Majority Leader, defended the original estimates and made amendments to restore the

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8 Ibid., p. 14. 9 Ibid. 10 Ibid.
full amount of the budget request ($125 million). These amendments were agreed to by the Senate. In addition, the following amendment was offered:

No appropriation may be made to the National Aeronautics and Space Administration unless previously authorized by legislation hereafter enacted by the Congress.11

In introducing this amendment, the chairman said: "... There is no controversy about it. It simply provides that all appropriations which may be made to the National Aeronautics and Space Administration must first be authorized by the Congress."12

The House and Senate conferees agreed on $80 million for NASA for fiscal year 1959, a cut of $45 million below the amount requested by the President. The difference in the amounts was compromised by the conferees on the following basis:13

<table>
<thead>
<tr>
<th>Salaries &amp; Expenses</th>
<th>$ 5,000,000</th>
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<tbody>
<tr>
<td>Research &amp; Development</td>
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<tr>
<td>Construction &amp; Equipment</td>
<td>$25,000,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$80,000,000</strong></td>
</tr>
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</table>

The conferees further modified the amendment providing that no appropriation may be made to NASA without previous authorization to read:

No appropriation may be made to the National Aeronautics and Space Administration for any period prior to

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to June 30, 1960, unless previously authorized by legislation hereafter enacted by the Congress.$^4$

Accordingly, NASA operated with a budget of almost $336 million (Table II), prior to passage of its fiscal year 1959 supplemental appropriation. Of this amount, approximately $100 million represented the continuing costs of the former NACA laboratories, and some $154 million represented amounts transferred from other Government agencies for carrying out programs that they had initiated. The remaining $80 million represented the amount that NASA could utilize in developing and rounding out the national space program, including the initiation of Project Mercury.$^5$

The balance of this chapter is devoted to the action taken on NASA's fiscal 1959 supplemental items and fiscal year 1960 regular budget request.

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$^4$ Ibid. The history of this amendment (referred to as the Johnson rider), requiring authorizations before any additional funds could be appropriated for NASA is interesting. The conferees originally approved the amendment as proposed by Senator Johnson (House Rept. No. 2677). The House rejected the Johnson rider, sending this provision back to conference. The Senate insisted on the rider. On August 21, 1958, the House and Senate passed a new conference report on the Supplemental Appropriation Bill, including the $80 million for NASA and a new compromise provision requiring for a period of one year new authorization authority over all appropriations for NASA. U. S. Congress, House, Committee on Science and Astronautics, A Chronology of Missile and Astronautic Events, House Rept. No. 67, op. cit., pp. 54-55.

### TABLE II

**NASA APPROPRIATION SUMMARY—FISCAL YEAR 1959 REGULAR**

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<th></th>
<th>NACA</th>
<th>NASA</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Salaries &amp; Expenses</td>
<td>$78,100,000</td>
<td>$5,000,000</td>
<td>$83,100,000</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td></td>
<td>50,000,000</td>
<td>50,000,000</td>
</tr>
<tr>
<td>Construction &amp; Equipment</td>
<td>23,000,000</td>
<td>25,000,000</td>
<td>48,000,000</td>
</tr>
<tr>
<td><strong>TOTAL APPROPRIATIONS</strong></td>
<td>$101,100,000</td>
<td>$80,000,000</td>
<td>$181,100,000</td>
</tr>
</tbody>
</table>

**Transfers from Defense Department**

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Force</td>
<td>$57,800,000</td>
</tr>
<tr>
<td>ARPA</td>
<td>67,200,000</td>
</tr>
<tr>
<td>Navy (Vanguard)</td>
<td>25,541,282</td>
</tr>
<tr>
<td>Army (JPL)</td>
<td>4,078,250</td>
</tr>
<tr>
<td><strong>TOTAL OBLIGATIONAL AUTHORITY</strong></td>
<td>$335,719,532</td>
</tr>
</tbody>
</table>


**72 Stat. 433.**
II. NASA SUPPLEMENTAL AUTHORIZATION FOR
FISCAL YEAR 1959 (S. 1096)

On January 19, 1959, the NASA Administrator, with the approval of the Bureau of the Budget, submitted to Congress a draft authorization bill covering both fiscal years 1959 and 1960 and requested its introduction. The Committee on Aeronautical and Space Sciences, the Senate standing committee handling space matters, took this position:

In view of the need for thorough examination and careful consideration of the overall space program proposed for fiscal year 1960, it was clear that combining the supplemental request for fiscal year 1959 with the authorization for fiscal year 1960 would involve needless delay for the former.16 Accordingly, to assure expeditious provision of authorizations required to meet current needs, the Senate Committee on Aeronautical and Space Sciences separated its consideration of NASA's needs for 1959 from the agency's requirements for 1960.17

On February 17, 1959, Senators Johnson and Bridges introduced S. 1096 to authorize supplemental appropriations


17 Ibid.
for the NASA covering fiscal year 1959, totaling $48,354,000. The bill was referred to the Senate Committee on Aeronautical and Space Sciences. Hearings were held on February 19 and 20, 1959. The budget request, in terms of the three NASA authorizations, was as follows:

<table>
<thead>
<tr>
<th>Salaries &amp; Expenses</th>
<th>$3,354,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and Development</td>
<td>20,750,000</td>
</tr>
<tr>
<td>Construction and Equipment</td>
<td>24,250,000</td>
</tr>
<tr>
<td><strong>Total Request</strong></td>
<td><strong>$48,354,000</strong></td>
</tr>
</tbody>
</table>

Salaries and Expenses

The $3,354,000 supplemental estimate for salaries and expenses was to cover the cost of the salary increases provided for under the "Federal Employees Salary Increase Act of 1958," and did not provide for additional positions.

Research and Development

The $20,750,000 in the supplemental estimate for research and development was earmarked entirely for Project

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19 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Supplemental Authorization for Fiscal Year 1959, Senate Rept. No. 82, op. cit., p. 1. Congress appropriated $3,186,500 under Public Law 86-30, the "Second Supplemental Appropriation Act, 1959," to cover the cost of pay raises pursuant to this authorization.
Mercury—the manned space flight program. A total of $37,661,200 of fiscal year 1959 funds was already available for Project Mercury. The $20,750,000 additional authorization in S. 1096 would increase the 1959 program to $58,411,200. The budget request for fiscal year 1960 for the Mercury Project was $70 million and Dr. Glennan testified that "before we have completed this first U. S. effort to put man into space, the bill will have exceeded $200 million." 20

Dr. Glennan further elaborated, pointing out that the 1.5 million pound thrust engine was a $12 million item in the 1959 budget and that its cost would increase to $30.2 million in the 1960 budget. He predicted, "Before this single-chamber booster has been brought to a state of usefulness, the cost will have exceeded approximately $200 million." Dr. Glennan continued:

Every time one of these giant boosters is used to send many tons of payload into space, we will be spending more than $20 million.

I don’t want to belabor the point, but I need to cite one final figure. The cost of the national booster program, to provide the building block units of basic rocket motors needed for our space programs, will exceed $2 billion in my opinion.

These are facts that must be considered now. The cost of our space programs will continue, year after year, and it will increase, year by year.21

20 Ibid., p. 2. (Senate Rept. No. 82.)
Construction and Equipment

The $24,250,000 supplemental estimate for construction and equipment may be broken down as follows:22

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet Propulsion Laboratory in Pasadena</td>
<td>$9,000,000</td>
</tr>
<tr>
<td>Tracking facilities</td>
<td>$12,050,000</td>
</tr>
<tr>
<td>Propulsion development facilities</td>
<td>$3,200,000</td>
</tr>
<tr>
<td><strong>Total, Construction and Equipment</strong></td>
<td><strong>$24,250,000</strong></td>
</tr>
</tbody>
</table>

Congressional Action on S. 1096

During the Senate hearings on S. 1096, Dr. Glennan was questioned as to the adequacy of the supplemental authorization requested for fiscal year 1959. He testified that NASA had requested what he believed would be needed to do its job at that time. He pointed out that NASA would "carry on a continuing, intensive review, not only of our presently scheduled programs, but also of what we should or could be doing in addition."23

Senate Bill 1096 was reported without amendment by the Senate Committee on Aeronautical and Space Sciences on March 5, 1959, and passed the Senate on March 10, 1959. The House Committee on Science and Astronautics amended the measure slightly, and the Senate agreed to the House amendment

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22 Details on this supplemental item may be found in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Supplemental Authorization for Fiscal Year 1959, Senate Rept. No. 82, op. cit., pp. 2-10.

23 Ibid., p. 11.
on April 15, 1959. President Eisenhower signed S. 1096 on April 22, 1959 as Public Law 86-12 (73 Stat. 16), authorizing the full amount of the budget request.

III. NASA AUTHORIZATION FOR FISCAL YEAR 1960 (H. R. 7007)

On May 7, 1959, H. R. 7007 was introduced by Congressman Brooks of Louisiana, to authorize appropriations to the NASA for fiscal year 1960, and the measure was referred to the House Committee on Science and Astronautics.

NASA's budget request for fiscal year 1960, its first full year of operation, totaled $485,300,000, an increase of $101,226,468 over the amount available for fiscal year 1959, including the 1959 supplemental request. The 1960 budget request consisted of the following:

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Salaries and Expenses $ 94,430,000
Research and Development 333,070,000
Construction and Equipment 57,800,000

Total, FY 1960 Request $ 485,300,000

Salaries and Expenses

A total of $94,430,000 was projected for "Salaries and Expenses" during fiscal year 1960, compared with $86,454,000 authorized for fiscal year 1959 and $76,076,209 appropriated for fiscal 1958. The increase over the 1958 figure was actually greater than indicated by the above figures, inasmuch as the appropriation structure for the fiscal year 1960 included the transfer of some $16,670,000 of costs involved in the operational support of NASA research laboratories and other activities from "Salaries and Expenses" to "Research and Development." Of the $94,430,000 allocated for salaries and expenses, $69,976,000, or 74 per cent, was devoted to salaries and the remainder was allocated to the major items of communications, rents, travel, and utility services.27

Research and Development

A total of $333,070,000 was requested for "Research and Development" during fiscal year 1960, as compared with $225,369,532 authorized for fiscal year 1959. This appropriation title did not exist in fiscal year 1958, since all funds appropriated to the National Advisory Committee for Aeronautics were provided under the appropriation titles "Salaries and Expenses" and "Construction and Equipment."

In order to make an appropriate comparison with the research and development estimate for fiscal year 1960, the amount authorized for fiscal 1959 should be increased from $225,369,532 to $237,506,834. Therefore, the estimate for fiscal year 1960 was $95,563,166; 40 per cent greater than the comparable amount authorized for fiscal year 1959.

The funds NASA requested under the "Research and Development" title provided, in part, for support of JPL and NASA plant; research contracts; scientific investigations in space, such as sounding rockets, scientific satellites, lunar and deep-space probes; satellite applications investigations (meteorology and communications); manned space flight; space

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28U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Authorizing Appropriations to the National Aeronautics and Space Administration, Senate Rept. No. 332, op. cit., p. 4. This represented an adjustment of $12,137,302 in research and development. These funds were provided under the "Salaries and Expenses" title in the fiscal year 1959 authorization. Accordingly, the funds under that title would be decreased by the same amount for fiscal 1959. Ibid., p. 5.
propulsion technology; vehicle development; and supporting activities (tracking and data acquisition). In all, 26 programs made up NASA's total research and development effort.\(^29\)

On February 19, 1959, Dr. Glennan testified before the Senate Committee on Aeronautical and Space Sciences concerning the increased costs in the budget request for fiscal 1960 as compared with fiscal 1959:

The point I want to make at this time is that these increases represent the accelerated level of space effort which we believe we can justify at this time. I emphasize "at this time" because we are now in the formative stages of one of the most challenging programs ever undertaken by the United States. The budget we have requested is what we need to do our job at present. . . .

I should probably add the comment that, in my opinion, this is the last time that, at least in the foreseeable future, NASA will be requesting a budget of one-half billion dollars. If anything, the level of our space effort today is minimal if we are to reach our goals as promptly as we must. In these early stages of organizing, and planning, and beginning our programs, however, there are definite limits to the sums of money we can usefully spend.\(^30\)

In his testimony before this Committee on April 7, 1959, Dr. Glennan said:


\(^{30}\)U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Authorizing Appropriations to the National Aeronautics and Space Administration, Senate Rept. No. 332, op. cit., p. 6.
At NASA we are concerned with the infinite possibilities of space but we are determined to base our space program upon facts, not fancies. With this in mind, we will constantly be reviewing our program—and our budgets. It is highly probable that our programs will change rapidly during the first years of effort in this new medium simply because we are opening up a new frontier and most of the ground rules are yet to be worked out and understood.31

In its report on H. R. 7007, the Senate Committee on Aeronautical and Space Sciences pointed out that there can be no doubt concerning the fact that the "continuing review" referred to by Dr. Glennan has, "indeed, taken place."32

Construction and Equipment

This appropriation title covers the construction and equipment at NASA field installations and for the acquisition or condemnation of real property. A total of $57,800,000 was requested for fiscal year 1960. Of this amount, $34,800,000 would be used for additions and improvements to existing NASA research centers and stations; $3 million would be utilized for specific facilities required by NASA at the Pacific Missile Range; and $20 million would be used for new facilities and for improvement of the global tracking and communications

31Ibid.

32Ibid., p. 7. For the magnitude of adjustments made by NASA in its research and development programs in the space of a few short months, see Ibid., p. 9. Because of the fluid nature of research and development, a detailed analysis of the NASA Research and Development programs is reserved for the budget submission for fiscal year 1961, when these programs were more completely defined (See Chapter VI).
facilities.\textsuperscript{33}

The $34,800,000 projected for additions and improvements of existing NASA research centers and stations is equal to less than nine per cent of the total value of such plant facilities, then estimated at about $390 million. On this point, the Senate Committee on Aeronautical and Space Sciences remarked, "Considering the rapid pace of technology, this does seem to warrant Dr. Glennan's description that 'This is really an austerity program.'\textsuperscript{34}

Section 2 of H. R. 7007 permitted the NASA Administrator to vary upward five percent the construction and equipment authorizations to meet unusual cost variations.

**Congressional Action**

The House Committee on Science and Astronautics reported H. R. 7007 on May 14, 1959, and the measure was passed by the House on May 20, 1959. The House Committee made two substantive changes in H. R. 7007. First, with subsequent House approval, the Committee struck out an NASA request for $4,750,000 for an exotic fuel experiment station on the grounds that a site had not yet been selected. The Committee indicated that it was prepared to consider a supplemental authorization request for

\textsuperscript{33}Ibid., p. 29.

\textsuperscript{34}Ibid., p. 30. Detailed justification for NASA's construction and equipment program is contained in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1960, Hearings on S. 1582 and H. R. 7007, Part II, \textit{op. cit.}, pp. 754-793.
this purpose as soon as a location had been selected.\textsuperscript{35}

The second amendment added a new section to the effect that until July 30, 1965, NASA could not receive appropriations unless previously authorized by legislation enacted by Congress. The then existing law required NASA to obtain authorization before being entitled to appropriations. In reporting H. R. 7007, the House Committee commented:

... It is recognized that NASA, in this respect, is somewhat unique as compared with other Government departments. At the same time, the committee believes that this requirement should be extended for an additional 5 years.

The exploration and development of outer space is a new science. The National Aeronautics and Space Administration is a new Government agency. The committee believes that an authorizing committee should review its budgetary requests for the next 5 years, so that such requests could be given added attention.\textsuperscript{36}

The Senate Committee on Aeronautical and Space Sciences made three substantive amendments to H. R. 7007. They were as follows:

1. \textbf{Restoration of Funds}. The Committee restored $4,750,000 to the "Construction and Equipment" authorization

\textsuperscript{35}U. S. Congress, House, Committee on Science and Astronautics, \textit{Report of the Activities of the Committee on Science and Astronautics, Committee Print, No. 32, op. cit.}, pp. 6-7; and U. S. Congress, House, Committee on Science and Astronautics, \textit{Authorizing Appropriations to the National Aeronautics and Space Administration, House Rept. No. 361, op. cit.}, pp. 34-35.

\textsuperscript{36}U. S. Congress, House, Committee on Science and Astronautics, \textit{Authorizing Appropriations to the National Aeronautics and Space Administration, House Rept. No. 361, op. cit.}, pp. 35-36.
for a new central facility for high-energy solid and liquid fuel rocket propellants deleted by the House. The Senate Committee report pointed out that it appeared that NASA witnesses, in an effort to justify the total cost estimate of $4,750,000, gave an impression of greater precision as to individual cost components than was possible with regard to an unknown site.37

2. Use of Research and Development Funds for Capital Items. Under Section 1(b) of H. R. 7007, "Research and Development" appropriations could be used for any item of a capital nature (other than land acquisition) which might be required for the performance of research and development contracts. While the Senate Committee recognized the necessity to grant NASA additional flexibility in connection with the use of research and development funds, it considered the language in question to be unnecessarily broad and possibly subject to misuse "as a means to avoid congressional scrutiny over, and the specific prior authorization of, major construction projects." Therefore, in order to insure that the necessary flexibility would not be abused, the Senate Committee added a notification proviso to Section 1(b) of H. R. 7007 as follows:

Provided, That none of the funds appropriated for "Research and development" pursuant to this Act may be used for construction of any major facility, the estimated cost of which, including collateral equipment, exceeds $250,000, unless the Administrator or his

37U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Authorizing Appropriations to the National Aeronautics and Space Administration, Senate Rept. No. 332, op. cit., p. 43.
designee notifies the Committee on Science and Astronautics of the House of Representatives and the Committee on Aeronautical and Space Sciences of the Senate of the nature, location, and estimated cost of such facility.38

3. Authorization Requirement. As noted above, the House Committee on Science and Astronautics had extended the requirement for prior authorization of NASA's appropriations to July 30, 1965. On this point the Senate Committee took the position that "close and continuing congressional review and surveillance is in order in this area," and deleted the terminal date of July 30, 1965, thus making the authorization requirement of an indefinite duration.39


The authorizations, in terms of the three NASA appropriations, were as follows:

38Ibid., pp. 45-47.
39Ibid., p. 47.
40U. S. Congress, House, Committee on Science and Astronautics, Report on the Activities of the Committee on Science and Astronautics, Committee Print, No. 32, op. cit., p. 6.
**Appropriation Title** | **Budget Request** | **Authorized in**
---|---|---
Salaries & Expenses | $94,430,000 | $94,430,000
Research & Development | 333,070,000 | 333,070,000
Construction & Equipment | 57,800,000 | 57,800,000

**Total, FY 1960 Authorization** $485,300,000

### IV. NASA 1959 SUPPLEMENTAL AND 1960 REGULAR APPROPRIATIONS (H. R. 7978)

During the First Session of the Eighty-Sixth Congress, two budget requests for funds, a 1959 supplemental request and the regular fiscal year 1960 request, were submitted to Congress. The House Committee on Appropriations decided to handle both requests in a single bill, H. R. 7978. Such funds would generally be considered in connection with the Independent Offices Appropriation Bill, but because of the requirement placed in the previous year's supplemental bill, the regular budget estimates could not be submitted until after passage of the specific authorizations.41

**House Action on H. R. 7978**

The House Committee on Appropriations considered NASA's budget estimates totaling $530,300,000, composed of $45 million

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It reported H. R. 7978 to the House on June 26, 1959 (House Report No. 579). The Committee recommended appropriations totaling $484,800,000, which was an increase of $145,894,168 over the obligational authority then available in fiscal year 1959, including $154,619,532 transferred from the Defense Department to NASA shortly after it became operative. This represented a reduction of $45.5 million in the overall budget estimates.42

H. R. 7978 was passed by the House on June 29, 1959. Since several technical points of order were sustained when the measure was debated on the House floor, the House Appropriations Committee's reduction of NASA's appropriation was increased from $45,500,000 to $68,225,000. The overall reductions may be tabulated as follows:

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Amount Requested</th>
<th>Reported by Committee</th>
<th>House Action</th>
<th>Final Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1959 supple.</td>
<td>$45,000,000</td>
<td>$41,400,000</td>
<td>$18,675,000</td>
<td>59%</td>
</tr>
<tr>
<td>1960 regular</td>
<td>485,300,000</td>
<td>443,400,000</td>
<td>443,400,000</td>
<td>9%</td>
</tr>
<tr>
<td>Totals</td>
<td>$530,300,000</td>
<td>$484,800,000</td>
<td>$462,075,000</td>
<td>13%</td>
</tr>
<tr>
<td>Net Cut</td>
<td>-$45,500,000</td>
<td>-$ 68,225,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


The areas in which the reductions were made by the House in H. R. 7978 are summarized below.

