THE NATIONAL SPACE PROGRAM--PROGRESS AND PROSPECTS

Based Upon and Excerpted From a Speech by

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Before discussing the national space program, a brief review of the policy of the United States in space may be in order. It is helpful to refer to the National Aeronautics and Space Act of 1958, where six major objectives are stated. They are:

1) Expansion of human knowledge to obtain better understanding of the universe.

2) The most effective utilization of the scientific and engineering resources of the United States.

3) Development and operation of vehicles to carry equipment and living organisms through space. This includes both launch vehicles and spacecraft.

4) Preservation of the role of the United States as a leader in aeronautical and space technology and its application to the conduct of peaceful activities.

5) Cooperation between the United States and other nations in aeronautical and space activities and their peaceful application.

6) Interchange of information and discoveries between NASA and agencies directly concerned with national defense.

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Our experience of the four years since 1958 has confirmed the wisdom and foresight of Congress in establishing these objectives. They remain our goals today.

On May 25, 1961, President Kennedy laid before Congress an expanded and accelerated program to achieve the objectives of the Act of 1958. The President declared, "Now it is time to act, to take longer strides--time for a great new American enterprise--time for this Nation to take a clearly leading role in space achievement . . .

"Recognizing the head start obtained by the Soviets. . . and recognizing the likelihood that they will exploit this lead for some time to come in still more impressive successes, we nevertheless are required to make new efforts on our own. For while we cannot guarantee that we shall one day be first, we can guarantee that any failure to make this effort will make us last."

Congress approved the proposals, and this great national effort is now well under way.

Although it is almost unnecessary to state why we have decided to marshal the resources required for leadership in space, it might be helpful to list them briefly.

First, we have traditional responsibilities in the quest for scientific knowledge. Returns from this effort will occur in many unplanned and unexpected ways and will have tremendous impact on our civilization.

Second, our Nation needs to realize the direct and immediate benefits of the application of space technology--in weather observation and prediction, in the improvement and expansion of world communications, in the betterment of navigation at sea and by air, and in the stimulus to the economy that will emerge from space activities.

Third, our international position requires leadership in space as it does in all activities that affect mankind now and in the future. As the President has observed, the space adventure has impact "on the minds of men everywhere, who are attempting to make a determination of which road they should take."

Finally, this Nation and the Free World would face grim consequences should another world power apply a superior space technology to military purposes.

Now, having stated our goals and the reasons that underlie them, where do we stand today?

We believe that the United States ranks first in the space sciences and that we have led in this area for years. Probably the most significant scientific discovery in space was made with the first United States satellite, Explorer I. This discovery was, of course, the great radiation belt surrounding the Earth, named for Professor James Van Allen. Undoubtedly you are familiar with other advances in science that, at an increasing rate, have been emerging from the national space effort.

The United States undoubtedly leads in the peaceful application of space technology. We have now conducted five successful flights of the Tiros meteorological satellite, and the U.S. Weather Bureau is using Tiros data on a routine basis to help prepare weather forecasts. The U.S. is implementing an operational system using an Earth stabilized satellite in polar orbit. Breadboard equipment for Nimbus is now undergoing systems tests and the first flight spacecraft will be available for launching in 1963.

In communications, the Echo balloon satellite has been aloft for almost two years. Just last week we launched the Telstar--a project directed and funded by the American Telephone and Telegraph Company. The feasibility of employing orbital receiving and transmitting stations to expand world teleradio and TV communications was clearly demonstrated. Another intermediate altitude satellite, the Relay, will be launched later this summer, and a synchronous altitude satellite called Syncom will be launched in early 1963.

We are looking into the possibility of a navigation satellite system, which might adapt for the use of civilian aviation and shipping the technology developed by the U.S. Navy in Project Transit.

We are determined that the United States shall also lead in manned space exploration. We have made striking gains in recent months. But it is essential that we be on constant guard against complacency.

The Nation is proud that Astronauts John Glenn and Scott Carpenter both accomplished three-orbit flights around the Earth this year. But we must keep in mind that the second

Soviet cosmonaut, Gherman Titov, almost a year ago achieved a 17-orbit flight lasting a full day, a feat we shall not equal before 1963.

Furthermore, according to the Soviet account, the Vostok spacecraft weighs upward of 10,000 lb--more than three times the weight of the Mercury spacecraft. We must recognize the likelihood of even more impressive Soviet successes with such a craft.

The United States is making excellent progress in developing more powerful launch vehicles. In the Atlas-Agena B, we now have a vehicle that can boost a payload of 5000 lb into Earth orbit. Its effectiveness was demonstrated on April 26 when Ranger IV became the first American-made object to strike the Moon. Further, we have conducted two successful suborbital flight tests of the first stage of the Saturn--to our knowledge the most powerful rocket that has so far been launched into space.

But the Soviets, for 17 months, have had a vehicle with the capacity to launch into orbit 14,000 lb. That is almost three times the payload of the Atlas-Agena B. We cannot equal or surpass such performance until Saturn begins carrying useful payloads--a time that is more than a year away. Who can say what launch vehicle progress the Soviets will have made in the meantime?

Consequently, in some areas we are in a "stern chase," as President Kennedy has termed it, to develop and then maintain the leadership our country must have in space. How are we going about it?

Here it is important to recognize that the space program is national in scope. The program is far broader than the activities of any one Government agency. It is a program in which the President takes great interest. The same is true of the Congress. From the outset, NASA and other agencies engaged in space activities have benefited from the attention not only of Congressional committees but also of the leadership in Congress.

In 1958, for example, both houses of Congress established special committees on space, headed by their majority leaders--Senator Lyndon B. Johnson and Representative John W. McCormack. Now Lyndon Johnson is the Vice President of the United States and Chairman of the National Aeronautics and Space Council, and Mr. McCormack is the Speaker of the House of Representatives.

In the Executive Office of the President, the National Aeronautics and Space Council, the Federal Council on Science and Technology, the President's Science Advisory Committee, and the Bureau of the Budget are concerned in a variety of ways with decisions related to the national space effort.

Among Federal departments and agencies, the National Aeronautics and Space Administration was assigned central responsibility for this national effort by Congress. Activities of great importance to the over-all program are also carried out by the Department of Defense, the Department of State, three bureaus of the Department of Commerce, the Atomic Energy Commission, the National Science Foundation, the National Academy of Sciences, the National Institutes of Health, the Smithsonian Institution, the Federal Aviation Agency, the Federal Communications Commission, and the United States Information Agency.

In the last 12 months we have reorganized NASA in line with the goals of the broadened and accelerated national aeronautics and space program. The reorganization is achieving the unification of major programs, improved communications between headquarters and the centers, closer coordination of related activities at different centers, and increased flexibility for the headquarters management. It has speeded the process of decision.

More than 80% of NASA research and development in fiscal 1962 went forward under contract. That proportion is increasing. Of the funds to be obligated under the President's Budget for the current fiscal year, more than 90 cents of every NASA dollar would be expended on contracts.

Since contracts represent so great a portion of the effort, a few statistics regarding NASA procurement during the last six months of the calendar year 1961 may be of interest.

1) About 87% of NASA's procurement was contracted to private industry, either directly by us or by the Jet Propulsion Laboratory, operated as a NASA center under a special contract with the California Institute of Technology. The remainder was expended