**Salaries and Expenses.** 1960 Regular--Under this title, $91,400,000 was approved by the House Appropriations Committee or a decrease of $3,030,000 in the budget estimate. The amount recommended provided for a staff of 9,836 employees for fiscal year 1960. This denied salaries for 150 of the requested 1,027 new employees and cut by 10 per cent the supporting expenses required under the "Salaries and expenses" appropriation. The House also reduced NASA's budget estimate for travel funds by approximately 10 per cent. The basis for these cuts was not stated. 44

**Research and Development.** 1959 Supplemental--The budget estimate for 1959 supplemental was $20,750,000 for research and development to be devoted entirely to Project Mercury. The House Appropriations Committee recommended $18,675,000. This item was deleted by the House on a point of order, but was added to the 1960 regular appropriation. 45

1960 Regular--The House Appropriations Committee cut the 1960 research and development appropriation by 10 per cent


to $300 million. No basis for the decrease was reported.
During debate, the House increased the research and development appropriation to $318,675,000 to partially compensate for deletion of the 1959 item, as noted above. The Appropriations Committee had inserted language that would require specific prior approval of the congressional legislative committees on items of a capital nature in excess of $250,000, instead of mere notification. In this connection, the Committee commented: "The legislative committees keep the authorized program under their control and this prevents the handing over of blank checks to the agency." This provision was deleted on a point of order during debate and the House inserted a new proviso requiring fourteen days notification to the congressional committees before funds may be available for other items of a capital nature that exceed $250,000.46

Construction and Equipment. 1959 Supplemental--The House Appropriations Committee recommended $22,725,000 for construction and equipment, as compared with the budget estimate and authorization of $24,250,000 supplemental for 1959. This item covered modernization and expansion of the Jet Propulsion Laboratory, and additional tracking and propulsion development facilities. The entire item was deleted by the

House on a point of order. 47

1960 Regular--The House Appropriations Committee recommended an appropriation of $52,000,000 for construction and equipment in lieu of the $57,800,000 authorized, a reduction of 10 per cent. All items proposed were approved, but the Committee believed that the NASA could effect savings in the overall program to the extent of the reduction; stating that "If additional sums are needed they can be obtained from other available appropriations under the 5 per cent transfer authority included in the bill." 48

The Committee inserted language in H. R. 7978 limiting the authorization for acquisition or condemnation of real property to Cleveland, Ohio. No basis was given for this insertion. This new language would prevent acquisition at other locations if required pursuant to reprogramming under the authority of the authorizing legislation for fiscal 1960. The House also inserted a provision similar to the one inserted in connection with research and development appropriation preventing obligation of construction and equipment funds for


fourteen days after the congressional legislative committees have been notified. 49

Senate Action on H. R. 7978

On July 13, 1959, the Senate Committee on Appropriations opened its hearings on the "Supplemental Appropriation Bill for 1960," H. R. 7978. Senator Lyndon B. Johnson appeared before the Committee and urged that appropriate action be taken to reinstate the full $68,225,000 cut by the House. He stated that he was convinced "... if the administration has erred at all in this field, it has erred in the field of conservatism in appropriations rather than exaggeration or extravagance." 50

Senator John Stennis, Chairman of the NASA Authorization Subcommittee of the Senate Committee on Aeronautical and Space Sciences, testified on behalf of his Subcommittee. He stated in part:

We on the subcommittee that held the hearings were favorably impressed indeed with Dr. Glennan and Dr. Dryden and their very fine staff. Dr. Glennan was very frank in his statements about the cost of these projects, that some of them might be more, and some might be less.

However, we went through every item and did not recommend reduction of one dollar in the overall program, and that passed the floor, as the majority leader said, by these overwhelming votes. But there was a technical


50 Ibid., pp. 3-4.
point of order raised on the floor of the House that resulted in the deletion of some funds. These funds were rejected not on the merits, as I understand it, but simply because of a technicality..."51

Here is how the cut occurred. The 1960 authorization bill was signed on June 15, 1959, as Public Law 86-45. The House, however, still had not taken action on NASA's 1959 supplemental appropriation, although the legislative authorization (Public Law 86-12) for such appropriation items had been available since April 22, 1959, and the House Appropriations Subcommittee's hearings had concluded on May 1, 1959.52

A point of order to NASA appropriations by Representative Gross, Republican of Iowa, was sustained on the basis that Section 4 of Public Law 86-45 (the 1960 authorization bill) had, in effect, repealed the authorization for the 1959 supplemental funds. Section 4 stated that no appropriation may be made to NASA unless previously authorized by legislation "hereafter enacted" by Congress. Senator Stennis pointed out that when Congress passed the 1960 authorization for NASA, it had "absolutely" no intentions to nullify the fiscal year 1959 supplemental authorization that had been provided earlier under Public Law 86-12.53 The loss of the $45 million supplemental items was only partially restored by the House in amending the 1960 funds by $18,675,000.

51Ibid., p. 4. 52Ibid., p. 5. 53Ibid.
In his testimony before the Senate Committee on Appropriations, Dr. Glennan expressed his deep concern over the crippling reductions and recommended changes to the NASA items in H. R. 7978 as passed by the House on June 29, 1959. One of the most serious cuts was in the area of research and development. Dr. Glennan emphasized that a research and development program of the complexity and magnitude such as the NASA's could not "be turned on and off at a moment's notice." He said, "Having made the decision to enter the race, and for many other important reasons, we must pursue with vigor an imaginative, well-planned program." 54

On July 31, 1959, the Senate Committee on Appropriations reported H. R. 7978 (Senate Report No. 597) recommending full restoration of the cuts made by the House to provide the total budget estimate of $530,300,000 for NASA. The measure passed the Senate as amended on August 3, 1959. 55

Conference Committee Action

A committee of conference met on August 18, 1959 to iron out the differences between the two versions. Several of the proposed amendments were reported in disagreement. The

54 Ibid., pp. 19-21.

following are the major amendments agreed to in conference:

1. Authorized a maximum of $2,885,000 for travel expenses proposed by the House instead of $3,181,000 proposed by the Senate.

2. Appropriated $91,400,000 for salaries and expenses proposed by the House in lieu of $94,430,000 proposed by the Senate.

3. Authorized the purchase of 32 passenger-carrying vehicles, 19 of which will be for replacement purposes, as proposed by the House instead of 65 and 38, respectively, as proposed by the Senate.

4. Appropriated $318,675,000 for research and development proposed by the House instead of $333,070,000 proposed by the Senate.

5. Retained House language relating to expenditures of a capital nature under research and development appropriation.

6. Retained House provision relating to the acquisition or condemnation of real property at Cleveland, Ohio.

7. Appropriated $52,000,000 for construction and equipment proposed by the House rather than $57,800,000 proposed by the Senate.

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8. Retained House provision relating to notification of intention to construct or modify research facilities using construction and equipment funds.

On September 1, 1959, President Eisenhower signed H. R. 7978 as Public Law 86-213, and cited as the "Supplemental Appropriation Act, 1960" (73 Stat. 437). In addition to the provisions agreed to in conference, the Act appropriated additional funds which were authorized under the fiscal year 1959 supplemental authorization (Public Law 86-12) as follows:

1. An additional amount for research and development as authorized by Public Law 86-12, $16,675,000, to remain available until expended; and

2. An additional amount for construction and equipment, as authorized by Public Law 86-12, $21,825,000, to remain available until expended.

These additional funds brought NASA's 1959 supplemental and 1960 regular appropriations to a total of $500,575,000, a cut of $29,725,000. This reduced the salaries and expenses fund by $3,030,000, the research and development funds by $18,470,000, and the construction and equipment funds by $8,225,000.
CHAPTER VI

NASA'S LONG-RANGE PROGRAM AND BUDGET FOR FISCAL YEAR 1961

"The budget process is never ending. It is continuous, one fiscal period overlapping the other in terms of work being done. It is never perfect, but being perfected. Of necessity, it is a pilgrimage, not a destination."

Dr. Catheryn Seckler-Hudson

I. NASA'S 10-YEAR PLAN

The NASA budget request for fiscal year 1961 was presented to Congress against the backdrop of a long-range program of space exploration, referred to as the 10-Year Plan, calling for 275 launchings over the next decade at an estimated cost of $12 to $15 billion. The long-range program was developed under the direction of Dr. Homer J. Stewart, Director of NASA's Office of Program Planning and Evaluation.

In presenting the long-range program to the NASA Authorization Subcommittee of the Senate Committee on Aeronautical and Space Sciences, Dr. Glennan noted that except for three experiments using higher thrust Atlas rockets, all of this country's launchings have employed the 150,000-pound-

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thrust Thor and Jupiter rockets. The Russians have had at their command powerful rockets estimated in the 600,000 to 800,000-pound-thrust range. Dr. Glennan pointed out that:

This disparity in thrust enables the Soviet Union to undertake very difficult space missions, some of which are completely denied to us today. It is reasonable to assume that the Russians can move more rapidly from concept, to drawing board, to the construction and launching of payloads because they are not limited by the weight restrictions we are experiencing.

I suspect . . . that they can avoid the time-consuming business of miniaturization, optimum-packaging, and other weight-saving practices. Moreover, their ability to carry heavy payloads improves the probability of success in any particular experiment because they have adequate weight-carrying margins to permit the employment of redundancy or duplication in many elements of their guidance, control, and communications subsystems.2

Dr. Glennan assured the Subcommittee that urgent and effective efforts were being made, both by the NASA and the Department of Defense, to develop a family of launch vehicle systems designed to correct this imbalance. He explained that NASA was developing a small group of multipurpose launch vehicles which, through repeated use by the NASA and the Department of Defense, should become very reliable launch vehicle systems. The family will consist of the Scout, the Atlas-Agena B, the Thor-Agena B, the Atlas-Centaur, the Saturn and the Nova vehicle type. All of these will be NASA's development responsibility, except the Agena B stages to be used with the Thor and Atlas rockets. (The launch vehicle development

2Ibid., pp. 16-17.
program will be taken up in some detail later.) Dr. Glennan
told the Subcommittee that by 1965 the two competing space
programs should be on a par. He said that before the end of
1964, the Saturn launch vehicle will be operational and
doubted that the Soviet Union would exceed the United States
in thrust capability after that time.3

In concluding his presentation of NASA's space program
for the 1960's, Dr. Glennan told the NASA Authorization Sub-
committee that:

Long-range objectives can and have been set. In the
early years of the decade we suggest dates by which
 technological progress should permit us to attain par-
ticular objectives. This plan will be updated annually
to serve as the guide for our programing activities.

The 10-year plan . . . will call for somewhat more
than $1 billion in fiscal year 1962 and upwards of $1½
billion annually within the next 5 years.

One of the characteristics of research and develop-
ment activities in any field is that useful and pro-
ductive work cannot be expected if the support is pro-
vided on a start-stop basis.

Fluctuations between great extremes result in good
people leaving the program. It is extremely important
that we develop an imaginative, technologically sound
program which can be supported on its merits as one
promising real values—not necessarily immediately
important in an economic sense—but promising real
values in the on-going development of man, his society,
and this Nation. We believe we have developed such a
program.4

3Ibid., pp. 17, 40-41.
4Ibid., pp. 21-22.
The anticipated growth in spacecraft weight from year to year during the 10-year period is depicted graphically in Figure 6 (Anticipated Growth of NASA Spacecraft Size).\(^5\) Spacecraft is a new term used to denote that part of the space vehicle intended to be placed in an Earth orbit or launched into space on a departure trajectory from the Earth. The term includes the useful payload in the form of "propulsion, attitude controls, and guidance units for maneuvering the spacecraft as well as the instrumentation for the experiments to be undertaken."\(^6\)

For the purposes of comparison, Figure 6 measures the spacecraft weight that can be launched into a low altitude Earth orbit of approximately 300 miles. During the next decade the spacecraft weight for this near-Earth satellite mission will increase from 100 pounds of Juno II to over 50,000 pounds. The increasing capabilities in the early years will come through the successive utilization of the Thor-Agena B, the Atlas-Agena B, and the Atlas-Centaur vehicles. In the 1963-1967 time period, the increased capability will be attributable to the use of Saturn (first-stage) and its successively improved upper stages based on the use of liquid hydrogen and liquid oxygen fuels. By 1967 the NASA should

\(^5\)The information in this Figure was extracted from Chart 1 in *Ibid.*, p. 19.

ANTICIPATED GROWTH OF NASA SPACECRAFT SIZE

(IN TERMS OF THE WEIGHT OF A NEAR EARTH SATELLITE)

FIGURE 6
have the capability of placing into low Earth orbits payload weights of approximately 25 times the magnitude of those now available. 7

The key to accomplishment of many space missions is the performance of the launch vehicle system. 8 To further define the framework of the long-range plan, consideration must be given to NASA's projected launching schedule which is illustrated in Figure 15 (Anticipated Major Vehicle Launching Schedule by Vehicle), 9 located in Appendix B. This illustrates in general terms the numbers of each vehicle launching scheduled for the last two quarters of 1960, four quarters in 1961, and for each fiscal year thereafter during the 10-year period. 10


9This figure is the official chart of the NASA as shown in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Hearings on H. R. 10809, Part 1, op. cit., p. 20.

10U. S. Congress, House, Committee on Science and Astronautics, Review of the Space Program, Hearings, Part 1, op. cit., p. 188.
By fiscal year 1962 and beyond, the present variety of first-stage launch vehicles should be reduced to only one solid-propellant rocket, the Scout, and three liquid propellant rockets—Thor, Atlas, and Saturn. The restriction on the number of vehicle types was planned in the interest of achieving reliability through repetitive use of the same vehicle. Beyond the Saturn series of vehicles, the plan provides for use of chemical fuels which will lead to a vehicle concept known as "Nova," with four to six times the first-stage thrust of Saturn, based upon the use of the F-1 engine currently under development. Depending on funding levels, the development testing on such a vehicle should occur after 1965.11

Experiments scheduled for the next decade will require about thirty major launchings per year, but the spacecraft weight will soon become greater than those available now. Dr. Dryden has pointed out that the "cost of the spacecraft will soon exceed that of the vehicle and the leadtimes for their development will increase considerably."12 During the next decade of space activities, sixty-two launchings are contemplated

11U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Hearings on H. R. 10809, Part 1, op. cit., p. 20. Nova is not a vehicle, but is one of the various possible vehicle configurations which has been under consideration for use of the F-1 engine.

for development of launch vehicles, forty-one for investigations related to manned space flight, ninety-six for scientific satellite investigations, thirty-three for lunar and planetary scientific missions, and twenty-eight for satellite applications.¹³

The 10-Year Plan included a list of mission target dates, Figure 16 (NASA Mission Target Dates),¹⁴ located in Appendix B. The missions ranged from the first launching of a meteorological satellite in calendar year 1960, the orbital flight of an astronaut in 1961, to the first launching in a program leading to manned circumlunar flight and to permanent near-earth space station in 1965 to 1967, with manned flight to the moon sometime beyond 1970. Provisions were made for many unmanned missions, which serve to support the later manned missions, such as the first launching of an unmanned vehicle for controlled landing on the Moon in 1963 to 1964, and unmanned lunar circumnavigation and return to Earth in 1964. Additionally, the Plan provided for launchings of unmanned missions to the vicinity of Mars and Venus in 1962 and 1964, as well as the first launching of an orbiting astronomical


¹⁴This figure is the official chart of the NASA as submitted in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Hearings on H. R. 10809, Part 1, op. cit., p. 21.
and radio astronomy observatory in the 1963 to 1964 period.\textsuperscript{15}

Mr. Richard E. Horner, NASA Associate Administrator, pointed out that the capacity of the spacecraft and the projected launching schedule are both a prerequisite for and a product of the proposed missions to be accomplished. The interplay between such schedules clearly is indicated in the mission target dates. Figure 16 reflects the probable pace of technological development for the next several years, provided the funds necessary to maintain this pace are made available.\textsuperscript{16}

Already, in calendar year 1960 NASA has scored successes in launching the meteorological satellite, TIROS, and the communications satellite, Echo. In addition, the first complete four-stage Scout vehicle was launched on July 1, 1960 from Wallops Island, Virginia.\textsuperscript{17}

According to \textit{Missiles and Rockets} magazine, it was


\textsuperscript{17}National Aeronautics and Space Administration, Fourth Semiannual Report to Congress, April 1, 1960 Through September 30, 1960 (Washington: National Aeronautics and Space Administration, 1961), pp. 2-4.
calculated that NASA's 10-Year Plan would render two results: (1) to stop the mounting criticism that this nation has no organized national space program, and (2) to lay down a long-range program that will not be affected from election to election. The general consensus is that one of the important needs of the nation's space program is a continuity of effort and support not affected by changing administrations. Dr. Glennan has repeatedly supported this thinking. In a recent address he summed up his convictions as follows:

The nation's space exploration program is not and should not be the subject of partisan politics. The rockets that launch our satellites do not bear the insignia of the Republican party or that of the Democratic party. They do not carry the name of one of the military services or the name of my agency. They carry only these words--United States.

They represent the genius, the labor and the devoted efforts of the citizens of this nation, regardless of religion, color or political affiliation. They represent the tax dollars of all the people--your dollars and mine.

I assert then, that the nation's program of space exploration is, and by its very nature should be, the responsible concern of all of our people.

Now let us turn our attention to the NASA authorization request for new obligating authority in fiscal year 1961 and the action taken by Congress on the request.

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18 Missiles and Rockets (February 8, 1960), p. 21.

19 Luncheon Address by Dr. T. Keith Glennan, NASA Administrator, Fifth AFBMD-STL-Aerospace Symposium on Ballistic Missile and Space Technology at the University of Southern California, Los Angeles, California, August 29, 1960, pp. 3-4.
II. NASA AUTHORIZATION FOR FISCAL YEAR 1961 (H. R. 10809)

House Action on H. R. 10809

In accordance with existing law, authorizing legislation must be passed for NASA's 1961 appropriation. The bill authorizing funds for NASA beginning July 1, 1960, was originally introduced on January 26, 1960 by Congressman Overton Brooks as H. R. 9918. The House Committee on Science and Astronautics held hearings on the measure in February and March 1960. Four subcommittees also conducted hearings on the measure during February 1960. After Committee amendments were adopted on February 29, and March 1, 1960, the House Committee on Science and Astronautics directed Chairman Brooks to introduce a "clean" bill. Consequently, House Bill 10809 to authorize appropriations to the NASA for fiscal year 1961 was introduced by Mr. Brooks on March 1, 1960 and referred to the House Committee on Science and Astronautics for consideration. The measure was reported to the House on March 3, 1960, and passed the House on March 9, 1960.20

As passed by the House, H. R. 10809 authorized NASA's appropriation for fiscal year 1961 in the exact amount requested by the Executive branch, $915 million in specific authorizations,

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plus authority for additional "Construction and equipment" appropriations of $5 million. 21

Senate Action on H. R. 10809

On March 28, 1960, the NASA Authorization Subcommittee of the Senate Committee on Aeronautical and Space Sciences opened hearings on H. R. 10809. Senator John Stennis of Mississippi served as Subcommittee Chairman.

The Question of Budget Ceilings. In order to arrive at a sound basis for evaluating NASA's authorization request for fiscal year 1961, the Senate Committee on Aeronautical and Space Sciences attempted to acquire detailed information concerning the step-by-step formulation of the NASA program and budget estimates. Of particular concern to the Committee was the question of whether budgetary ceilings had precluded consideration of NASA's complete funding requirements. In this regard, the Senate Committee found that the testimony had been "somewhat equivocal." When Dr. Glennan was queried on this subject, he responded in a written statement as follows:

The National Aeronautics and Space Administration did not receive at any time a formal budget ceiling from the Bureau of the Budget. During the lengthy series of informal discussions of the NASA's budget estimates with personnel from the Bureau, various areas of possible adjustments were, from time to time, discussed which,
if accepted, would have produced a NASA budget of approximately $550 million, exclusive of the Saturn responsibility. However, the NASA did not accept these unofficial suggestions and they were not reflected in the final official recommendations of the Bureau of the Budget to the President. The estimates currently before the Congress . . . have been completely supported by the Bureau of the Budget.22

While the Senate Committee was convinced that no formal written budget ceiling had been established, it was not clear however, whether the NASA programs and budget for fiscal year 1961 were "considered on the basis of national needs, without reference to a preconceived dollar level."23

Summary of NASA's Budget Preparation. After about six months of continuing review at both the field level and Headquarters, NASA submitted to the Bureau of the Budget its detailed fiscal year 1961 budget estimates totaling $1,048,300,000. The official amount requested from Congress was $915 million, a reduction of $133,300,000, or approximately 13 per cent.24

The following salient points highlights NASA's chronology of budget preparation for fiscal year 1961:25

1. On September 30, 1959, NASA submitted its formal request for estimates of appropriations to the Bureau of the Budget in the sum of $783,300,000.

2. On October 20, 1959, the NASA Administrator suggested to the President the possibility of a $75 million

22Ibid., pp. 1-2.  
23Ibid., p. 2.  
24Ibid., p. 5.  
25Ibid., pp. 3-4.
reduction in the original NASA estimate of $783,300,000 on the basis of possible savings in NASA's program as a result of the then pending transfer to NASA of the Development Operations Division of the Army Ballistic Missile Agency, along with the responsibility for the Saturn project. The Defense Department's estimate of $140 million for Saturn would be included in the amount requested for NASA.

3. On December 11, 1959, the Bureau of the Budget approved a total of $802 million for inclusion in the President's budget with the stipulation that the amount included $175,873,000 (140 million for the Saturn project) not included in NASA's original estimate submission to cover the proposed transfer of the ABMA Development Operations Division to NASA.

4. On January 14, 1960, President Eisenhower directed Dr. Glennan to make a study of any possible need for additional funds for the rest of fiscal year 1960 and for fiscal year 1961 to speed up the superbooster program for which NASA was given technical and managerial responsibility. The study was to be completed at the earliest practicable date.

5. The President's budget was submitted to Congress on January 18, 1960, which requested $802 million for NASA for fiscal year 1961.

6. On January 26, 1960, the NASA Administrator requested the Budget Bureau to approve amendments to fiscal year 1961 budget, totaling $125 million to accelerate work on the
large booster projects.

7. On February 1, 1960, an amendment to the fiscal year 1961 budget in the amount of $113 million was approved by the Budget Bureau (including an additional $90 million for Saturn).

8. On February 8, 1960, a formal amendment to the 1961 budget was transmitted by President Eisenhower to Congress, increasing NASA's budget request from $802 million to $915 million.

Regarding the proposed $75 million reduction in NASA's budget estimates, the Senate Committee on Aeronautical and Space Sciences reported that no formal amendment was ever submitted to the Bureau of the Budget, nor was this overall $75 million reduction ever "spelled out in terms of programs, projects or even major appropriation accounts." Furthermore, the Committee found that the absorption of the ABMA Development Operations Division actually created additional costs which NASA had to bear at the expense of other space programs, particularly in the field of research and development.26

**Flexibility in NASA's Budget.** The Senate Committee on Aeronautical and Space Sciences made the following statement in reporting the NASA Authorization Act for fiscal year 1960:

It is hardly necessary to point out that the space program is still in its infancy and can be expected to

26Ibid., p. 5.
grow significantly in cost and scope in the years ahead. As a corollary, it must be anticipated that the plans for, and estimated costs of, various individual research and development programs will be subject to continuing change. It is not possible to make precise forecasts for programs in which we are going beyond existing scientific knowledge.\(^{27}\)

Accordingly, the previous year's authorizing legislation provided NASA with considerable reprogramming flexibility which was continued in H. R. 10809. The reprogramming of fiscal year 1960 research and development funds demonstrated the manner in which NASA employed this authority.\(^{28}\)

In view of the previous year's cost experience, the Chairman of the NASA Authorization Subcommittee expressed concern as to whether reprogramming authority alone would provide enough flexibility for fiscal year 1961. Of course this would depend to a large extent on the "tightness" of the NASA budget estimates, and whether the budget request contained any "cushion to ease the impact of unexpected costs or events."\(^{29}\)

The following testimony is pertinent to the point in question:

Senator STENNIS. Last year you made the following statement to this committee:

"The 1960 cost of Project Mercury is $70 million, and before we have completed this first U. S. effort to put man into space, the bill will have exceeded $200 million."

According to your budget justification book, the research and development costs of Project Mercury during fiscal year 1960 are now estimated at more than $87 million and the construction and equipment costs

\(^{27}\)Ibid., p. 6. \(^{28}\)Ibid., pp. 6, 25. \(^{29}\)Ibid., p. 6.
of the Mercury project net are estimated at $17,750,000. On this basis, the 1960 costs of Project Mercury are $105 million compared with the $70 million you estimated last year.

Similarly, Mr. Johnson, General Counsel of NASA, stated in a speech on December 10 that the total costs of the Mercury project over a 4-year period are likely to run around $350 million. This is almost double your estimate made at the beginning of the year.

Could you tell us in some detail what factors have been responsible for this significant increase in the estimated cost of the Mercury project?

Dr. GLENNAN. At the time of the $200 million estimate in February 1959, Project Mercury had been underway for only 5 months. A whole new area of technology was to be explored for the first time; there were no precedents or experience factors to go on in projecting the total program cost. Cost projections were made on what, at that time, seemed a realistic basis. Since that time, experience has dictated that the scope of the project be increased to insure accomplishment of the original program objectives in the safest possible manner. As a result of this increase in scope, the total number of Mercury capsules on order has been increased from 12 to 24; the number of Atlas boosters has been increased from 10 to 15; and the total number of flights with full-scale capsules has been increased from 27 to 33.

Contractor costs have been appreciably higher than contractor estimates. These costs increases of course show up directly in increased overall project cost.30

Dr. Glennan further indicated that the fiscal year 1961 budget estimates did not include funds specifically for backup boosters or launch vehicles for individual shots, in case a failure occurred. In view of the reductions in NASA's total budget request originally submitted, which have been indicated earlier, the flexibility in assigning backup

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30 Ibid., pp. 6-7.
vehicles to provide a greater degree of reliability for planned experiments was also reduced. 31

**Senate Amendments.** The Senate Committee on Aeronautical and Space Sciences made two substantive amendments in H. R. 10809, and reported the bill on April 29, 1960 accompanied by Senate Report 1300. The measure passed the Senate as amended on May 3, 1960, and on that date the Senate requested a conference to consider the disagreeing votes of the two Houses on the Senate amendments. 32 On one of these amendments the Senate receded, and on the other the House receded.

The first of the substantive Senate amendments increased the authorization from $915 million to $970 million. This included $50 million of emergency authorization for "Research and Development," to be available for expenditure to defray the cost of research and development activities which the NASA Administrator determines to be urgently required in the national interest to exploit technological or scientific breakthroughs; to insure safety of personnel; to fund required changes in the research and development program; and to provide for unusual cost variations in research and development activities. Also included was a $5 million emergency

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31Ibid., p. 8.

authorization for "Construction and Equipment." The Conference Committee was receptive to the Senate amendment and it was agreed to in order to assure that neither the space program nor the safety of personnel are jeopardized by the lack of sufficient funds.33

The second Senate amendment of a substantive nature deleted Section 4 of the House bill, which amended the Space Act to increase the number of "excepted" NASA positions by 30, from 260 to 290, with 13 rather than 10, of these positions authorized to be paid salaries up to $21,000. The remaining positions would fall within the salary range of $14,000 to $19,000. The Senate Committee on Aeronautical and Space Sciences believed that NASA had made a valid case for authorizing the 30 additional top-level positions in order to attract and hold high-caliber personnel, but in view of the request of the Chairman of the Senate Committee on Post Office and Civil Service, the provision was deleted from the Senate bill. The House took the position that these additional positions were essential and that the "space program could be expected to be slowed down if NASA was restricted in its efforts to employ first-class personnel." Accordingly, the Senate receded

to the House position.34

Conference Report 1629 was approved by the House on May 23 and it was adopted in the Senate on May 24, 1960.35 President Eisenhower signed H. R. 10809 on June 1, 1960 as Public Law 86-481 (74 Stat. 151).

The authorizations, in terms of NASA appropriations, for fiscal 1961 were as follows:36

Regular Authorizations:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and expenses</td>
<td>$170,760,000</td>
</tr>
<tr>
<td>Research and development</td>
<td>621,453,000</td>
</tr>
<tr>
<td>Construction and equipment</td>
<td>122,787,000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$915,000,000</strong></td>
</tr>
</tbody>
</table>

Emergency Authorizations:

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research and development</td>
<td>$ 50,000,000</td>
</tr>
<tr>
<td>Construction and equipment</td>
<td>5,000,000</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$ 55,000,000</strong></td>
</tr>
</tbody>
</table>

**Grand Total** $970,000,000

III. NASA APPROPRIATION FOR FISCAL YEAR 1961 (H. R. 11776)

The appropriation for the above authorization was contained in H. R. 11776, the "Independent Offices Appropriation

34 Ibid., p. 4; and U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Senate Rept. No. 1300, op. cit., p. 23.


36 Public Law 86-481, 74 Stat. 151.
House Action on H. R. 11776

After hearings were held, the House Committee on Appropriations reported H. R. 11776 with amendments on April 14, 1960, accompanied by House Report 1519. The Committee recommended an appropriation of $876,015,000 for NASA for fiscal year 1961, a reduction of $38,985,000 in the budget estimates. The bill was passed by the House of Representatives on April 20, 1960. The House cut of $38,985,000, when related to the $915 million requested by NASA and authorized by Congress, amounted to four per cent. In reporting the bill to the full House, the Committee on Appropriations suggested specific reductions in the program items, and in some cases complete deletion.38

Salaries and Expenses. The House Committee on Appropriations recommended $166,500,000 for salaries and expenses, a reduction of $4,260,000 in the budget estimates. The Committee cut about 16 per cent from the NASA budget request for travel funds, reducing the request from $5,849,000 to $4,900,000. The basis for this decrease was not reported.

3786th Congress, 2d Session.

The House bill provided for 16,000 jobs, an increase of 5,989 in fiscal 1961, but did not specify where the increase in staff should be applied.\textsuperscript{39} The House Committee was especially critical of the staffing level that was proposed for the Washington Headquarters, stating that this office was already overstuffed in numbers of positions and salary grades, including the number of excepted positions. It also decreased the authorization for purchase of passenger motor vehicles by 25 per cent, from 60 to 45.\textsuperscript{40}

\textbf{Research and Development.} In the research and development account, the House bill proposed a total reduction of $19,213,000 in the budget estimate. Of this amount, $5,135,000 was proposed as a reduction in the amount requested for support of NASA plant. The level of support for research grants and contracts was reduced by $5 million, a 50 per cent cut. The House Committee on Appropriations gave no explanation for the reductions, except that the $2,750,000 cut in Project Mercury was intended as a "token" reduction. It allowed full $277,608,000 requested for rocket and rocket vehicle development,

\textsuperscript{39}This denied salaries for 373 of the requested 962 new employees (exclusive of the 5,400 positions at the Marshall Center, most of which were in the nature of a transfer from Army funding to NASA in 1961). \textit{Ibid.}, p. 238.

including the Saturn program. The Committee directed that closer attention be given to contractor costs. It asserted, "This is the field that invites the most waste." 41

Table III shows the budget estimates and the amounts recommended by the House Committee on Appropriations for all of NASA's research and development programs.

Construction and Equipment. In the construction and equipment account, the House bill made an overall reduction of $15,512,000 in the budget estimate. Four specific construction projects were disallowed; funds requested for fallout shelters were deleted; and unspecified reductions totaling $8,018,700 were made with the observation of surprise at the high square-foot cost of construction for most of the buildings proposed in the program. 42

House bill H. R. 11776 was referred to the Senate Committee on Appropriations for consideration.

Senate Action on H. R. 11776

On May 19, 1960, the Subcommittee of the Senate Committee on Appropriations opened hearings on NASA's appropriation for


### TABLE III

SUMMARY OF NASA BUDGET ESTIMATES FOR RESEARCH AND DEVELOPMENT PROGRAMS FOR FISCAL 1961 AND AMOUNTS RECOMMENDED BY THE HOUSE COMMITTEE ON APPROPRIATIONS*  

<table>
<thead>
<tr>
<th>Program</th>
<th>Budget Estimates</th>
<th>Recommended in House Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aeronautical &amp; space research:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support of NASA plant</td>
<td>$51,345,000</td>
<td>$46,210,000</td>
</tr>
<tr>
<td>Research grants &amp; contracts</td>
<td>10,000,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td><strong>Scientific investigations in space:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sounding rockets</td>
<td>8,000,000</td>
<td>7,600,000</td>
</tr>
<tr>
<td>Scientific satellites</td>
<td>41,700,000</td>
<td>40,000,000</td>
</tr>
<tr>
<td>Lunar &amp; planetary exploration</td>
<td>45,000,000</td>
<td>45,000,000</td>
</tr>
<tr>
<td><strong>Satellite applications:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteorology</td>
<td>20,700,000</td>
<td>19,500,000</td>
</tr>
<tr>
<td>Communications</td>
<td>5,600,000</td>
<td>5,400,000</td>
</tr>
<tr>
<td>Manned space flight</td>
<td>107,750,000</td>
<td>105,000,000</td>
</tr>
<tr>
<td>Vehicles systems technology</td>
<td>21,200,000</td>
<td>20,000,000</td>
</tr>
<tr>
<td><strong>Space propulsion technology:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid rockets</td>
<td>2,800,000</td>
<td>2,800,000</td>
</tr>
<tr>
<td>Liquid rockets</td>
<td>63,000,000</td>
<td>63,000,000</td>
</tr>
<tr>
<td>Nuclear systems technology</td>
<td>10,000,000</td>
<td>10,000,000</td>
</tr>
<tr>
<td>Space power technology</td>
<td>8,000,000</td>
<td>8,000,000</td>
</tr>
<tr>
<td><strong>Vehicle development:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DELTA</td>
<td>12,500,000</td>
<td>12,500,000</td>
</tr>
<tr>
<td>CENTAUR</td>
<td>47,000,000</td>
<td>47,000,000</td>
</tr>
<tr>
<td>SATURN</td>
<td>134,308,000</td>
<td>134,308,000</td>
</tr>
<tr>
<td>Tracking and data acquisition</td>
<td>32,550,000</td>
<td>30,922,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$621,453,000</td>
<td>$602,240,000</td>
</tr>
</tbody>
</table>

fiscal year 1961. Senate Majority Leader, Lyndon B. Johnson, and Senator Thomas E. Martin appeared before the Subcommittee and urged that the $38 million-plus reduction made by the House in NASA's appropriation be restored, thus providing at least the full budget estimate of $915 million. 43

NASA took the position that the House action could not be accepted without jeopardy to the Nation's long-range position in the aeronautical and space fields, and therefore requested full restoration of the House reduction. NASA supported this position with convincing testimony and item-by-item justification. In his prepared statement, Dr. Glennan observed that, although NASA had been in operation for only eighteen months, this was the second consecutive year the agency had to come back to Congress and request restoration of cuts in its original budget estimates. 44

NASA officials testified that no allowance was made in the budget request for contingencies, cost increases, or unplanned modifications in its program, "despite the fact that the short history of the space program has been characterized by gross underestimates of the costs." An example cited was the estimates for Project Mercury. In February of 1959, Project Mercury was officially estimated at a total of $200

44 Ibid., pp. 238-241, 248.
million. The fiscal 1960 budget was based on this estimate, but by December 1959, the cost estimate had increased to $350 million, an increase of $150 million in less than one year.45

Similarly, Dr. Glennan testified that during fiscal 1960, there had been significant cost overruns in other program areas, such as Tiros I and its booster, and on the Pioneer V and Explorer satellites. He pointed out that:

These unforeseen cost increases have had to be covered at the expense of other programs since no contingency funds were provided. Some of these programs have been reduced in scope, others deferred as we robbed them to get on with the more immediate tasks.46

At the hearings, Dr. Glennan observed that the costs overrun estimates in research and development operations for many reasons, the most important being that, by definition, research extends into the "unknown" where precise estimates were impossible to achieve in many areas. Nevertheless, NASA's policy was to budget tightly, Dr. Glennan declared, "because we believe it the most sound method of fiscal operation and because we believe the Congress would not want us to do otherwise." He continued, "But, we still face the fact . . . that we are in the Kitty Hawk stage of an exceedingly


46Ibid.
costly, rapidly developing technology. . . . What this adds up to is that at this stage in the development of the Nation's program, our activities are apt to get ahead of our estimates.\textsuperscript{47}

The Senate Committee on Appropriations took cognizance of the fact that NASA had already identified more than $20 million of additional costs not covered by the budget request for fiscal 1961. Accordingly, the Committee recommended research and development appropriation in the full amount authorized by Congress, $671,453,000 (which included emergency authorization of $50 million).\textsuperscript{48}

Regarding the "Salaries and Expenses" and "Construction and Equipment" accounts, the Senate Committee on Appropriations recommended restoration of the House cuts to provide the full budget estimates of $170,760,000 and $122,787,000, respectively. The Committee also recommended an increase in the travel limitation by $949,000 to provide the budget estimate of $5,849,000.\textsuperscript{49}

Under the General Provisions, the Senate Committee on Appropriations added a proviso allowing $20,000 for scientific consultation and emergency or extraordinary expense, as

\textsuperscript{47}\textit{U. S. Congress, Senate, Committee on Appropriations, Independent Offices Appropriations, 1961, Hearings on H. R. 11776, op. cit., p. 257.}

\textsuperscript{48}\textit{U. S. Congress, Senate, Committee on Appropriations, Independent Offices Appropriation Bill, 1961, Senate Rept. No. 1611, op. cit., p. 10.}

\textsuperscript{49}\textit{Ibid.}, pp. 10-11.
authorized. The House had deleted this entire provision on a point of order on the basis that the required authorization had not been enacted prior to the House action on the appropriation bill for fiscal 1961.  

The Senate Committee on Appropriations reported H. R. 11776 with amendments on June 17, 1960, and the Senate approved the measure as amended. The two versions of H. R. 11776 were referred to conference.

Conference Committee Action on H. R. 11776

On June 30, 1960 the House-Senate conferees reached agreement on the Independent Offices Appropriation Bill for 1961 (H. R. 11776). The Committee of Conference agreed to the Senate amendments relating to NASA appropriation with the following three exceptions:

1. Authorized $5,375,000 for travel expenses instead of $4,900,000 proposed by the House and $5,849,000 proposed by the Senate.

2. Appropriated $621,453,000 for research and development as requested in the budget estimates instead of $602,240,000 proposed by the House and $671,453,000 proposed by the Senate.

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3. Under General Provisions, authorized $10,000 of NASA's appropriation to be available for scientific consultations and any emergency or extraordinary expense, instead of $20,000 proposed by the Senate.


**Summing Up**

Congress appropriated the full $915 million requested in the President's amended budget for NASA. Congress also enacted legislation authorizing an additional $55 million in terms of NASA appropriations--$50 million authorized for emergency "Research and Development" and $5 million authorized for emergency "Construction and Equipment." This action has one advantage. With the approval of the Bureau of the Budget, NASA may request a supplemental appropriation in the amount authorized without securing further authorization from Congress.

The remainder of this chapter is devoted to a review and analysis of the contents of NASA program requirements for fiscal year 1961, with emphasis on the major projects, Mercury and Saturn.
IV. ANALYSIS OF NASA PROGRAM REQUIREMENTS--
FISCAL YEAR 1961

NASA's budget request was divided into three major functional areas of activities or appropriations as shown in Figure 7: $621,453,000 for "Research and Development"; $170,760,000 for "Salaries and Expenses"; and $122,787,000 for "Construction and Equipment." The request may also be broken down by program, Figure 8, as follows: $129,379,000 for the Office of Advanced Research Programs, which is concerned with advanced aeronautical and space research; $370,132,000 for the Office of Space Flight Programs, which is charged with the responsibility for mission planning, payload design and in-flight research and operation; $403,023,500 for the Office of Launch Vehicle Programs, which is concerned with developing and launching rocket vehicles; and $12,465,500 for program direction (about one and one-half per cent of the entire budget), which includes NASA Headquarters' operation and coordinating activities throughout the United States.52

This represented an increase over the previous year of about $530 million, which indicates the tremendous growth and importance of NASA's programs. The 1961 estimates reflect the

FY 61 BUDGET REQUEST
$ 915,000,000

R & D
$ 621,453,000
(68\%)

C & E
$ 122,787,000
(13.4\%)

S & E
$ 170,760,000
(18.6\%)

FIGURE 7
NASA FY 1961 BUDGET
$ 915,000,000

BY PROGRAM

- **SPACE FLIGHT**
  - 370,132,000
  - (40.4%)

- **LAUNCH VEHICLE**
  - 403,023,500
  - (44%)

- **DIRECTION**
  - 12,465,500
  - (1.5%)

- **ADVANCED RESEARCH**
  - 129,379,000
  - (14.1%)

**FIGURE 8**
anticipated transfer to NASA of the Development Operations Division of the Army Ballistic Missile Agency and funding for the Saturn project, and additional funds to accelerate large booster development. The two highest priority projects, Saturn and Mercury, account for the considerable portion of the increase over fiscal 1960.53

Salaries and Expenses ($170,760,000)

The account for "Salaries and Expenses" has grown from $91,400,000 in fiscal year 1960 to $170,760,000 in fiscal year 1961. This represents an increase of $79,360,000 or 87 per cent over fiscal 1960 appropriation, and is almost double the fiscal year 1959 appropriation of $86,286,300. Approximately 75 per cent of this increase is required for the first full year of funding and 5,500-man staff of the George C. Marshall Space Flight Center at Huntsville, Alabama, transferred to NASA, effective July 1, 1960. Expanding the scope of operations at the Goddard Space Flight Center accounts for approximately two-thirds of the remaining increase in the "Salaries and Expenses" account.54


The proposed budget program reflected an estimated increase in personnel from 10,086 as of June 30, 1960 to 16,373 as of June 30, 1961. No change in employment level is planned for NASA Headquarters. The Langley Research Center, Ames Research Center, Lewis Research Center, and the Flight Research Center will maintain their present staffing levels. Due to increased workloads, plans are to add personnel at the remaining NASA installations. Table IV shows the "Salaries and Expenses" account broken down by NASA installation, indicating the staff levels at each of the installations and the money required for each. The table, however, does not cover personnel employed at the Jet Propulsion Laboratory, since the activities of the Laboratory are funded on a contract basis with research and development funds.

Additional "Excepted" Positions Requested. Section 203(b)(2) of the Space Act authorized NASA to establish 260 positions for scientific, engineering, and administrative personnel of the agency at salaries up to $19,000 per annum, with a provision that ten of these positions could be paid up to $21,000 per annum. Since all other NASA personnel are appointed in accordance with the civil service laws and their compensation fixed in accordance with the Classification Act

TABLE IV

SUMMARY--NASA SALARIES AND EXPENSES FOR FISCAL YEAR 1961 *

<table>
<thead>
<tr>
<th>Installation</th>
<th>Number of Employees at End of Fiscal Year</th>
<th>Salaries and Expenses-- Appropriations</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA Headquarters</td>
<td>428</td>
<td>683</td>
</tr>
<tr>
<td>Langley Center</td>
<td>3,297</td>
<td>3,220</td>
</tr>
<tr>
<td>Ames Center</td>
<td>1,478</td>
<td>1,440</td>
</tr>
<tr>
<td>Lewis Center</td>
<td>2,783</td>
<td>2,736</td>
</tr>
<tr>
<td>Flight Center</td>
<td>336</td>
<td>416</td>
</tr>
<tr>
<td>Goddard Center</td>
<td>782</td>
<td>1,214</td>
</tr>
<tr>
<td>Wallops Station</td>
<td>171</td>
<td>225</td>
</tr>
<tr>
<td>Marshall Center</td>
<td>--</td>
<td>100</td>
</tr>
<tr>
<td>Western Operations</td>
<td>7</td>
<td>32</td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlantic Missile</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Range Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific Missile</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Range Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wright Field Office</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>9,286</td>
<td>10,086</td>
</tr>
</tbody>
</table>

of 1949, it has become customary to refer to these 260 statutory positions as "excepted" positions. When the Space Act was passed, the former NACA personnel who had been drawing salaries above the GS-15 level either by virtue of holding "supergrades" or Public Law 313 scientific positions, were transferred to "excepted" positions and all allotments of "supergrade" and Public Law 313 positions were withdrawn from the NASA.\textsuperscript{56}

At the time it was decided to transfer the ABMA Development Operations Division to NASA, the Division had nineteen supergrade and Public Law 313 positions authorized. Since the Project Director for the Pershing missile program remained with the Department of the Army, his position authorized under Public Law 313 was retained by the Defense Department. The remaining eighteen supergrade and Public Law 313 positions were assigned to the employees of the von Braun team and transferred to NASA along with the incumbents of these positions. Therefore, NASA has authority for a total of 278 positions to be paid above GS-15 level. In the 1961 budget estimates, NASA requested thirty additional excepted positions, which would give it a total of 308 positions for which advanced pay levels above GS-15 would be authorized. Three of the thirty positions would be paid at a rate between the $19,000 to $21,000 salary range. The remaining requested positions

\textsuperscript{56}\textit{Ibid.}, p. 16.
would fall within the salary range of $14,000 to $19,000. 57

The Senate Committee on Post Office and Civil Service Chairman, Olin D. Johnston, was informed of the contemplated action regarding the additional excepted positions requested by NASA. By letter on April 22, 1960, Senator Johnston requested Senator Stennis, Chairman of the NASA Authorization Subcommittee of the Senate Committee on Aeronautical and Space Sciences, to delete the proposed authorization from H. R. 10809 so that his Committee could consider the matter in connection with the total personnel picture of the Federal Government. The Post Office and Civil Service Committee was to begin pay hearings on April 28, 1960. Senator Johnston explained:

Favorable action by your committee at this time on the suggested request of NASA would, in the opinion of this committee, not be advisable and would result in making our task of adjusting all Federal salaries equitably in relation to each other greatly more difficult if not, in fact, virtually impossible. 58

It was for this reason that the provision in question was deleted from the Senate bill.

Research and Development ($621,453,000) 59

The $621,453,000 earmarked for research and development.

57Ibid., pp. 16-19. 58Ibid., pp. 22-23.

constituted approximately 68 per cent of NASA's total budget request for fiscal year 1961. Table V summarizes the NASA research and development programs for fiscal years 1959, 1960 and 1961.

NASA's research and development account for fiscal year 1961 may be broken down into seven major program groups as follows:

<table>
<thead>
<tr>
<th>Program Group</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research at Advanced Research Centers</td>
<td>$61,345,000</td>
</tr>
<tr>
<td>Space Science and Exploration</td>
<td>$94,700,000</td>
</tr>
<tr>
<td>Satellite Applications</td>
<td>$26,300,000</td>
</tr>
<tr>
<td>Manned Space Flight</td>
<td>$107,750,000</td>
</tr>
<tr>
<td>Vehicle System Development</td>
<td>$215,008,000</td>
</tr>
<tr>
<td>Space Propulsion Technology</td>
<td>$83,800,000</td>
</tr>
<tr>
<td>Tracking and Data Acquisition</td>
<td>$32,550,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$621,453,000</strong></td>
</tr>
</tbody>
</table>

Now let us consider in more detail what is actually involved in these programs.

**Research at Advanced Research Centers, $61,345,000**

**Support of NASA Plant.** In support of NASA plant, $51,345,000 was requested to provide for leased communication lines, certain transportation services, contractual services, repairs, alterations and minor construction, materials, supplies and equipment necessary in the operation of all NASA operated facilities. The principal funding increases reflected in the 1961 budget estimates are due mainly to the

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### TABLE V

**SUMMARY--NASA RESEARCH AND DEVELOPMENT PROGRAMS**

**FISCAL YEAR 1961 ESTIMATES***

<table>
<thead>
<tr>
<th>Program</th>
<th>Fiscal Year 1959</th>
<th>Fiscal Year 1960</th>
<th>Fiscal Year 1960 Supplemental</th>
<th>Fiscal Year 1961</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AERONAUTICAL AND SPACE RESEARCH:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support of NASA Plant</td>
<td>$1,097,651</td>
<td>$22,694,000</td>
<td></td>
<td>$31,345,000</td>
</tr>
<tr>
<td>Research Grants and Contracts</td>
<td>3,028,000</td>
<td>4,950,000</td>
<td></td>
<td>10,000,000</td>
</tr>
<tr>
<td>Support of JPL Plant</td>
<td>8,156,500**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SCIENTIFIC INVESTIGATIONS IN SPACE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sounding Rockets</td>
<td>3,555,170</td>
<td>8,811,000</td>
<td></td>
<td>8,000,000</td>
</tr>
<tr>
<td>Scientific Satellites</td>
<td>21,305,114</td>
<td>23,813,000</td>
<td></td>
<td>41,700,000</td>
</tr>
<tr>
<td>Lunar and Planetary Exploration</td>
<td>31,882,607</td>
<td>49,000,000</td>
<td></td>
<td>45,000,000</td>
</tr>
<tr>
<td>Vanguard</td>
<td>21,943,562**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SATELLITE APPLICATIONS:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meteorology</td>
<td>987,550</td>
<td>7,930,000</td>
<td></td>
<td>20,700,000</td>
</tr>
<tr>
<td>Communications</td>
<td>3,574,506</td>
<td>3,170,000</td>
<td></td>
<td>5,600,000</td>
</tr>
<tr>
<td><strong>MANNED SPACE FLIGHT</strong></td>
<td>46,416,333</td>
<td>74,962,000</td>
<td>$12,200,000</td>
<td>107,750,000</td>
</tr>
<tr>
<td><strong>VEHICLE SYSTEMS TECHNOLOGY</strong></td>
<td>1,903,651</td>
<td>6,737,000</td>
<td></td>
<td>21,200,000</td>
</tr>
<tr>
<td><strong>SPACE PROPULSION TECHNOLOGY:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solid Rockets</td>
<td>615,898</td>
<td>3,785,000</td>
<td></td>
<td>2,800,000</td>
</tr>
<tr>
<td>Liquid Rockets</td>
<td>15,976,589</td>
<td>30,328,000</td>
<td></td>
<td>63,000,000</td>
</tr>
<tr>
<td>Nuclear Systems Technology</td>
<td>3,610,496</td>
<td>6,000,000</td>
<td></td>
<td>10,000,000</td>
</tr>
<tr>
<td>Space Power Technology</td>
<td></td>
<td>4,814,000</td>
<td></td>
<td>8,000,000</td>
</tr>
<tr>
<td><strong>VEHICLE DEVELOPMENT:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scout</td>
<td>6,048,000</td>
<td>2,800,000</td>
<td></td>
<td>12,500,000</td>
</tr>
<tr>
<td>Delta</td>
<td>12,927,417</td>
<td>13,300,000</td>
<td></td>
<td>47,000,000</td>
</tr>
<tr>
<td>Vega</td>
<td>14,291,494</td>
<td>4,000,000</td>
<td></td>
<td>13,308,000</td>
</tr>
<tr>
<td>Centaur</td>
<td>4,000,000</td>
<td>37,000,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TRACKING AND DATA ACQUISITION</strong></td>
<td>3,095,674</td>
<td>16,266,000</td>
<td></td>
<td>32,550,000</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>$204,619,532</td>
<td>$320,350,000</td>
<td>$12,200,000</td>
<td>$621,453,000</td>
</tr>
</tbody>
</table>


**Funded under program activities in 1960 and 1961.**
following:

1. Addition of several major new facilities involving high operating costs, such as the Plum Brook research facilities under direction of the Lewis Research Center; the 3.5-foot hypersonic tunnel at Ames Research Center; and the 7-foot thermal structures tunnel at the Langley Research Center.

2. Expensive and increasingly complicated nature of experimental research generally, and on space projects in particular.

3. Large backlog of needed alteration, repair and facility modernization projects.

4. Increased rate of obsolescence with respect to research equipment and instrumentation.

5. Transfer of the ABMA Development Operations Division at Huntsville to NASA.

Research Grants and Contracts. NASA requested $10 million for research grants and contracts, during fiscal year 1961, to enable the agency to utilize most effectively the non-governmental research talents and facilities of the country for conducting fundamental and applied research needed to advance aeronautical and space technology. There is an urgent and continuing need for NASA to augment its present capabilities

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61 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Senate Rept. No. 1300, op. cit., p. 27.
by utilizing, through the medium of research grants and contracts, the research potential of universities and other research organizations of the Nation. Important problem areas may be grouped as follows: physical sciences, cosmological sciences, engineering sciences, bioscience, and socioeconomic studies. 62

Space Science and Exploration, $94,700,000

Sounding Rockets. NASA requested $8 million for sounding rockets for fiscal year 1961. A sounding rocket may be defined as a rocket that can carry a usable scientific payload to a height of up to one earth's radius, i.e., approximately 4,000 miles. Such a vehicle affords a means of studying the Earth's atmosphere in vertical cross section out to a distance at which it merges with the medium of interplanetary space. Exploratory as well as routine experimental programs are possible with relatively simple tracking ranges and launching sites. Moreover, the sounding rocket supplies a means for testing under actual operating conditions, equipment designed for later use in satellites or deep space probes, therefore providing a check on the equipment before it is committed to the more expensive space vehicles. 63

The current NASA program continues the rocket sounding experiments of the past thirteen years, and is directed toward

62 Ibid., pp. 27-29.  
63 Ibid., p. 29.
filling in gaps in the knowledge so far acquired on the Earth's upper atmosphere and in rocket astronomy. The requested funding for fiscal 1961 provided for the continuation of the rocket sounding program at a level of approximately 100 rockets per year.64

Scientific Satellites. The request for scientific satellites totaled $41,700,000. Scientific satellites are used as tools of research to investigate three areas of primary interest to the NASA space sciences program. These are: (a) Investigating the energy transfer relation between the Sun and the Earth, (b) Probing the origins and fundamental workings of our solar system and the universe, and (c) Searching for the origin and distribution of life within our solar system. The program includes the following scientific disciplines or study areas:65

1. Upper atmosphere.
2. The ionosphere.
3. Magnetic and electric fields.
4. Radiation belts.
5. Geodesy and gravitation.
6. Cosmic rays.

64Ibid., pp. 29-30.
7. Solar terrestrial relations.
8. The Sun.
9. The stars.

The knowledge to be acquired should lead to a better understanding of the Earth and man's environment and thus a better use of the environment for the benefit of man. Progress can be cited. The Vanguard III satellite, Explorers VI and VII have already furnished valuable scientific data on the Van Allen radiation belt, the Earth's magnetic field, cosmic rays, micrometeorites, and solar terrestrial phenomena.

Of the $41.7 million requested for this program, $24.2 million will be expended on satellite payloads which almost doubles the amount allocated for this item in fiscal 1960. In connection with program phasing, NASA pointed out:

... the purchase of vehicles and the initiation of preparations of payloads are both long leadtime items. Thus, vehicles purchased in one year are fired 1 or 2 years from the date of purchase. Similarly, the payloads for these vehicles must be started 1 or 2 years in advance of the actual launching.

Lunar and Planetary Exploration. For this program, NASA requested $45 million for fiscal 1961. Program objectives are in part to acquire fundamental physical and chemical

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67 Ibid., p. 33.
data on the Moon and planets; to explore space phenomena; to investigate the surface of nearby environment of the Moon and to measure and describe in detail its characteristics; and to improve the means and techniques for conducting lunar, interplanetary and planetary investigations and explorations. The nearest and most familiar heavenly body to us in our solar system is the Moon. It has been a subject of speculation for thousands of years. It is hoped that the Moon will give the first solutions that will "unlock the secrets" of the origin and evolution of our solar system. The increased scientific knowledge secured from early lunar explorations and space probes and the experience that will result from operation of space flight systems hundreds of thousands of miles from the Earth, should provide the basis for the design of instrumented spacecraft that will eventually explore the planets and deep space.68

Associated with lunar, planetary and interplanetary investigations is the search for extraterrestrial life forms. Since the existence of such life forms is presently unknown, NASA is engaged in a program that will lead to methods and procedures for the sterilization of space probes and payloads.

68 Ibid., pp. 34-35.
Satellite Applications, $26,300,000

At present, the NASA is conducting experiments in two major areas of satellite applications—Meteorology and Communications. NASA's programs in these areas are dependent on the sequence of research, development and experimentation needed to perfect the equipment and associated technology required for practical applications. It should be noted that at present and for the next several years, the agency's projects are extremely experimental in character and may change substantially as new information becomes available.69

Meteorology Satellite Program. In fiscal year 1961, $20.7 million are programmed for funding of NASA's Meteorology program. Objectives are to develop a meteorological satellite capability for worldwide coverage and to provide observations of atmospheric elements needed by the meteorologist to understand atmospheric processes and make weather predictions. Measuring these elements from a meteorological satellite is indeed a unique and challenging assignment. The long-range objective of this program is to develop operating principles for a system of instrumented orbiting satellites that would be linked with a communications network so that worldwide meteorological information may be transmitted swiftly to the National Meteorological Center of the Weather Bureau, Suitland, Maryland,

for its operational uses.  

The Tiros project, originated by the Advanced Research Projects Agency of the Defense Department, was transferred to NASA in April 1959. Participation in this project is indicated in Figure 17, Appendix B. Tiros I, Figure 18 (Appendix B), the first satellite utilized in the meteorological program was successfully launched on April 1, 1960 into an almost perfectly circular orbit about 450 miles above the Earth. For the first time in his history, man was able to "perceive cloud patterns visually on a global scale." Tiros I was a historic milestone toward an operational meteorological satellite system, since it proved the feasibility of satellite observation of cloud cover. Experience gained with Tiros has helped to pave the way for the next generation of meteorological satellites, the Nimbus series, which will provide much greater coverage than did Tiros I. The Nimbus project is just getting underway under the direction of the Goddard Space Flight Center. The first launching of a Nimbus satellite is planned for the latter part of calendar year 1961, with additional launchings to follow until late 1963.  

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71 Ibid., pp. 37-38. Figures 17 and 18 are photographs of the NASA.

Communications Satellite Program. The communications satellite is the second class of applications under development by NASA. The level of funding for this program is $5.6 million for fiscal year 1961. The program objectives are:

... to develop communications satellites and operating techniques for use in a worldwide communications system using satellites as relay stations for ground-to-ground, ground-to-satellite, and satellite-to-ground transmission of messages, data, voice, and television; to develop communications systems for the transmission of scientific data from deep space probes to earth and of commands from earth to deep space probes; and to conduct studies of the application of active relay satellites to civilian and commercial communications.73

During the past two years, NASA has been developing a passive communications satellite known as Project Echo. On August 12, 1960 Echo I (Figure 19 in Appendix B), the world's first passive communications satellite was launched by a Thor-Delta launching vehicle from the Atlantic Missile Range into a near-circular orbit. The sphere was inflated after the satellite was placed in orbit. This highly successful, developmental 100-foot-diameter inflatable sphere weighing about 136 pounds was used primarily to "relay voice messages, facsimile photographs, teletype signals, and two-way telephone conversations."74


There are two primary stations taking part in tracking the Echo communications experiment: the Bell Telephone Laboratories station at Holmdel, New Jersey, and the NASA-Jet Propulsion Laboratory station at Goldstone, California. Echo I, the first launching in a series of Project Echo experiments, is part of a long-range program designed to investigate the feasibility of worldwide communications systems utilizing satellites. Follow-on experiments with the Echo satellite are scheduled to include one launch in 1961 and one in 1962 using the Thor-Delta launch vehicle.75

Manned Space Flight, $107,750,000

"Project Mercury," the current manned space flight program of NASA, represents the Nation's effort to put a man in space. The NASA requested $107,750,000 in support of this effort during fiscal year 1961.

Objectives. The objectives of Project Mercury are three-fold: (1) to put a manned space capsule into orbital flight around the Earth, (2) to recover the capsule and its human passenger safely, and (3) to investigate the psychological and physiological effects of space flight on man. The research will investigate man's reactions to weightlessness during orbital flight, high acceleration during launching, and high

deceleration during reentry into the Earth's atmosphere.\textsuperscript{76}

\textbf{Background.} The Mercury project was first conceived by the Air Force in February 1958 as the man-in-space program under a directive by Mr. Roy W. Johnson, then head of the Advanced Research Projects Agency (ARPA) of the Department of Defense. On October 1, 1958, the first day of NASA's operation, the project was transferred to the new civilian agency and became known as Project Mercury.\textsuperscript{77}

\textbf{Project Management.} The prime responsibility for Project Mercury management rests with the NASA. This responsibility is exercised with the advice and assistance of ARPA through the Joint NASA-ARPA Manned-Satellite Panel. Advice on qualifications and attributes required of the human pilot and advice on other human aspects of Project Mercury is provided by the NASA Special Committee on Life Sciences, composed of members drawn from the Departments of the Army, Navy and Air Force; the Atomic Energy Commission; the Department of Health, Education, and Welfare; and from private life. The detailed direction of the project is the responsibility of the NASA


Space Task Group, which includes as working members, technical and medical personnel from the three military departments. The Space Task Group is an organizational unit of the NASA located at the Langley Research Center. This Group is headed by a Project Director, Robert R. Gilruth, who was an Assistant Director of the Langley Research Center before he was appointed to this post. The Group came into existence on October 7, 1958 with specific responsibility to put a manned satellite into a controlled orbit around the Earth and return it safely.78

During the year preceding the formation of the Space Task Group, Langley personnel had conducted theoretical and experimental studies into the problems associated with manned space flight. NASA Administrator Glennan directed that the group be organized and the Langley Research Center released personnel to the group who formed its nucleus. The Space Task Group reports directly to the Director, Office of Space Flight Programs, NASA Headquarters. The Group drew up the preliminary specifications for a manned space capsule upon which the contractor capsule proposals were based.79 Figure 20 (Appendix B)


79 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Project Mercury: Man-in-Space Program . . . op. cit., Senate Rept. No. 1014, p. 6.
indicates the various organizations participating in carrying out the management responsibilities for the Mercury Project.80

**Capsule Contractor Selected.** In January 1959, the NASA selected from among twelve firms that submitted proposals, the McDonnell Aircraft Corporation, St. Louis, Missouri, as the contractor to design, develop and build the Mercury capsule. The contractor is fabricating 24 one-ton, bell-shaped capsules for this project. By the end of September 1960, six capsules had been delivered to the NASA. Figure 21 (Appendix B) is an artist's conception of the Mercury capsule. Dr. Glennan declared that Project Mercury is the most urgent of NASA's projects. It was approved by the National Aeronautics and Space Council as a program of top national priority and was assigned a DX priority rating.81

**Astronaut Selection and Training Program.** As important as developing a reliable capsule was the selection and training of the capsule's human pilot or astronaut. NASA established rigid criteria for an astronaut. In January 1959, the agency screened the records of some 473 Navy, Air Force, and

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80Figure 20 is a NASA photograph.

Marine Corps officers, all of whom were graduates of test pilot schools. More than one hundred who met the general qualifications volunteered as potential candidates. NASA selected 32 for extensive physical and psychological examinations. The records of the candidates were evaluated by the Space Task Group and seven of the volunteers were chosen to become Mercury astronauts. The astronauts have been receiving extensive technical training and conditioning for space flight. Each astronaut is specializing and contributing to a different aspect of the Mercury Project—control systems, cockpit layout, life support system, communications and navigation, tracking and recovery, and others. Each is responsible for determining within his particular area, whether the Mercury system is ready for manned operation. 82

Mercury System. The space capsule is based upon design principles that required no major technological breakthroughs for successful accomplishment of its mission. The Mercury system consists of the ballistic capsule, fitted with a retrograde and separation rocket package, an emergency escape rocket

and an escape rocket pylon. The ballistic capsule is illustrated in Figure 22 (Appendix B). 83

**Mercury Test Program.** As in the case of new research aircraft, orbital flight of the manned Mercury capsule will take place only after a logical buildup of vehicle capabilities and scientific data. Project Mercury program includes ground testing, development and qualification flight testing and pilot training. 84 A basic concept of Project Mercury is that the safe return of the astronaut must be assured. NASA will not place national prestige above human life. In this connection, NASA Deputy Administrator Dryden has declared:

> All this training of the selected pilots, and all this repeated testing of the rocket and its component parts, are directed toward one end: that the first orbital flight of the Mercury vehicle shall be as nearly routine as human ingenuity and practice can make it. We are determined that the risks to the pilot will be no greater than those experienced during the first flight of a new high-performance airplane.85

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83 U. S. Congress, House, Committee on Science and Astronautics, *Project Mercury First Interim Report*, House Rept. No. 1228, op. cit., pp. 1, 9-11. Figure 22 is a NASA photograph.


Flight Plans. The suborbital flight plans call for a Redstone vehicle to launch the manned Mercury capsule. In the orbital flight, the Mercury capsule will be boosted into orbit by an Atlas launch vehicle from the Atlantic Missile Range, Cape Canaveral, Florida. After the satellite has circumnavigated the globe three times at an approximate speed of 18,000 miles per hour, the capsule will return to Earth and recovery will be made in the Atlantic Ocean near Puerto Rico approximately five hours after take-off. The Atlas vehicle will launch the Mercury capsule along a series of ballistic trajectories before it is employed in orbital missions, as shown in Figure 23 of Appendix B. The Atlas ballistic flights will be unmanned. After completion of the ballistic flight tests, the Mercury capsule and its launch vehicle will be ready for the first orbital flight.

Mercury Tracking, Communications and Recovery Network. The orbital flights will require a worldwide tracking, communications, and recovery network. The Western Electric Corporation of New York was selected as the prime contractor to equip and manage the construction of a global network of

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87 U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, NASA Authorization for Fiscal Year 1961, Hearings on H. R. 10509, Part 2, op. cit., pp. 727-728. Figure 23 is a NASA photograph.
ground stations to track and monitor the manned flights of the satellite. The Company also has the responsibility for training personnel to operate the network. The NASA responsibility for planning and designing the network and monitoring contracts has been assigned to the Langley Research Center. Capsule recovery operations will be a joint NASA-Department of Defense responsibility. In early 1961, the global Mercury tracking and ground instrumentation network will become operational.\textsuperscript{88} Figures 24 and 25\textsuperscript{89} indicate the location of the sites that make up the multimillion-dollar tracking and communications network for the man-carrying satellites in Project Mercury. The Mercury net is taken up in more detail later in this chapter.

Program Costs. In fiscal years 1960 and 1961, the major portion of the funds allocated for manned space flight will be devoted to Project Mercury. The following indicates the funding associated with the manned space flight program:\textsuperscript{90}

\begin{center}
\begin{tabular}{|c|c|c|c|}
\hline
Fiscal Year & Project Mercury & Advanced Manned Spacecraft & Total  \\
\hline 1960 & 87.06 & 0.10 & 87.16  \\
1961 & 106.75 & 1.00 & 107.75  \\
\hline
\end{tabular}
\end{center}


\textsuperscript{89}These are photographs of the NASA.

In fiscal year 1961, the major portion of the funds will be devoted to the flight research program, which is composed of the Atlas and Redstone boosters, $25,650,000; Mercury capsule, support equipment and support services, $35,290,000; tracking network operations and equipment, $24,670,000; and recovery operations, $15,000,000. The balance is allocated for advanced technical development. The Mercury Project is the initial step in the ultimate achievement of interplanetary manned space flight and the Mercury capsule is a steppingstone to larger systems needed in the not too distant future. NASA long-range goals include manned landings on the Moon and later on the planets. The Mercury satellite is not suitable as a return vehicle for a lunar probe, since a capsule capable of re-entering the Earth's atmosphere at greater speeds will be required.

Project Mercury experiments should reveal two essential facts: (1) man's ability to function in space flight, and (2) the design and operation problems that must be solved before advanced manned space flights can be a reality. While Project Mercury is still being implemented, and based on its flight experience, more advanced manned space missions are being planned by NASA. The first follow-on program will be Project

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Apollo. As presently conceived, the Apollo spacecraft would weigh from five to ten tons and should be capable of carrying three human passengers on either a lunar-orbiting mission or an Earth-orbiting space laboratory mission. An advanced version of the Saturn vehicle would be used to launch Apollo.92

**Vehicle System Development, $215,008,000**

This category combines programs relating to vehicle systems technology and vehicle development.

**Vehicle Systems Technology.** For vehicle systems technology, $21,200,000 was allocated. The objectives of this program are to conduct studies and to develop components, materials, subsystems and systems that will provide the optimum configuration, structure, control, guidance, and orientation and auxiliary power systems for space exploration such as lunar missions, deep space missions, and earth satellite projects.93

**Vehicle Development.** For vehicle development an additional $193,808,000 was requested for fiscal year 1961, of which $134,308,000, or approximately 70 per cent is earmarked

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for the Saturn Project. A breakdown of the amounts allocated to the various launch vehicles under development is shown in Table V (see page 191). It is recognized that rocket power is the key to space supremacy. The development and operation of rocket launch vehicles is the area in which the NASA space program has been subject to the most severe criticism. It is no secret that the Russians enjoy a substantial lead in the development of high thrust space vehicles. The NASA is working with great urgency to close the gap as soon as possible.94

Through mid-1960, NASA's choice of launch vehicles was based on either the Vanguard program or various guided missile programs of the Department of Defense. The primary reason for this approach has been this country's eagerness to demonstrate a capability for exploring space at the earliest possible date. Only about a year ago the NASA began a study and analysis of the requirements of this country for launch vehicles. Based on this study, NASA has stabilized on a launch vehicle program. While many of the vehicles in its program still employ elements from the military's missile programs, the NASA's overall vehicle systems are specifically designed for space exploration

NASA's launch vehicle program has been predicated on the following guiding principles:

First, to create a standardized family of vehicles with a minimum number of different designs and configurations. The monetary limitation alone dictates this approach;

Second, and closely allied to the first, reliability must be attained through repetitive use of a given space vehicle design for a maximum variety of payloads and missions; and

Third, to avoid early obsolescence, each new vehicle developed must incorporate the most advanced technical approaches and growth potential, consistent with the reliability requirements.96

General Ostrander, NASA's Director, Office of Launch Vehicle Programs, has stated that the philosophy for attaining a high reliability in the NASA launch vehicle program can be condensed to the following rule: "Reduce to a minimum the number of different types of vehicles and components that are developed and thereby increase the frequency with which those that remain are used."97 The same philosophy governs NASA's

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96Ostrander, "Rocket Power--Key to Space Supremacy," op. cit., p. 7.

component and technical development programs. The agency hopes to develop a small family of standardized vehicles whose reliability will more than balance the disadvantage of using vehicles on particular missions for which they may not be optimum. Only if the NASA achieves a high reliability in its launch vehicles can the number of failures experienced in the past be greatly reduced. The NASA family of launch vehicles will include Delta, Scout, Thor-Agena B, Atlas-Agena B, Centaur and Saturn. The characteristics, capabilities and contemplated missions of these vehicles are shown on Figure 9. In view of the size and importance of the Saturn Project to the national space program, a highlight review of this project is in order.

The Saturn vehicle is the largest launch vehicle under development in the free world. The project was initiated on August 15, 1958 by an order from the Advanced Research Projects Agency (ARPA) of the Defense Department to the Army Ordnance Missile Command, Huntsville, Alabama, to develop a large booster vehicle of about 1.5 million pounds of thrust

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98 Ibid., pp. 36-37.

99 This figure was reproduced from NASA chart in U. S. Congress, House, Committee on Science and Astronautics, Third Semiannual Report of the National Aeronautics and Space Administration, Covering the Period October 1, 1959, to April 1, 1960, House Doc. No. 454, 86th Congress, 2d Session (Washington: Government Printing Office, 1960), facing page 30.

100 Ibid., p. 32.
Descriptions, capabilities, and contemplated employment of propulsion systems being developed for NASA's Launch Vehicle Program.
utilizing available engines. The project was funded in fiscal years 1959 and 1960 by ARPA. Initial funding was $5 million but later increased to $34 million for fiscal year 1959. In June 1959, the final funding plan of $70 million for fiscal 1960 was established. In November 1959, President Eisenhower decided to assign to NASA the sole responsibility for developing large space boosters and announced his intention to transfer the Saturn Project to NASA. In anticipation of the transfer, NASA and the Defense Department established an interim working agreement, whereby the NASA immediately assumed technical direction of the Saturn Project. ARPA furnished administrative direction until March 1960 when this was also assumed by NASA. 101

In January 1960, the NASA Administrator approved the Saturn Development Plan and Program recommended by the Saturn Vehicle Study Group comprised of representatives from the NASA, ARPA, Air Force, Army, and the Department of Defense, under the Chairmanship of NASA's Dr. Abe Silverstein, Director of the Office of Space Flight Programs. The Saturn Vehicle Study Group made a significant contribution towards consolidation of the overall program. It established clearly that Saturn's upper-stages should utilize the high-energy oxygen-

hydrogen propellants, and that no parallel effort with conventional propellants could be undertaken because of limited funds available for such an ambitious project and because of schedule conditions. This approach, of course, involved a calculated risk; it resulted in a building-block approach to upper-stage development, thus minimizing the number of new stages that would have to be developed. The development plan for the Saturn vehicle is the application of the basic rule enunciated by General Ostrander, to rephrase slightly, "Reduce to a minimum the number of different types of vehicles and stages to attain high reliability." 102

The overall technical and administrative management responsibility of the Saturn Project is assigned to the Marshall Space Flight Center at Huntsville, under the direction of Dr. Wernher von Braun, who in turn reports directly to the Director, Office of Launch Vehicle Programs at Headquarters. The first stage (C-1) of the Saturn vehicle is presently under development as an in-house project at Marshall. Plans are to have the development of all upper stages carried out by industrial contractors. In fact, the second-stage is already under development by the Convair Astronautics Division of General Dynamics Corporation in connection with the Centaur vehicle project. NASA plans to use this stage as a third stage of the Saturn (C-1), and as a fourth stage of the second generation

of Saturn (C-2). 103

A Saturn Systems Office has been established by Dr. von Braun to coordinate and direct the overall systems effort in detail. Its primary tasks are to give internal coordination of the in-house effort at the Marshall Center and to serve as the "focal" point for industry contact with that Center. Mr. Oswald H. Lange, Saturn Project Director at Marshall, has stated, "There is no substitute for close teamwork between the principal participants in this project, in which each stage has the complexity of an individual vehicle." 104

The objective of the Saturn program is to develop a series of multistage launching vehicles of increasing payload capability for performing various advanced space flight missions. Three generations or configurations of the Saturn launch vehicle are under consideration, namely, configurations C-1, C-2, and C-3. The C-1 configuration with the least payload capability, but earliest availability, is currently under development as above noted. The second generation, C-2 configuration, is in the planning stages and early layout phase. The third generation, C-3 configuration, which will be the largest all-chemical version of the Saturn vehicle, is in the initial conceptual


Saturn C-1 is propelled by a cluster of eight Rocketdyne H-1 engines, each generating 188,000 pounds of thrust, for a total of 1.5 million pounds of thrust. The propellants are kerosene and liquid oxygen. The C-1 configuration can carry a payload of about 25,000 pounds into orbit around the Earth, and about 12,000 to the Moon in a hard landing. This is only an "interim" version of the Saturn launch vehicle. It has basically far greater capabilities. However, in order to develop these greater capabilities, NASA will first have to develop a new rocket engine. It would utilize liquid hydrogen and liquid oxygen, and would generate 200,000 pounds of thrust, or ten times as much as the individual rocket engines on the present second stage. Dr. von Braun has testified that the second generation of Saturn (C-2) will easily carry a couple of men around the Moon and bring them back safely into the Earth's atmosphere. But he believes that the primary purpose of the Saturn vehicle will ultimately be to furnish manned space transportation. 106

Firing of the first Saturn booster with dummy upper-stages is scheduled for the latter half of 1961. Present plans

105Ibid., pp. 46-47.

call for Saturn C-1 and C-2 versions to be launched from the Atlantic Missile Range at Cape Canaveral, Florida. A launching pad, blockhouse, and auxiliary facilities are under construction there. 107

As noted earlier, a budget amendment transmitted to Congress on February 8, 1960 increased the fiscal year 1961 funding of the Saturn program from $140 million to $230 million. The NASA program for fiscal year 1961 allocated a total of $134,308,000 of "Research and Development" funds to develop Saturn. Of this amount, $57,500,000 is provided for the continued development, construction and testing of the first-stage booster tanks and engines; $42,300,000 is provided for design and development of upper stages initiated during fiscal year 1960. The balance of the research and development funds is allocated to provide materials, vehicle-borne guidance, controls and instrumentation, and development of ground-support equipment. 108

NASA has given considerable consideration and study to determine the next generation vehicle to follow Saturn. The main mission that the agency used as an objective in the planning studies has been that of landing a manned spacecraft


on the Moon and returning to Earth. The study has considered three principal approaches. The first was by the use of rendezvous and refueling techniques using later configurations of the Saturn vehicle. The second approach considered was what may be described as a "brute force" attack by a direct flight from the Earth, using conventional fuels. This approach has come to be known as "Nova." However, the Nova is not an active program, but only one of several vehicle concepts NASA has considered for use of the 1.5 million-pound-thrust F-1 engine. The third approach was the possible use of nuclear powered upper-stages, which would reduce the overall size and weight of the vehicle considerably. 109

Space Propulsion Technology, $83,800,000

The demand for rocket engines with increased thrust has intensified research on new and improved fuels. To meet the demands of supersonic aircraft and heavier payloads and more intricate space missions, NASA is attacking the propulsion problem from various approaches. The chemical propulsion systems which offer a wide range of thrust capabilities continue to claim much attention, since they seem to offer immediate results. 110 The family of space launch vehicles


planned by NASA to handle requirements for the next decade is based on use of chemical rockets. All use liquid fuels except the all solid-propellant Scout vehicle. Beyond chemical propulsion, NASA has been searching for new sources of power for eventual use in interplanetary space exploration. For advanced space missions, nuclear energy shows great promise, as does solar energy. Liquid propellants, solid propellants, and electrical and nuclear propulsion systems are discussed below.

**Liquid Rocket Program.** For use in developing liquid rockets, $63 million was requested by NASA for fiscal year 1961. Liquid propellants are still the most important in NASA power program. Except for Scout, virtually all major launch vehicles employ kerosene and liquid oxygen, a comparatively low-energy propellant-oxidizer combination. Moreover, NASA is developing rocket engines utilizing a higher energy combination—liquid hydrogen and liquid oxygen. These engines are expected to greatly increase payload and mission capabilities because they will generate a "specific impulse" over 25 per cent greater than that of the basic ingredient kerosene with liquid oxygen (LOX) mixture used today. Fuel-oxidizer research is being directed at the Lewis Research Center to

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"Specific impulse" is one generally accepted criterion in evaluating the performance of a rocket propellant—that is, "the number of seconds one pound of propellant mass will produce one pound of thrust." *Ibid.*
learn ways to handle, contain, and store fuel-oxidizer mixtures safely and reliably. Theoretically, ozone is the best chemical oxidizer, but it is highly unstable and has a tendency to explode spontaneously. Fluorine is another highly active oxidizer but is extremely corrosive to metals and known plastics especially at high temperatures.\textsuperscript{112}

**Solid-Propellant Rocket Program.** NASA requested $2.8 million for solid rockets in fiscal 1961. The basic objectives and philosophy of the solid-propellant rocket program are to establish, on an experimental basis, the background that will permit the rapidly advancing technology of solid-propellant systems to be exploited for launch vehicles. Solid-propellant rockets have several inherent advantages over their liquid counterparts—reliability, simplicity, and economy. They are storable for extended periods of time and will give instant and reliable performance. The basic characteristics of the solid rockets permit them to be developed at a lower cost and in less time compared to liquid propellant systems. Despite the apparent advantages, the solid fuel rocket has certain limitations. To date, no extremely high energy solid propellant has been developed. The major application of solid fuels, except for upper-stage engines and relatively small

\textsuperscript{112}Ibid., pp. 80-81; and National Aeronautics and Space Administration, Fourth Semiannual Report to Congress . . . op. cit., p. 87.
research rockets, has been in the Scout launch vehicle. The utility of solid-propellant rockets is limited by the current cumbersome and relatively inefficient methods for controlling thrust level during burning, for terminating thrust and for securing thrust direction control. NASA's solid fuel propulsion research and development is carried out at the Langley Research Center, the Jet Propulsion Laboratory, and by contracts with commercial contractors. 113

**Space Power Technology (Electrical Propulsion Program).** The program objectives are to develop electrical thrust systems and electrical power supplies based on energy sources other than atomic reactors for use in space vehicles. Most all space vehicles require an electrical power supply (auxiliary power unit) to generate electricity for the operation of instruments, communications systems and other equipment. Solar cells and batteries have generally been used, but for power requirements of 0.5 to 30 electrical kilowatts, other systems need to be developed that will have higher reliability, lower weight, and possibly lower cost. These are referred to as electrical propulsion systems. The characteristic features of these systems are high specific impulse and low thrust. It

seems that electric engines will not be used as the primary powerplants, but will be extremely useful after the launch vehicle has escaped the Earth's atmosphere and achieved orbital speed. In addition, they are compact and can generate thrust over long time periods. The primary application then will be for deep space missions of the next decade and beyond. The level of support for advanced technical development in the area of electrical propulsion for fiscal year 1961 is $8 million.  

Nuclear Systems Technology. The nuclear powered systems, to which NASA and the Atomic Energy Commission have been giving increased emphasis during the past year, have great potential for advanced space missions. For example, a three-stage Saturn launch vehicle with a nuclear third-stage could boost about twice the payload of its all-chemical counterpart. For advanced lunar and interplanetary missions with heavy payloads, the nuclear propulsion systems hold great promise. The advantage of the nuclear propulsion system over the chemical system is that the jet velocity of the propellant is more than doubled. For long-distance space missions the performance of nuclear systems outstrips the chemical systems and will be perhaps the

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leading contender. 115

The two principal types of nuclear systems considered suitable for propelling large payloads in space are: (1) the nuclear heat-transfer rockets, and (2) the electrical propulsion system using a nuclear reactor to generate electrical power. The latter will be used for large amounts of auxiliary power for instruments and also for producing electricity to power the electric rocket engine just discussed. The nuclear heat-transfer rocket program (Project Rover) is a joint effort of NASA and the Atomic Energy Commission. The AEC is responsible for the reactor development and the NASA is responsible for developing all non-nuclear components, for supplying the hydrogen propellant, and developing a flyable engine system integrated into a flight vehicle. 116

Another joint NASA-AEC effort is the SNAP-8 Project (System for Nuclear Auxiliary Power.) NASA has contracted with Aerojet General Corporation to develop the SNAP-8 electric power system capable of generating 30 to 60 kilowatts of electric power. AEC is developing the reactor for the SNAP-8 system under contract with the Atomics International Division of North American Aviation, Incorporated. The SNAP-8 reactor


has promise for application to future generations of satellites and space missions. The SNAP-8 reactor and power conversion system will be the first in the SNAP series powerful enough to generate electricity for propulsion, besides serving as the source of electricity for payload instrumentation.117

In support of the nuclear heat-transfer rocket development and the nuclear electric power generating systems, NASA has allocated a total of $10 million for fiscal year 1961.

Tracking and Data Acquisition, $32,550,000

Tracking and data acquisition facilities play a significant role in supporting the overall space flight program. Man's success in space exploration is due in no small measure to the development of complicated ground equipment and stations to locate and track rockets, satellites and space probes; to receive their signals and reduce them to usable form; and to correlate the data so that it can be studied and applied to a multitude of purposes. NASA's tracking and data acquisition networks perform these functions. The ground tracking and data acquisition networks must be capable of supporting four basic types of space flight operations: (1) research or sounding rockets, (2) scientific Earth satellites, (3) manned space vehicles, and (4) deep space probes. In addition, the

networks must provide for adequate communication links to permit rapid data transmission from remote tracking stations to a central control center, where rapid digital computing equipment can reduce the raw material to a form in which it can be analyzed by the scientists. The tracking networks include installations throughout the free world and employ radio, optical tracking, and telemetry.

**Minitrack Stations.** During fiscal year 1961 there will be fourteen minitrack stations in operation, including four new stations being installed during fiscal year 1960. These stations are used primarily to obtain a satellite's angular position by reception of radio signal from a small beacon transmitter carried in the satellite. One significant advantage of the Minitrack equipment is that it encounters no problem in tracking satellites and records the passage of all vehicles transmitting on the appropriate frequency as they pass through the beacon. They cannot track passive satellites (those that do not emit radio signals) such as Echo I, nor can they furnish precise orbital information available from optical tracking systems.119

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118 U. S. Congress, House, Committee on Science and Astronautics, Third Semiannual Report of the National Aeronautics and Space Administration, House Doc. No. 454, op. cit., p. 73.

The Minitrack stations are basically located along a north and south line through the American continents plus a few placed so as to give the desired information on the important first orbit from both the Atlantic and Pacific Missile Ranges. Those stations located in this country were installed by United States' contractors. Those located in foreign countries were installed by foreign contractors through cooperative agreements negotiated between the United States and foreign governments. The capital cost of these stations totals approximately $16 million.\textsuperscript{120}

\textbf{Baker-Nunn Optical Network.} A second general-purpose network is the Baker-Nunn telescopic camera system. The system comprises a worldwide network of twelve stations under the technical direction of the Smithsonian Astrophysical Observatory, Cambridge, Massachusetts. The large Baker-Nunn cameras are used for optical tracking, which actually tracks by taking a photograph of the satellite against a star background. The Minitrack stations and the Baker-Nunn networks were initiated as part of the International Geophysical Year and supplement each other. The "Moonwatch" observers are volunteer teams assisting the Smithsonian Astrophysical Observatory in sighting

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satellites and other objects in the skies at different places in the world, using relatively simple telescopic equipment. Any compensation given to Moonwatch teams merely helps to defray expenses for materials and equipment. Moonwatch stations are placed at about 200 sites throughout the free world.\textsuperscript{121}

**Deep Space Network.** The Deep Space Network consists of three stations located on the equator and separated by 120° of longitude to provide continuous 24-hour coverage of space probes, despite the Earth's rotation. The two sites chosen to operate along with the existing Goldstone station in California are Woomera, Australia and Krugersdorp, South Africa, which is 30 miles west of Johannesburg. These three stations are expected to be operational during fiscal year 1961. The Deep Space tracking network is under the direction of the Jet Propulsion Laboratory at Pasadena, California. When completed, these stations will be utilized primarily for tracking and communications with vehicles penetrating deep into space, such as lunar probes. They will also be useful in certain satellite tracking including the passive communications experiments. The total capital cost of the three-station network is estimated at $17 million.\textsuperscript{122}

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\item \textsuperscript{121} Ibid., pp. 86-87; and U. S. Congress, House, Committee on Science and Astronautics, Third Semiannual Report of the National Aeronautics and Space Administration, House Doc. No. 454, \textit{op. cit.}, p. 75.
\item \textsuperscript{122} NASA-Industry Program Plans Conference, July 28-29,
\end{itemize}
\end{footnotesize}
Mercury Network. Project Mercury, the manned satellite program, will require the establishment of additional tracking and ground instrumentation systems to provide complete radio tracking, communications (including voice), and data acquisition in the launching, flight, reentry and recovery of the Mercury capsules. Program requirements are quite rigid for at least two reasons. First is that there will be a human passenger aboard and emphasis is on the reliability of the tracking and control facilities to assure the astronaut's safety, especially during launch and recovery operations. The second reason is that the Mercury satellite, unlike the majority of the others launched to date, will not remain in orbit for a very long period of time. The Mercury Network will be capable of more detailed data gathering and faster tracking than is possible under the existing Minitrack stations, which can compute accurate orbits only after the satellite has completed several passes. 123

In the Mercury net shown in Figure 25, there are 16 stations in addition to a control center and a computing and communications center. These stations will lie in a geographic area bounded by the 35° north and 35° south latitudes in the

1960, op. cit., pp. 88-89; and National Aeronautics and Space Administration, Fourth Semiannual Report to Congress ... op. cit., p. 70.

projected path of the manned capsule and will provide for a 3-orbit mission. Most of the stations will be of a transportable nature so that their locations may be shifted at the completion of the project. Eight stations will be located on foreign territory; two will be established on ships. The Mercury control center will be consolidated with the Minitrack Network control center at the Goddard Space Flight Center. The computing and communications center will also be located at Goddard. All stations will be linked with the centers through a communications network, Figure 24. Ground communications required will be achieved through the lease of existing commercial facilities and use of existing military links. The operations of the Mercury net and the recovery operations will be a joint effort, including the NASA, Department of Defense and foreign countries. As discussed earlier, the Mercury Network will be installed by the Western Electric Company, with the assistance of several subcontractors and it is estimated to cost approximately $53 million. The annual communications cost will run about $8 million.\textsuperscript{124}

Non-NASA Tracking Stations. Pending further extension of its tracking capabilities, NASA utilizes on a part-time

basis, the tracking and data acquisition facilities of a number of cooperating non-NASA stations to provide additional coverage for specific projects. The extent of NASA's use of these facilities is arrived at by mutual agreements. Currently, NASA depends heavily on the 250-foot dish (parabolic antenna) at Jodrell Bank in England, operated by the University of Manchester, which tracked Pioneer V out to 23 million miles. On some projects NASA has used a 60-foot dish in Hawaii that belongs to the Navy.125

Program Costs. For fiscal year 1961, NASA requested $32,550,000 to operate tracking and data acquisition and transmission facilities; and to provide for research and development for improving these facilities. Included in this amount are funds to cover NASA's operations at the Atlantic and Pacific Missile Ranges. In fiscal 1961, NASA will have over 40 tracking stations in operation, including the Mercury net. Approximately 10 per cent of the overall operating cost of the stations has been added to provide sufficient funds for repair and maintenance, and to provide for spares and logistic materials such as tapes.126


### Construction and Equipment ($122,787,000)

The construction and equipment portion of NASA's budget request totaled $122,787,000 for fiscal year 1961. This sum provides for the purchase of new facilities, for modernization of existing ones, and for the purchase of major items of equipment. During the past two years NASA has made progress in reorienting and reequipping the centers to permit a more active participation in the space program.

The construction and equipment program may be broken down into three major categories as shown below:

#### Aeronautical and Space Research Facilities:

<table>
<thead>
<tr>
<th>Facility</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langley Research Center, Va.</td>
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<tr>
<td>Ames Research Center, Calif.</td>
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<tr>
<td>Lewis Research Center, Ohio</td>
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#### Space Flight Development and Operations Facilities:

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<tr>
<td>Goddard Space Flight Center, Md.</td>
<td>9,500,000</td>
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<tr>
<td>Wallops Station, Va.</td>
<td>4,000,000</td>
</tr>
<tr>
<td>Jet Propulsion Laboratory, Calif.</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Marshall Space Flight Center, Ala.</td>
<td>26,750,000</td>
</tr>
<tr>
<td>Atlantic Missile Range, Fla.</td>
<td>27,750,000</td>
</tr>
</tbody>
</table>

#### Tracking and Data Acquisition (Various Locations):

<table>
<thead>
<tr>
<th>Facility</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minitrack Net</td>
<td>4,750,000</td>
</tr>
<tr>
<td>Deep Space Net</td>
<td>8,000,000</td>
</tr>
<tr>
<td>Mercury Net</td>
<td>15,000,000</td>
</tr>
</tbody>
</table>

Total $122,787,000

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127 Ibid., pp. 360, 364. For a detailed listing of NASA's various Construction and Equipment programs and the amount allocated for each during fiscal 1961, see Ibid., p. 361.
V. CHAPTER SUMMARY

In this chapter, the writer has reviewed in some detail NASA program objectives, plans, and accomplishments in relation to its budget for fiscal year 1961, against the framework of the agency's 10-Year Plan of space exploration. Legislative action on both the authorization bills and appropriation measures for fiscal year 1961 has been traced.

During fiscal year 1961, the emerging pattern was that of a new agency making progress in its efforts to integrate into a unified structure, a number of different but related programs and organizations which had been absorbed by or transferred to NASA; and at the same time moving forward in a number of current research and development programs of importance to our nation's progress in space.

The civilian space program which is NASA's responsibility is related to the space activities conducted by the Department of Defense in connection with the development of weapons systems and the defense of the United States. In the following chapter, the problem of coordinating these programs and activities, both at the Presidential and Departmental levels, will be examined.
CHAPTER VII

COORDINATION OF AERONAUTICAL AND SPACE ACTIVITIES

"It is no longer possible for the head of a great organization to know all the detail of an undertaking, or even to know all the minor coordination. . . . He, the mind of the organization, must leave to lower ganglia, the minor coordinations. He is the cerebrum and must care for the higher coordinations."

Russell Robb

Congress provided in the Space Act that NASA would be responsible for directing all United States aeronautical and space activities except that:

. . . activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which such agency has responsibility for and direction of any such activity shall be made by the President. . . .

The separation between military and nonmilitary projects is implicit in the legislation. However, there is an unavoidable overlapping or "grey area" linking the civilian and military interests. Since distinction between civilian activities

1Section 102(b) of Public Law 85-568 (72 Stat. 426). See Figure 10 on the following page which shows the organization and function of the national space program. The information for this figure was extracted from a chart in U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Investigation of Governmental Organization for Space Activities, Hearings before the Subcommittee on Governmental Organization for Space Activities, March 24, 26, and April 14, 15, 22, 23, 24, 29, and May 7, 1959, 86th Congress, 1st Session (Washington: Government Printing Office, 1959), p. 103.
NATIONAL SPACE PROGRAM

REFERENCES:
(1) PUBLIC LAW 85-568, TITLE II, SEC. 201 (e)
(2) " " " TITLE II, SEC. 201 (a) (d)
(3) " " " TITLE I, SEC. 102 (b), LINES 6 TO 14
(4) " " " TITLE II, SEC. 203 (a)
(5) " " " TITLE II, SEC. 204 (b)

FIGURE 10
and military requirements is difficult to determine, the President must determine which agency, the Department of Defense or NASA, shall have responsibility for, and direction of, a particular activity.

The Space Act further provides for close coordination between the NASA and the Department of Defense in the interest of avoiding unnecessary duplication and providing interchange of information between the two agencies. The National Aeronautics and Space Council and the Civilian-Military Liaison Committee were established to help accomplish this purpose.

I. NATIONAL AERONAUTICS AND SPACE COUNCIL

Creation and Authority

Pursuant to Section 201 of the Space Act, the National Aeronautics and Space Council was established in the Executive Office of the President.

Function

The Space Council is an advisory body having no executive authority. Its sole function is to advise the President in discharging his duties as prescribed in Section 201(e) of the Space Act.

Organization

The statutory members of the nine-member Space Council are: the President (who is Chairman), the Secretary of State,
the Secretary of Defense, the Administrator of NASA and the
Chairman of the Atomic Energy Commission. In addition, the
President may appoint to the Space Council one additional
member from the Executive Branch of the Government, and not
more than three other members from private life. All appointed
members serve at the pleasure of the President. Each of the
members from the Federal Government may appoint an alternate
to serve in his unavoidable absence. 2

Role of the President

The Space Act stipulates that the President shall pre­
side over the meetings of the Space Council. In conformity
with the "Declaration of Policy and Purpose," it is the duty
of the President to:

(1) survey all significant aeronautical and space
activities, including the policies, plans, programs, and
accomplishments of all agencies of the United States
engaged in such activities;

(2) develop a comprehensive program of aeronautical
and space activities to be conducted by agencies of
the United States;

(3) designate and fix responsibility for the
direction of major aeronautical and space activities;

(4) provide for effective cooperation between the
National Aeronautics and Space Administration and the
Department of Defense in all such activities, and specify
which of such activities may be carried on concurrently

2Ibid., Section 201. The membership of the Space Coun­
cil as of September 30, 1960 is listed in National Aeronautics
and Space Administration, Fourth Semiannual Report to Congress,
April 1, 1960 Through September 30, 1960 (Washington:
National Aeronautics and Space Administration, 1961), Appendix
B, p. 225.
by both such agencies notwithstanding the assignment of primary responsibility therefor to one or the other of such agencies; and

(5) resolve differences arising among departments and agencies of the United States with respect to aeronautical and space activities under this Act, including differences as to whether a particular project is an aeronautical and space activity.3

II. CIVILIAN-MILITARY LIAISON COMMITTEE

Creation and Authority

At a different level, Section 204 of the Space Act established a Civilian-Military Liaison Committee, commonly referred to as the "CMLC."

Purpose and Function

The CMLC was formed to bridge the gap that might otherwise appear to exist, and to provide a permanent channel of communication and consultation between the NASA and the Department of Defense, with equal representation from both agencies. In the terms of the legislation:

The Administration and the Department of Defense, through the Liaison Committee, shall advise and consult with each other on all matters within their respective jurisdictions relating to aeronautical and space activities and shall keep each other fully and currently informed with respect to such activities.4

In the event the CMLC members and their superiors, the

3 Public Law 85-568, op. cit., Section 201(e).
4 Ibid., Section 204(b).
NASA Administrator and the Secretary of Defense fail to reach agreement on differences arising between the two agencies, then either official may refer the matter to the President for final decision. In arriving at a decision, the President would invoke the authority vested in him as Chairman of the National Aeronautics and Space Council.

Membership

Pursuant to Section 204(a) of the Space Act, the President appointed as Chairman of the Civilian-Military Liaison Committee, Mr. William M. Holaday of the Office of the Secretary of Defense. The CMIC includes one representative from the Defense Department; one from each of the Departments of the Army, Navy, and Air Force; and four from the NASA.5

III. EFFECTIVENESS OF THE COORDINATING MACHINERY

On March 3, 1959, Lyndon B. Johnson, then Chairman of the Senate Committee on Aeronautical and Space Sciences, appointed the Subcommittee on Governmental Organization for Space Activities to investigate the organization, the responsibilities and the procedures which were being developed by the Executive Branch in carrying out the Space Act. The

5On April 30, 1960, Mr. Holaday resigned as the CMLC Chairman. The membership of the CMLC as of September 30, 1960 is listed in National Aeronautics and Space Administration, Fourth Semiannual Report to Congress, op. cit., Appendix D, p. 229.
Subcommittee, headed by Senator Stuart Symington, held its hearings between March 24 and May 7, 1959. Key civilian and military officials charged with the administration of space activities were questioned by the Subcommittee. 6

The Subcommittee submitted its report to the Senate Committee on Aeronautical and Space Sciences on July 14, 1959. Its findings and recommendations were based on 747 pages of printed hearings, together with additional supporting material. The effectiveness of the two organizations as coordinating mechanisms was discussed at some length during the course of the hearings. The Subcommittee's findings and recommendations with excerpts of supporting testimony are highlighted below:

**Failure to Staff the Space Council**

The Space Act provides that the Space Council may employ a small staff headed by a civilian Executive Secretary, to be appointed by the President by and with the advice and consent of the Senate, and to receive compensation at the rate of $20,000 per annum. (Section 201(f)) The Subcommittee Chairman, citing the Conference Report on the Space Act, pointed out that while the authority for appointment is permissive, the conferees felt that a small professional staff

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with an Executive Secretary would increase the effectiveness of the Space Council.7

In his testimony before the Subcommittee, Dr. T. Keith Glennan, NASA Administrator, stated that a permanent Executive Secretary had not been appointed but that Mr. Franklyn W. Phillips had been appointed as Acting Executive Secretary. Dr. Glennan explained that Mr. Phillips was carried on the NASA payroll as a matter of convenience and that his assistants were supplied jointly from the Department of Defense and the NASA.8

Senator Margaret Chase Smith questioned whether this type of arrangement was in violation of the spirit of the Space Act.9 Dr. Glennan replied:

... As I recall this discussion ... when the President determined on the manner in which he wanted to start off the operation of the Space Council, it was a matter of his concern over the development of an overlarge staff in the field upon which we were just entering, and I suspect that once the field clarifies somewhat that this matter would be taken care of in the normal course.10

7U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Investigation of Governmental Organization for Space Activities, Hearings before the Subcommittee . . . op. cit., p. 63.
8Ibid., pp. 30-31, 65.
9The salary of Mr. Phillips was $16,500 per year; and the advice and consent of his appointment in the acting capacity was not requested from the Senate. Ibid., pp. 65, 68.
10Ibid., p. 66.
Space Council's Activities Considered Privileged

The Subcommittee pointed out that exercising the Executive privilege concerning the advice that the Space Council gives to the President has made it difficult to obtain information on overall space policies, programs, plans, and accomplishments.\(^1\)

Dr. Glennan declined to give certain information regarding the matters discussed by the Space Council when he was questioned by the Subcommittee on March 24, 1959, stating that the refusal was not due to the secrecy of the information, but because the President considered such matters as being confidential to him and within the area of the Executive privilege. Dr. Glennan agreed that he would try to get the privilege removed in order that he might answer pertinent questions.\(^2\) However, the President's position was confirmed. A letter of April 7, 1959 from Dr. Glennan to the Chairman of the Subcommittee contained the following statement:

I have consulted with the President on the question and he has told me that he must maintain his previous position. The President restated his view that in order to provide for the full effectiveness of the Space Council members in carrying out their advisory responsibilities to him as set forth in the National

\(^{1}\)U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Governmental Organization for Space Activities, Senate Rept. No. 806, op. cit., p. 15.

\(^{2}\)U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Investigation of Governmental Organization for Space Activities, Hearings, op. cit., pp. 12, 31-33.
Aeronautics and Space Act, it was necessary that the activities of the Council be considered confidential to the Chief Executive.\textsuperscript{13}

The Subcommittee concluded that "The exercise of executive privilege hinders the Congress from obtaining basic policy information."\textsuperscript{14}

Role of the CMIC: An Appraisal

In its report, the Subcommittee stated that the Civilian-Military Liaison Committee was not authorized or organized to perform effectively its coordinating function between the Department of Defense and NASA.\textsuperscript{15} Testifying before the Subcommittee on April 29, 1959, Mr. William M. Holaday pointed out that since the CMIC was set up to deal with matters between the two agencies, it had no formal relationships with other agencies involved in the nation's space activities.\textsuperscript{16} He illustrated the typical items considered by the CMIC and considered that the role of this body had been of relative minor importance. The only item that had been referred to the CMIC for any discussion at all was the matter referred from

\textsuperscript{13}Ibid., p. 106.

\textsuperscript{14}U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Governmental Organization for Space Activities, Senate Rept. No. 806, op. cit., p. 54.

\textsuperscript{15}Ibid., p. 46.

\textsuperscript{16}U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Investigation of Governmental Organization for Space Activities, Hearings, op. cit., p. 499.
the Deputy Secretary of Defense relating to the Dyna-Soar program. The CMIC reviewed the program objectives of Dyna-Soar in relationship with objectives of the X-15 rocket aircraft and Project Mercury programs. Mr. Holaday further noted that in case of dissent by any member, the matter would be referred to higher authority, generally to the President.17

In his prepared statement Vice Admiral John T. Hayward, Assistant Chief of Naval Operations (Research and Development), observed the limited authority of the CMIC:

The Civilian-Military Liaison Committee was envisioned by the Space Act as an effective body to insure the necessary coordination between the DOD and NASA, but is currently staffed by competent representatives who have limited authority and no channel for appeal to a superior body.18

Admiral Hayward testified that the Space Act is "nebulous" as to the duties of the CMIC Chairman and he really didn't have any control over the space program. He concluded, "I feel that in the present situation the decision level is so high that when you get to a lot of these nuts and bolts, getting a decision between the two agencies it is going to be quite difficult."19

There were some witnesses, however, who believed at that time the method of operation of the CMLC was adequate. Dr. Glennan testified that it was functioning adequately. He

17 Ibid., pp. 500, 509.  
18 Ibid., p. 277.  
19 Ibid., pp. 279, 293.
stated that the two agencies have had no real difficulty in this relationship, and pointed out that the CMLC had been helpful in the areas in which it had undertaken, such as interchange of personnel, military personnel who were assigned to some of NASA's projects. 20

On the other hand, Mr. Roy W. Johnson, Director of the Advanced Research Projects Agency, testified that while he could perform his job without the CMLC, it was not getting in the way of anyone and in some cases it might add to the total communication between the NASA and the Defense Department. Mr. Johnson, however, felt that a formal channel of communication, such as this which has no authority, imposes some "needless time and energy in meetings in order to conform to a requirement of law, and might better be performed if we let these communications come about naturally on a day-to-day operation." 21

Dr. Herbert F. York, Director of Defense Research and Engineering, also pointed out that the CMLC was providing only a fraction of the coordination between the two agencies which was being carried on by various groups at "numerous levels, depending on what the problem is." At times, the CMLC was not even advised of the various informal personal contacts. Mr. Holaday testified that the NASA Administrator and the Defense

20Ibid., p. 35. 21Ibid., p. 175.
Secretary had conferred directly, thus by-passing his Committee entirely. Both Major General Bernard A. Schriever of the Air Force and Admiral Hayward of the Navy testified that they had dealt directly with Dr. Glennan on many of the items of interest to the military and the NASA. Mr. Holladay indicated that he was not aware of these personal dealings or as to what they entailed, but stated that in order for the CMLC to function properly, he should have been advised.22

Testimony indicated that steps could be taken to make the CMLC function more effectively without changing the existing law. It was the general consensus among the witnesses that there should be more experience under the new Space Act before further legislation was requested, and that the problem of organization which had arisen could be resolved by administrative action.23

Subcommittee Conclusions and Recommendations

At the conclusion of the hearings, the Subcommittee on Governmental Organization for Space Activities reported its conclusions and recommendations to the Senate Committee on Aeronautical and Space Sciences. These included:24

1. The National Aeronautics and Space Act of 1958 did

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22Ibid., pp. 507, 511, 591.
23U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, Governmental Organization for Space Activities, Senate Rept. No. 806, op. cit., p. 51.
24Ibid., p. 54.
not require revision at that time. Since the Space Act had been in effect for less than a year, it had not been fully tested.

2. Issues and problems that needed to be resolved could be achieved by administrative action within the Executive Branch. The recommended action included:

a. Appointment of a full-time Executive Secretary to the Space Council;

b. Appointment of a small capable professional staff for the Space Council, as authorized in the Space Act; and

c. Responsibility and authority for effecting coordination between the Defense Department and NASA be delegated to the CMLC.

IV. REVISED CHARTER FOR THE CIVILIAN-MILITARY LIAISON COMMITTEE

After conclusion of the hearings before the Subcommittee and prior to the issuance of its report, a joint NASA-DOD press release announced on July 1, 1959 that President Eisenhower had approved a revised charter for the Civilian-Military Liaison Committee, giving it expanded authority to coordinate military and civilian aeronautical and space activities. The major change in the charter directed the CMLC and its Chairman to handle jurisdictional disputes as they arise between the NASA and the Department of Defense. The previous charter permitted such mediatory action only when requested by either of the two agencies. The revised "Terms of Reference" spelled out the organizational objectives, functions, authority,
membership, procedures; and responsibility and authority of the Chairman. The announcement further stated that Defense Secretary Neil H. McElroy had released the CMIC Chairman, Mr. Holaday, to spend full time on CMIC activities.\textsuperscript{25}

In its report, the Subcommittee took note of this executive action and commented, "The subcommittee regards this action as promising in connection with strengthening the CMIC in view of the testimony on the weaknesses which were revealed during the course of the hearings."\textsuperscript{26}

V. PRESIDENT'S PROPOSAL FOR AMENDING THE SPACE ACT

On January 14, 1960, President Eisenhower submitted a special message to Congress requesting enactment of amendments to the National Aeronautics and Space Act of 1958 to clarify management responsibilities and streamline organizational arrangements concerning the nonmilitary space activities of the Government.\textsuperscript{27}

This would involve the following major changes in the


\textsuperscript{26}U. S. Congress, Senate, Committee on Aeronautical and Space Sciences, \textit{Governmental Organization for Space Activities}, Senate Rept. No. 806, \textit{op. cit.}, p. 56.

Space Act:

1. Revise the Congressional declaration of policy and purpose (Section 102);

2. Eliminate the statutory provisions which impose planning and supervisory duties in connection with aeronautical and space activities upon the President, and abolish the National Aeronautics and Space Council (Section 201);

3. Abolish the Civilian-Military Liaison Committee (Section 204);

4. Clearly delineate the jurisdiction of the NASA and the military in space activities; and

5. Provide adequate safeguards against unnecessary duplication of effort by the NASA and the Defense Department, particularly in the costly field of launch vehicle development.

President Eisenhower told the Congress that he was convinced by the experience of the fifteen months since the NASA was established that the Space Act needed to be amended in order to "place responsibility directly and unequivocally in one agency, NASA, for planning and managing a national program of nonmilitary space activities." First of all, this would require deletion of those provisions which reflect a single national space program embracing both civilian and military space activities directed at the top by the President and his advisory Space Council. "In actual practice," President Eisenhower said in his message, "a single civil-military program does not exist and is in fact unattainable; and the statutory
concept of such a program has caused confusion." At the same
time he suggested that the military use of space and associated
research and development were integral parts of the total de-
fense program of the United States, and should not be tied to
peaceful exploration of outer space. He pointed out that the
Defense Department has ample authority outside the Space Act
"to conduct research and development work on space-related
weapons systems and to utilize space for defense purposes; and
nothing in the act should derogate from that authority."\(^2\)

Mr. Eisenhower objected to the Space Council provisions
of the Space Act because they imposed upon the President an
"unusual degree of personal responsibility for developing this
'comprehensive' space program and of surveying its operations
in detail."\(^2\) He believed that such provisions were no longer
desirable. He referred to the end of a transitional period
during which responsibilities for a wide range of space ac-
tivities shifted from the Defense Department to NASA, stating
that NASA's capabilities for carrying out those responsibilities
were being developed. Furthermore, the President said: "From
now on it should be made clear that NASA, like the Department


\(^2\)Ibid., p. 2.
of Defense in the military field, is responsible in the first instance for the formulation and execution of its own program, subject, of course, to the authority and direction of the President. 30

With repeal, therefore, of the specific statutory enumeration of the President's duties under the Space Act, he requested the abolition of the Space Council, since its only duty is to advise the President on the performance of those duties. He also requested the abolition of the Civilian-Military Liaison Committee, which in practice served only as one of many channels of communication and consultation between the Department of Defense and NASA. On this change, the President commented: "The statute should go no further than requiring that NASA and the Department of Defense advise, consult, and keep each other fully informed with respect to space activities within their respective jurisdictions; it should not prescribe the specific means of doing so." 31

Finally, the President requested only a few limited powers: (i) the authority to settle disputes arising between the Department of Defense and NASA; and (ii) the authority to assign the responsibility for the development of each new launch vehicle, irrespective of its intended use, to either the Department of Defense or NASA. Mr. Eisenhower requested the latter authority as a safeguard "against undesirable

30 Ibid., p. 3. 31 Ibid.
duplication by NASA and the Department of Defense in developing the major tools of space exploration." 32

In conclusion, the President summed up the effects of his proposed amendments, thus: "Amended, as I have recommended, the National Aeronautics and Space Act of 1958 would become the organic act of an independent civilian agency having a well defined statutory responsibility for which it is answerable to both the President and to Congress." 33

The special message embodied the "suggested improvement" President Eisenhower promised in his 1960 State of the Union Message to correct the deficient Space Act. 34

VI. CONGRESSIONAL ACTION

The Administration Bill (H. R. 9675)

In response to the President's special message, Congressman Overton Brooks introduced H. R. 9675 in the House on January 18, 1960, a bill to amend the National Aeronautics and Space Act of 1958, and for other purposes. This bill was designed to give effect to the President's recommendations. The bill was referred to the House Committee on Science and Astronautics for consideration. 35

32 Ibid.
33 Ibid.
The House Committee held hearings on H. R. 9675 during the spring of 1960, just one year after the Senate Subcommittee on Governmental Organization for Space Activities made its investigation as covered above. On March 8, 1960, the first day of the hearings on the measure, Dr. Glennan discussed the proposed amendments to the Space Act. In his prepared statement, Dr. Glennan said:

In proposing these amendments for congressional enactment, the President is taking cognizance of NASA's coming of age after a very active transitional period during which our capabilities have been developed and expanded and our goals have come more sharply into focus. The amendments are a natural evolution based upon operating experience under the present law.36

If the Space Council were eliminated, Dr. Glennan testified that he would appoint an advisory committee to the Administrator to take its place. He intended for such a committee to deal more specifically than was possible with the Space Council, with the development of programs, organization and operations of the NASA.

Pointing to the provision for deleting the Civilian-Military Liaison Committee, Dr. Glennan stated that there were many channels of communication between the Pentagon and NASA other than the CMLC. He noted that they existed at every level of his organization. He indicated that he did not feel that

36 U. S. Congress, House, Committee on Science and Aeronautics, To Amend the National Aeronautics and Space Act of 1958, Hearings on H. R. 9675, op. cit., p. 29.
the CMLC had been a failure, but in his opinion, it was not a useful device in such a broad program as space activities, "... where there has to be so many links of information and coordination as there need to be between ourselves principally and the Department of Defense." 37

Mr. James H. Douglas, Deputy Secretary of Defense, testified on behalf of the proposed amendments saying that he favored the elimination of the CMLC since he felt that more effective coordination of space activities could be accomplished by direct contact and joint effort at all levels. 38

Dr. Hugh L. Dryden, NASA Deputy Administrator and a member of the CMLC, pointed to the crux of the problem in trying to make the CMLC an effective coordinating mechanism when he said that neither Dr. Glennan nor Defense Secretary Gates was willing to delegate to subordinate personnel the settlement of major issues. 39

House Bill 12049

On May 3, 1960, Congressman Brooks introduced a "clean bill," H. R. 12049, to amend the Space Act, and the measure was referred to the House Committee on Science and Astronautics. H. R. 12049 also embodied the provisions of two bills previously introduced proposing amendments to the Space Act—H. R. 4148, authorizing NASA to indemnify its contractors, and H. R. 9484,

37 Ibid., pp. 33, 81.
38 Ibid., p. 132. 39 Ibid., p. 81.
amending Section 305, entitled "Property Rights in Inventions"—thus tabling these bills.  

On May 19, 1960, the House Committee on Science and Astronautics reported H. R. 12049 favorably, accompanied by House Report 1633. The bill as reported followed in general the amendments recommended to Congress by President Eisenhower and in many respects was the same as the Administration bill, H. R. 9675. The House passed H. R. 12049 on June 9, 1960 without amendment.

As approved by the House, H. R. 12049 made the following significant revisions in the Space Act: (1) Abolished the National Aeronautics and Space Council, (2) Abolished the Civilian-Military Liaison Committee, (3) Created an Aeronautics and Astronautics Coordinating Board, (4) Revised the patent provisions under which the NASA operates, and (5) Added an indemnification section to guarantee NASA contractors against losses which may arise from unusually hazardous risks.

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41 Ibid.

42 Ibid. The CMLC was replaced by the Aeronautics and Astronautics Coordinating Board, a managerial type of joint NASA-Department of Defense coordinating mechanism, which would be responsible for coordinating activities of common interest, avoiding undesirable duplication, and providing for exchange of information between the two agencies. The revision in the patent provisions would give the NASA Administrator a greater degree of discretionary authority concerning the disposition of property rights in inventions conceived or first reduced
The Senate took no action on H. R. 12049. On August 31, 1960, Lyndon B. Johnson, then Chairman of the Senate Committee on Aeronautical and Space Sciences, and the Democratic Party's nominee for Vice President of the United States, placed a memorandum on the proposed amendments under H. R. 12049 in the Congressional Record. In this memorandum, Mr. Johnson explained why the Senate did not seriously consider H. R. 12049 during the Eighty-Sixth Congress. He said in part:

Analysis of the key issues involved fails to uncover any persuasive reasons for pressing for Senate action on these amendments during the current session.

One fact is of overriding importance. A new President will take office on January 20, 1961—less than 5 months from now. The next President could well have different views as to organization and functions of the military and civilian space programs. Any changes in the Space Act at this session will have little or no effect on the space programs during these next few months, but could restrict the freedom of action of the next President.43

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43 Congressional Record (Daily), Volume 106, No. 147, August 31, 1960, p. 17215.
CHAPTER VIII

SUMMARY AND CONCLUSIONS

"There is a tide in the affairs of men,
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries.
On such a full sea are we now afloat;
And we must take the current when it serves
Or lose our venture."

Shakespeare

In this report, the writer has undertaken to determine the extent to which the NASA has implemented the mandates set forth in the Space Act of 1958, with principal emphasis on budgeting and programing aspects during its first two years of operations, beginning October 1, 1958. On the basis of the research conducted, supported by the findings and observations contained in the foregoing chapters, the writer has arrived at certain conclusions. These conclusions together with a summary of the salient points discussed, are set forth in this chapter in an arrangement similar to that followed in grouping the subject matter under the individual chapters.

I. DECLARATION OF POLICY AND PURPOSE

The National Aeronautics and Space Act of 1958, enacted during the Eighty-Fifth Congress, was the first legislative expression of the United States policy concerning its activities in outer space. This was an legislative act having the most profound implications. It projected this country into an
entirely new dimension of human endeavor—the exploration of outer space. For the first time in the nation's history of legislation, the terms "space activities" and "space vehicles" have been written into law.¹

This legal innovation stemmed directly from the challenge induced by Soviet spectacular successes with the first Sputnik launchings in the fall of 1957. The most important features in the legislative Declaration of Policy and Purpose was Congress' insistence that activities in space should be devoted to peaceful purposes and its decision that such activities should be directed by a civilian agency. The Space Act established such an organization, the National Aeronautics and Space Administration.²

Accordingly, the conduct of the nation's program for the exploration, scientific investigation and utilization of space for peaceful purposes is the specific mission of the National Aeronautics and Space Administration. It is a program that does not embrace the military uses of outer space. It

¹In this connection see "Where Are We Going in Space?" an address by John A. Johnson, General Counsel, NASA, before the National Security Industrial Association, Mayflower Hotel, Washington, D. C., on December 10, 1959 (NASA Release No. 59-272), pp. 6-7; and "Space Activities and the National Aeronautics and Space Administration," an address by Paul G. Dembling, Assistant General Counsel, NASA, before the Rotary Club of St. Joseph and Benton Harbor, Michigan on March 23, 1959, p. 4.

²See especially "Responsibilities of the National Aeronautics and Space Administration," a Statement of John A. Johnson, General Counsel, NASA, on September 14, 1959, p. 4.
is desirable here to clarify the confusion that still exists concerning what is frequently referred to as the national space program and which is the topic of this study. Perhaps this civilian program should more properly be designated as the nation's space exploration program, since all of the civilian activities are designed to further the exploration of space. 3

For the Department of Defense, military space projects are undertaken only to meet military objectives and therefore must compete in the defense budget with alternate methods for accomplishing the same military requirements. The Space Act does not preclude military utilization of space, and the research and development directed toward that end are integral parts of the total national defense program. In terms of the legislation, the Department of Defense continues to be responsible for space activities which are primarily associated with the development of weapons systems, military operations or the defense of the United States. 4 Thus, the legislative intent was clear.

II. NASA: ITS ORGANIZATION AND GROWTH

The new agency began operations on October 1, 1958 under the direction of Dr. T. Keith Glennan, the first NASA

3On this point, see address by Johnson, op. cit., pp. 7-8.

4Ibid., p. 8.
Administrator and Dr. Hugh L. Dryden, as Deputy Administrator, both of whom were nominated by the President and confirmed by the Senate. When the Senate Special Committee on Space and Astronautics opened its hearings to consider the nominations, Vice President Johnson, then Chairman of the Committee, told Dr. Glennan, "If you are confirmed, I am not certain whether congratulations or commiserations will be in order." He continued, "There are no blueprints or roadmaps which clearly mark out the course that the new space director must follow. The limits of the job are no less than the limits of the universe. And those are limits which can be stated but are virtually impossible to describe."5 This was a formidable challenge, particularly when the mandate implied that this nation must overtake and surpass a competing nation that had the advantage of about six years head start in laying groundwork for space exploration.

It was the task of these top NASA officials to marshal the facilities and technical talents to assure a first-rate position for this country in the exploration and development of outer space. A corollary task was convincing Congress that consistent and sufficient financial support of a national

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space program was necessary. Furthermore, it was a great responsibility of NASA personnel at all levels in the organization to assure that neither time nor effort was wasted in this undertaking. NASA assumed these responsibilities with a sense of urgency.

Under the provisions of the Space Act, the new agency absorbed the National Advisory Committee for Aeronautics (NACA), a distinguished 43-year old research organization, which, through concentration on aeronautics, accomplished much spadework for the transition to astronautics or outer space. The new agency's legacy included 8,000 employees, many highly skilled in both aeronautics and space research, and a $350 million plant investment consisting of the three research laboratories, Langley, Ames, and Lewis; plus a rocket launching facility at Wallops Island, Virginia; and a high-speed flight test station at Edwards, California. These facilities and a well-planned broad research program already underway served as the nucleus for the development of NASA's operating organization. Under the leadership of Dr. Glennan and Dr. Dryden, NASA expanded rapidly. What was lacking, however, was sufficient competence in the design, construction and operation of space vehicles; and in the related areas of advanced guidance and control, tracking, communications, and data reduction.6

NASA then took over a series of nonmilitary space projects of the Department of Defense including the Navy Vanguard Project, along with the Vanguard team and personnel from the upper atmosphere group of the Naval Research Laboratory. From this transfer, NASA was fortunate to acquire 400 highly trained and experienced personnel in the area of space sciences and satellite applications, as well as tracking, communications, and data reduction.\textsuperscript{7}

Next, NASA assumed the Army's contract relationship with the Jet Propulsion Laboratory near Pasadena, operated by the California Institute of Technology. The transfer of this Government-owned laboratory represented another great strength in building the new agency. NASA gained additional staff of approximately 2,300 scientists and engineers who had demonstrated ability in virtually all aspects of space sciences and technology, with particular capability in guidance systems, rocket propulsion, electronics, systems analysis, tracking and telemetering.

Neither the Vanguard group nor the JPL group provided the new agency with the required competence to develop large space vehicle systems. This capability was met by the transfer to NASA of the Development Operations Division of the Army Ballistic Missile Agency at the Redstone Arsenal, Huntsville,\textsuperscript{7}

\textsuperscript{7}Ibid., pp. 23-24.
Alabama. The acquisition of Dr. von Braun's group added about 5,500 to the payroll and NASA acquired research and test facilities valued at $100 million under this transfer. These facilities were officially transferred to NASA on July 1, 1960 and became the George C. Marshall Space Flight Center. NASA was assigned the sole responsibility for developing super-thrust boosters by President Eisenhower.

Additionally, NASA is building the Goddard Space Flight Center at Greenbelt, Maryland, a multi-million-dollar installation. The Navy Vanguard group formed the nucleus of the staff at Goddard which will grow to about 2,400 persons by June 30, 1962. With this accretion, Dr. Glennan pointed out that the agency's rapid growth will be virtually complete. This gives NASA an estimated total in-house capability of 19,000 people. No new major installation to be operated by the Government is planned; nor does NASA plan any major increases in the complements of its centers. With the exception of the Marshall Center, NASA has no great capacity to design, develop and produce launch vehicle systems. Thus, the new agency will look to industry and other organizations to furnish capability for an increasing proportion of this program. An estimated 75 per cent of NASA's budget will be spent by contract with industrial firms and with educational and other non-profit organizations. Figure 11 shows the ratio of outside contracts

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IN HOUSE VS CONTRACTED EFFORT

(IN MILLIONS OF DOLLARS)

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<tr>
<th>FY</th>
<th>IN HOUSE</th>
<th>OUTSIDE CONTRACTS</th>
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<tr>
<td>FY 1959</td>
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<td>FY 1960</td>
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<td>FY 1961</td>
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FIGURE 11
to in-house expenditures in fiscal year 1959 was approximately 3 to 1. This ratio increased in fiscal 1960. This reflects the fact that the NASA program has increased in size at a greater pace than the in-house capability.9

In the interest of effective management, NASA has adopted the policy of delegating authority and responsibility to the greatest possible extent. In the discharge of this responsibility, all management echelons have the advantage of making prompt and meaningful decisions based on timely and accurate operating information.

Despite the expansion of its activities, NASA has attempted to remain as small and flexible an organization as possible. It adopted the approach of its predecessor, which was to center only a fraction of its personnel in Washington Headquarters and to build up a strong operating staff at its field establishments. Comparatively speaking, NASA Headquarters is a fairly small organization with a complement of about 600 people. Under the Administrator are five major program offices or directorates that plan, integrate and monitor NASA's total research and development program. Without reiterating their

Conference held in Washington, D. C., July 28-29, 1960, National Aeronautics and Space Administration, pp. 3-4.

specific functions, they are: the Office of Advanced Research Programs; the Office of Space Flight Programs; the Office of Launch Vehicle Programs; the Office of Life Sciences Programs; and the Office of Business Administration.

Execution of NASA in-house research and development projects and the technical monitoring and administration of NASA development contracts with industry are accomplished by the NASA field installations. The Langley, Ames and Lewis Research Centers, and the Flight Research Center are responsible for basic and applied aeronautical research activities formerly conducted by the NACA, but there has been a redirection of emphasis from research in aeronautics to research on more pressing problems of space science and technology.

The Marshall Space Flight Center has been assigned the principal responsibility for the design and development of launch vehicle systems, and associated launch operations. The Jet Propulsion Laboratory concentrates on the exploration of deep space, including unmanned lunar and interplanetary missions and deep space tracking operations. The Goddard Space Flight Center is responsible for satellite missions; sounding rockets; manned space flight; application of space vehicles to useful purposes, including communications and meteorology; and tracking operations, except the deep space net. The

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10 As of this writing, the Space Task Group, formerly a part of Goddard, has been set up as a separate unit reporting directly to the Director, Office of Space Flight Programs.
Wallops Station continues to probe the upper atmosphere with numerous launchings of sounding rockets and also launches solid propellant orbital vehicles. To round out the organizational structure, there is the Western Operations Office in Santa Monica, California with a staff of about forty people. Its functions are to perform liaison with the principal development contractors engaged in the NASA program located West of Denver, and to carry out contract administration in that area as required.

III. NASA PROGRAMING AND FUNDING

NASA is implementing (i) a broad space sciences program in support of aeronautical and space activities, (ii) a comprehensive program of research and development in advanced technological areas, and (iii) a program intended to apply space flight capabilities to practical, beneficial purposes.

Space Sciences

A considerable research effort in the related fields of science and engineering is required to establish the basis for the kinds of activities that NASA will be pursuing in the next decade as well as to improve its present capabilities. NASA has developed the National Space Sciences Program on a very broad basis, soliciting the advice of many specialists in other Government organizations, industry, and the scientific community.
The principal areas of research are: atmosphere, ionospheres, energetic particles, electric and magnetic fields, gravity fields, astronomy, and biosciences. The subdivision indicated is solely for convenience. Actually the various areas are related in a great many complex ways. Scientific space investigations make use of the data-collecting capabilities of such space research tools as sounding rockets, satellites, and space probes to investigate the Earth's atmosphere through the solar system and into the far reaches of space for the purpose of gaining a better knowledge of the universe. 11

In the past two years the United States has achieved substantial success with its space investigations. Instrumented space vehicles have discovered the Great Radiation Region and the pear-shape of the Earth; successfully photographed pictures of cloud cover from a distance of 20,000 miles; demonstrated the use of solar power and the feasibility of passive communications satellites. These and other United States space activities have produced significant advances in space sciences and technology, and in this area exceed substantially the results reported by our competitor, the Soviet Union.

It is recognized that the National Space Sciences

Program is subject to continuing review, expansion, and modification as the work progresses and scientific information and results are received from the currently orbiting space vehicles. In addition, the desired scientific investigations must be continuously matched with current and future capabilities and availabilities of supporting technology, space vehicles, and facilities.  

**Advanced Technology**

Another major aspect of the NASA program is the development of new kinds of rocket vehicles and propulsion systems. It is well established that propulsion will be the key to space travel. Whatever the mission or particular objective, propulsion systems have played the key role in success or failure. Unfortunately, the NASA did not possess the propulsion systems required for the payloads for many missions it needed to undertake. Its capability has been further limited by the unavailability of upper stage rockets of the appropriate sizes to match the capabilities of the Intercontinental Ballistic Missile (ICBM) boosters available for use as the first stage of a space launch vehicle. Until Mid-1960, NASA was compelled to use available rockets from the Vanguard Project or other missile programs of the military. Thus, the major difficulty in launch vehicle development has been the problem of securing

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\[12\] Ibid.
suitably designed equipment that could efficiently use the full capabilities of the large military ICBM rockets.\textsuperscript{13}

In the family of launch vehicles that comprise the National Booster Program, the multi-stage Saturn vehicle designed to utilize high-energy propellants will play a major role with its large payload capability and inherent growth potential. Considerations have been directed toward broadening the use of Saturn for all possible applications by both NASA and the Department of Defense. Beside Saturn, the family consists of the solid-propellant Scout, the Agena (Atlas-Agena and Thor-Agena Vehicles), the Atlas-Centaur, and the Nova vehicle concept, based upon the use of a cluster of the 1.5-million-pound-thrust F-1 engines. The primary objective in selecting this small group of standardized multi-purpose vehicles designed for specific missions was to provide a series of launch vehicles of increasing capability and reliability, which would be adequate for most of the space missions planned during the next several years. These missions encompass satellite launchings, lunar exploration, planetary exploration and deep space probes.

NASA programs and plans for advanced technology and development work in the field of propulsion include chemical, nuclear and electrical propulsion. Early developments have been based on chemical fuels. However, increased attention is

being given to the use of nuclear fuel. The potentialities of the application of nuclear energy in space exploration are considered very great both for primary power plant propulsive power and auxiliary power. In fact, scientists believe that some large payloads used for distant space missions cannot be accomplished by any other practicable means. Operating nuclear rockets will probably be demonstrated by 1970, possibly as an upper stage of an interplanetary probe. For long-range missions, there is no doubt that nuclear energy will be the leading contender.14

Electrical propulsion technology is still in its infancy. The characteristic feature of the electrical propulsion system is high specific impulse and low thrust. Electrical propulsion is considered well suited for interplanetary space missions.

The means of guidance, navigation and control will be greatly advanced over the presently available systems. In summary, the NASA has set in motion a strong National Space Vehicle Program, which ultimately will provide the United States with rocket vehicles exceeding six million pounds of thrust. In addition, a global tracking network and a comprehensive data acquisition system are being expanded.

Applications Program

In its current applications program, NASA is carrying out three different kinds of activities. The first is concerned with the use of space for scientific experiments and scientific measurements in sounding rockets, satellites, and space probes. Already valuable results have been obtained as noted earlier.

The second application of space flight is concerned with investigating the problems of manned space flight. Project Mercury is the highest priority effort in this direction. Its primary objective is to study man's capabilities in a space environment. Recently, a successful test flight of the Mercury capsule was made carrying a chimpanzee, named "Ham." It was discouraging to learn that the Redstone rocket used in the launching overshot its target considerably. However, scientists reported that the "Chimp" performed satisfactorily and was not harmed by his flight through space. Truly, this is a major step toward manned space flight. NASA hopes to accomplish the first manned orbital flight during calendar year 1961. Manned flights will be continued into fiscal year 1962.

The third is the satellite program which will produce practical application of space technology—a program involving satellites that will have an impact on our daily living. The two primary fields of satellite application at present are meteorology and communications. Significant milestones
in this area have already been reached. Tiros I, the first of a series of experimental meteorological satellites, transmitted 23,000 pictures of the Earth's cloud cover, providing new and important information on the formation and extent of clouds. The next generation is the Nimbus series now under development. The successful launching of Echo I was the first step in the investigation of the feasibility of global communications systems using passive satellites as reflectors. Application in these areas should achieve notable success in the next decade. It seems that a fully operational meteorological satellite system having world-wide coverage should be in operation in the next decade. In this time period, satellites should make possible world-wide communications for commercial use.

As the program progresses, it is expected to provide greatly improved weather forecasting, if not weather control; and world-wide television and telephone services that may literally revolutionize our lives. It is safe to predict that these applications of rocket vehicles will have more direct effect on the man in the street than any other development in space technology.

Space investigations are useless unless there is a provision for acquiring scientific data from them about our universe and environment of outer space. Thus, tracking and data acquisition networks have been installed and are now operating in some fourteen countries around the world. Tracking facilities are under construction in seven additional countries.
The Next Decade in Space

Early in calendar year 1960, NASA presented to the Congress its Ten-Year Plan calling for a broad spectrum of space activities. The 10-year objectives met with encouraging Congressional response. This appears to be a well conceived plan of action for the immediate and distant future and must be updated annually to take full benefit of knowledge gained as the Agency moves toward its objectives.

Barring any spectacular breakthrough, the success in achieving many of these missions will depend upon the success of the new and powerful Centaur and Saturn launch vehicles still under development. The weight-lifting capacity of the Saturn when finally launched will dwarf anything now known to exist.

The cost of this ambitious program is estimated to run between $12 to $15 billion in the next decade. However, the soaring costs that have been experienced indicate that the price tag may well reach considerably more. According to Dr. Glennan, as the NASA program expands it will require annual budgets ranging from more than $1 billion in fiscal year 1962 to $2 billion annually within the next five years.

Turning to the agency's past and present funding, NASA had a sum of $338,905,832 for fiscal year 1959, made up of a combination of resources transferred from other Government agencies, together with those appropriated directly to the Administration. The first full year of operation, fiscal year 1960, NASA received a total obligational authority of $523,575,000.
NASA officially requested $915 million in appropriations for fiscal year 1961 which Congress granted in full. At the time of the budget hearings, NASA identified over $20 million of additional costs not covered by the fiscal year 1961 budget request. Congress realized that more than flexibility was required and authorized an additional $50 million appropriation for emergency research and development in order to assure that neither the space program nor the safety of personnel will be jeopardized by lack of funding. Figure 12 provides an indication of the rate of growth of NASA program from year to year and the increased emphasis placed on research and development.\textsuperscript{15}

In order to achieve the mission objectives envisioned in the next ten years, the program activities must be carried out with consistency and determination, and with a sustained adequate level of support. Dr. W. H. Pickering, Director, Jet Propulsion Laboratory at Pasadena has stressed the need for adopting a sound attitude regarding the funding of space programs:

\textit{... This attitude, I believe, should reflect the fact that for some time to come, it should be recognized that considerable funds must of necessity be invested in supporting research, in facilities, and for experimental equipment with the realization that the accomplishment of the early missions may not necessarily result in any immediate or significant dividends in terms of tangible}

\textsuperscript{15}Data extracted from U. S. Congress, House, Committee on Science and Astronautics and Subcommittees Nos. 1, 2, 3, and 4, 1961 NASA Authorization, Hearings on H. R. 10246, op. cit., p. 5.
TOTAL NASA OBLIGATIONAL AUTHORITY
(IN MILLIONS OF DOLLARS)

FY 1959  338.9

S&E  R&D  C& E

FY 1960  523.6

FY 1961  915.0

FIGURE 12
gains to the economy. This attitude, of course, discounts any dividends having a psychological or propaganda value which might accrue to the free world from having achieved significant "firsts" in the exploitation of space. It is conceivable that the prestige value to the nation of achieving these "firsts" may well prove to be one of the most economical means of carrying the cost of a cold war.16

Dr. Hugh L. Dryden has given an indication of what space exploration can ultimately achieve for mankind:

Through advance in these sciences we will gain a deeper understanding of the universe in which we live, including our earth and nearby space, the moon and planets, interplanetary space and distant galaxies. This deeper understanding and knowledge will bring the power to predict, to direct and to control the forces of nature and our own destiny.17

Dr. Dryden is confident that eventually space travel will be commonplace, although it is not possible to foretell the details of future spacecraft or the timetable for their development.18

IV. COORDINATING AERONAUTICAL AND SPACE ACTIVITIES

The Space Act provides for close coordination between the NASA and the Department of Defense in the interest of preventing unnecessary duplication of effort in space activities


and provides for complete interchange of information between the two agencies. The National Aeronautics and Space Council, chaired by the President, and the Civilian-Military Liaison Committee (CMLC) are the formal machinery created by law to help accomplish these objectives.

Coordination between agencies was only one of the duties of the President as head of the Space Council. A corollary task was to develop a comprehensive national space program and fix responsibilities for the direction of major aeronautical and space activities. This requirement put the President in the position of running the nation's space activities on a day-to-day basis.

President Eisenhower felt that the statute imposed upon the Chief Executive an unusual degree of personal responsibility and requested the Eighty-Sixth Congress to amend the Space Act making the NASA responsible in the first instance for the formulation and execution of its own program under the direction of the President. With the statutory enumeration of Presidential duties repealed, Mr. Eisenhower recommended that the Space Council be abolished, since its sole function was to advise the President in the discharge of those duties. At the same time, President Eisenhower requested Congress to abolish the Civilian-Military Liaison Committee. He believed that the statute should go no further than requiring the NASA and the Department of Defense to keep each other informed with respect to the space activities within their respective.
jurisdictions, but it should not prescribe the specific means to accomplish this.

The House of Representatives acted favorably on the Presidential request, but it was not considered by the Senate.

**National Aeronautics and Space Council**

The moribund Space Council has not been a strong administrative mechanism. It seldom met and has never been properly staffed. Some of its key staff positions, established by law, have not been filled. One of these posts is the $20,000-a-year Executive Secretary. Two of the Space Council's major tasks are to assist the President in deciding which projects would be carried out by the military and which would be assigned to the NASA, and resolve differences between the two agencies.

Lately there has been criticism that the NASA on the one hand and the Air Force on the other have been left to their own devices in fighting out their battles for jurisdiction and appropriations without the over-all direction that the Space Council was created to provide. As a result, the critics claimed, there has been waste, delays and in general, a space

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19 On March 22, 1961, President Kennedy nominated Edward C. Welsh to be Executive Secretary of the National Aeronautics and Space Council. His nomination was confirmed by the Senate on March 24, 1961. Mr. Welsh formerly was an assistant to Senator Stuart Symington, and played a key staff role in a number of important Senate defense investigations and military and space legislative activities.
program not worthy of the world's most advanced scientific and technological society. 20

The Kennedy Administration has announced that it plans to activate the Space Council as a mechanism for coordinating Government space activities and advising the President on policy. To carry out the plans, President Kennedy has named Vice President Lyndon B. Johnson as chairman of the Space Council. A minor change in the Space Act will be required to permit the Vice President to assume leadership and direct its activities. In a recent press conference, Mr. Kennedy said that he would recommend to Congress shortly that the Space Council be reconstituted with the Vice President instead of the President as chairman.

Both President Kennedy and Vice President Johnson vigorously endorse the theory underlying the Space Council, but they feel that the Eisenhower Administration failed to make the proper use of this body. Mr. Johnson helped to draft the Space Act when he was Chairman of the Senate Special Committee on Space and Astronautics. This is a field in which he is well versed, particularly the political and psychological implications connected with the conquest of outer space; and it is one much in demand of Mr. Johnson's unusual talents for

leadership and conciliation.

**Civilian-Military Liaison Committee**

Testimony before Congressional committees indicated that the Civilian-Military Liaison Committee has been cumbersome, unnecessary and unworkable. It was created to provide a channel of coordination and interchange of information between the Department of Defense and the NASA. However, the day-to-day contacts at each level in the organization have been the most important continuing channels in accomplishing these objectives. Perhaps the CMLC could have been an effective mechanism had the Secretary of Defense and the NASA Administrator been willing to delegate to subordinate personnel the authority to make major decisions.

The Aeronautics and Astronautics Coordinating Board established in September 1960 to coordinate military and NASA space activities has, in effect, replaced the CMLC. The Board is regarded as quite effective. It provides a means for making decisions by management people composed of the NASA, the Office of the Secretary of Defense, the Army, Navy and Air Force. The Co-Chairmen are Dr. Herbert F. York, Director of Defense Research and Engineering and Dr. Hugh L. Dryden, NASA Deputy Administrator. By virtue of their official positions in the two organizations, Board members have authority to carry out agreements and decisions reached as a result of discussions and determinations within the Board.
V. CONCLUDING REMARKS

Both Dr. Glennan and Dr. Dryden have been extremely candid and realistic in their testimony before the Congressional committees on the cost and timing of the proposed NASA program missions. Never have they promised spectacular feats at economy prices. In fact, they have repeatedly told Congress that space is an expensive business.

During the short span of some 29 months that Dr. Glennan was Administrator, NASA mustered the necessary resources and built an organization capable of carrying out the mandates contained in the Space Act. The NASA organization was formed out of a mixture of heterogeneous groups with diverse backgrounds, experience, technical approaches, and institutional philosophies. The predecessor organization, NACA, had a smaller staff and a research oriented management. It operated a program, which by 1958, had grown to approximately $100 million. NASA, by comparison, is responsible for a broad and diversified program which in less than three years has grown to about $1 billion, and may grow to about $1.5 billion in 1962. The other units acquired by NASA from Government agencies, principally from the Army and Navy, and the Jet Propulsion Laboratory by contract with the California Institute of Technology, have been merged with NACA to form the present organization.

Any one who has observed the progress of NASA in the past two years must admit that while these different groups have not as yet been fully assimilated into the organizational
machinery, there is increasing evidence of a closer knit relationship between them. A new agency is in fact emerging and maturing. Efforts are being made to promote an essential common understanding and more unified direction of effort.

From a standing start, NASA has done a good job in formulating a realistic long-range program of space exploration, and has made notable progress in implementing this program. On the operational side, the agency has been able to successfully complete a little more than half of the experiments that have been undertaken. Dr. Glennan has indicated that the latter provides the greatest satisfaction.\textsuperscript{21} As the first NASA Administrator, he has won a great deal of praise from the Congress for his frankness and the integrity and dedication he has brought to his task. Significant milestones in the exploration of outer space have been first Pioneer V which demonstrated the feasibility of deep space communications when it sent back messages from 22.5 million miles in space; and then Echo and Tiros. Except in the time of war have agencies been required to expand so rapidly and with such urgency; and NASA has had to do this under public pressure, and the uninhibited scrutiny of Congress and the press.

So far the agency has resisted the temptation to overspend on spectacular firsts at the expense of funds for

scientific projects in other fields. The magnitude of the national space program must be supported by a broad program of research and development in many fields of technology and by vigorous development of advanced technology which exceed the present state-of-the-art. NASA has structured its program accordingly. It is not a crash program; and it does not offer the immediate and dramatic appeal of the concerted drive of our competitor, which is obviously oriented primarily to significant firsts for political and propaganda purposes. However, it should be clearly understood that the national space program must operate in a political environment. The spectacular Russian achievements in space and the superior thrust of their rocket boosters to ours should cause much soul searching among Americans. Congressional committees and the press find much to criticize and the public limelight is on NASA constantly. There is mounting concern at high levels, both in the Executive and Legislative branches, that the prestige of the United States abroad has suffered as a result of the spectacular Russian feats, and that despite the sound scientific achievements of the United States space program to date, substantial additional resources must be allocated to the nation's space effort on a top priority basis if this country is to overcome the present Russian lead in rocket engine thrust.
POSTSCRIPT

During the final drafting stage of this report, the writer observed an avalanche of criticism directed at the Eisenhower Administration in general and NASA in particular appearing in the form of news articles and editorials in leading newspapers and magazines, and in an official report of the new Administration. These charges may be summed up as follows: that the Eisenhower Administration has had no overall space policy; that the space activities have not been properly organized; and that what is being done has been hampered by competition between the civilian agency and the military for dominant role in space flight, which has resulted in duplication, waste, confusion and loss in national power and prestige while the Soviet Union has gained.

The Space/Aeronautics magazine, which has always been highly critical of the establishment of the civilian agency, has not changed position. Its editor, Randolph Hawthorne, writing in the February 1961 issue, alleged that a major battle "looms" between the Department of Defense and NASA for space programs and budget dollars. He believes the NASA should only direct research, thus leaving "operations" to user agencies; and that military requirements must have priority over scientific ones, concluding: "It is wasteful to support competing multi-billion dollar programs, both of them siphoning off competent technical and management personnel, so that two inadequate programs exist where one good one should be."
Mr. Hawthorne alleged that today opinion is veering toward this position, pointing out that even the aerospace news weekly which led in promoting the National Advisory Committee for Aeronautics into the operational NASA has issued an editorial "180."  

Veteran columnist, Roscoe Drummond did not mince words regarding the long delay in appointing a new Administrator for NASA when the Kennedy Administration assumed power. Mr. Drummond also pointed out that both Vice President Johnson and Professor Jerome B. Weisner, the President's advisor on science and technology, were aware that the NASA has suffered during the eleven-week "hiatus" after the election and were not happy about the situation. There were two complicated circumstances that contributed to the extended period before the 19,000 personnel of the NASA knew the destiny of their agency. Mr. Drummond described these circumstances as follows:

That at least eight people, whom the Administration asked to head NASA, turned it down. The post remained vacant until James E. Webb, former Director of the Budget Bureau and Under Secretary of State under President Truman, was finally persuaded to take the job.

That the life of NASA itself, as an independent agency in charge of the exploration of outer space for peaceful purposes, was in doubt for a considerable period. New pressures had developed, principally from industry, to merge the military and civilian programs into a combined operation. Until this controversy was finally and firmly settled—as it was in the end settled on the side

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22 Space/Aeronautics (February, 1961), p. 17.
of retaining N.A.S.A.'s independence—the search for a suitable administrator could not be effectively pressed. 23

It was also reported that this action to keep the peaceful exploration of space under civilian control and to appoint Mr. Webb as NASA Administrator had the support of Vice President Johnson and Professor Wiesner. Vice President Johnson has always displayed an overriding interest in space activities and has taken a strong position that non-military space projects must be kept firmly under civilian control. If Mr. Johnson as chairman of the Space Council and Professor Wiesner as the President's science advisor work closely together, they can perhaps shape the crucial decisions and supply the impetus and better coordination that the space activities need.

The writer shares the views expressed recently by Brigadier General David Sarnoff, Chairman of the Board, Radio Corporation of America. He considers that the Russians have outdistanced this country, temporarily, in development of high-thrust rockets and they have gained substantially in propaganda spectacular firsts. However, any gap is "quantitative," not "qualitative," the General declares. It simply signifies an earlier beginning and a greater concentration of effort and resources. This country is capable of catching up or surpassing

the Russians, provided it musters the national resolve to do so, the General thought. American resources and know-how are fully sufficient to meet the Soviet challenge not only in rockets and outer space, but in all areas of technology. General Sarnoff pointed out that the reason this wealthy country got a late start in the space race was a political one, and stated that another gap exists—not only in this country, but in the entire Western world—a gap he described as more menacing and potentially more destructive than any missile gap. "I refer to a gap in political and psychological appraisal and action. This, rather than American technology and military planning, is responsible for any missile gap." The General went on to say that "The gap is not Republican or Democratic. It is a gap in the understanding by all of us, as a nation, of the political and psychological effects of a Russian 'first' in the dimensions of space."24

Before President Kennedy took office, he appointed a nine-member Ad Hoc Committee on Space headed by Dr. Jerome B. Wiesner of the Massachusetts Institute of Technology, now special assistant to the President for Science and Technology. While it is not within the scope of this paper to make a complete review of the Committee's report, some of its findings and recommendations are worthy of mention. In general, the

24The American Weekly Magazine (March 5, 1961), pp. 8-12.
Committee was critical of the Eisenhower Administration's performance in developing missiles and planning outer space activities.

After admitting that it made a "hasty review of the national space program," the Committee asserted that the present Project Mercury--man-in-space program--is "marginal" and if its Atlas rocket booster proves inadequate for the task, it may be necessary to accelerate alternatives vigorously. The report added, "Because of our lag in the development of large rocket boosters, it is very unlikely that we shall be first in placing a man into orbit around the earth." It went on to warn against giving the impression that man in space is the most significant objective of this nation's space effort.25

NASA was also criticized for paying such "little attention" to basic aeronautical research and development. There is ample evidence the Committee found that Russia and Britain are surpassing the United States in development of supersonic commercial aircraft. It predicted that it may be necessary to take such work from the NASA and give it to another Government agency.26

The report called for the reorganization of NASA into

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25 Report to the President-Elect of the Ad Hoc Committee on Space (Preliminary), January 12, 1961, pp. 1, 6, 11.
26 Ibid., p. 5.
four technical offices along different lines than now organized, designed to stress aeronautics and greater practical application of existing technology. The report alleged that neither the National Aeronautics and Space Administration as presently operated nor "the fractionated military space program nor the long-dormant space council have been adequate to meet the challenge that the Soviet thrust into space has posed to our military security and to our position of leadership in the world." However, the report conceded that America now holds a position of leadership in space science, but called for a radical reorganization with more capable personnel to direct what the country is now doing in order to maintain that position. 27

Roscoe Drummond, commenting on the Committee's findings, pointed out that no representative of the Kennedy Administration, including the chairman of the Ad Hoc Committee on Space, made "any effort to see, to consult with, or to get information from Dr. Glennan or any of the NASA officials." Mr. Drummond further stated that to the majority of the newspaper men who have long covered the country's space program, the Committee's critique read like a "melange of observations based on superficial study." 28

27 Ibid., pp. 4, 8.

President Kennedy described the report as "highly informative," but at a recent press conference said that the views expressed were not necessarily correct.

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SELECTED BIBLIOGRAPHY

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APPENDICES
APPENDIX A

GLOSSARY OF INTERVIEWS

During the course of the research conducted for and the writing of this report, the writer gained valuable information and suggestions from interviews with knowledgeable people. The following is a partial listing of these interviews and the dates on which they occurred.

2. **Dr. Hugh L. Dryden**, Deputy Administrator, National Aeronautics and Space Administration, August 18, 1960.
5. **Ray Harris**, Assistant Patent Counsel, National Aeronautics and Space Administration, April 17 and 18, 1961.
6. **Walter Hering**, Head, Photographic Coordination Section of the Office of Technical Information and Educational Programs, National Aeronautics and Space Administration, January 17, 1961.
7. **Dr. James A. Hootman**, Secretary of the Inventions and Contributions Board, National Aeronautics and Space Administration, September 21, 1960.


X-15 MANNED RESEARCH VEHICLE
CREDIT: NASA

FIGURE 14
TABLE II
ANTICIPATED MAJOR VEHICLE LAUNCHING SCHEDULE BY VEHICLE

<table>
<thead>
<tr>
<th>FISCAL YEAR</th>
<th>1960*</th>
<th>1961</th>
<th>'62</th>
<th>'63</th>
<th>'64</th>
<th>'65</th>
<th>'66</th>
<th>'67</th>
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<th>'69</th>
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</table>

* LAST TWO QUARTERS ONLY

FIGURE 15
Calendar Year

1960
First launching of a Meteorological Satellite.
First launching of a Passive Reflector Communications Satellite.
First launching of a Scout vehicle.
First launching of a Thor-Delta vehicle.
First launching of an Atlas-Agena-B vehicle (by the Department of Defense).
First suborbital flight of an astronaut.

1961
First launching of a lunar impact vehicle.
First launching of an Atlas-Centaur vehicle.
Attainment of manned space flight, Project Mercury.

1962
First launching to the vicinity of Venus and/or Mars.

1963
First launching of two stage Saturn vehicle.

1963-1964
First launching of unmanned vehicle for controlled landing on the moon.
First launching Orbiting Astronomical and Radio Astronomy Observatory.

1964
First launching of unmanned lunar circumnavigation and return to earth vehicle.
First reconnaissance of Mars and/or Venus by an unmanned vehicle.

1965-1967
First launching in a program leading to manned circumlunar flight and to permanent near-earth space station.

Beyond 1970
Manned flight to the moon.
PARTICIPATION IN TIROS

NASA
OVERALL DIRECTION AND COORDINATION

U.S. ARMY AND CONTRACTORS FROM INDUSTRY
DEVELOPMENT OF PAYLOAD AND SELECTED GROUND EQUIPMENT, DATA ACQUISITION, DATA TRANSMISSION

U.S. AIR FORCE AND CONTRACTORS FROM INDUSTRY
DEVELOPMENT OF LAUNCH VEHICLE, MATING OF VEHICLE AND PAYLOAD, LAUNCH, DATA ACQUISITION. ASSISTANCE IN DATA ANALYSIS AND INTERPRETATION

U.S. NAVY:
ASSISTANCE IN PHOTO ANALYSIS

U.S. WEATHER BUREAU
DATA ANALYSIS AND INTERPRETATION, DATA DISSEMINATION, HISTORICAL STORAGE
FIGURE 18

Tiros I, NASA'S Meteorological Satellite
FIGURE 19
Echo I, NASA'S 100-Foot-Diameter Passive Communications Satellite
PROJECT MERCURY
ORGANIZATION

SPECIAL COMMITTEE ON LIFE SCIENCES

NASA

DOD REPRESENTATIVE FOR PROJECT MERCURY OPERATIONS

CAPSULES
McDONNELL AIRCRAFT

BOOSTERS
USAF-CONVAIR
ARMY-ABMA
NASA-NAA

TRACKING NETWORK
WESTERN ELECTRIC

OPERATIONS
DOD
NASA CONTRACTORS

FIGURE 20
PROJECT MERCURY
BALLISTIC CAPSULE

- MAIN & RESERVE CHUTES
- PITCH & YAW CONTROL JET
- INSTRUMENT PANEL
- WINDOW
- SIDE HATCH
- COMMUNICATIONS SYSTEM
- HEAT SHIELD
- ATTITUDE CONTROLLER
- ESCAPE INITIATOR
- COUCH
- ENVIRONMENTAL CONTROL SYSTEM
- RECOVERY AIDS
- PERISCOPE (EXTENDED)
- ANTENNA HOUSING

FIGURE 22
MERCURY GROUND COMMUNICATIONS

LEGEND

1. CAPE CANAVERAL (AFMTC)
2. BERMUDA
3. MID-ATLANTIC SHIP
4. CANARY ISLANDS
5. KANO, NIGERIA
6. ZANZIBAR
7. INDIAN OCEAN SHIP
8. WEST AUSTRALIA
9. WOOMERA, AUSTRALIA

10. GUADALCANAL (DELETED)
11. CANTON ISLAND
12. HAWAII
13. SOUTH CALIFORNIA
14. WEST MEXICO
15. WHITE SANDS
16. SOUTH TEXAS
17. EGLIN AFB

■ COMMUNICATIONS CENTER
----- RADIO
----- SUBMARINE CABLE
----- LAND LINES
A ALT. ROUTE

FIGURE 24
FIGURE 25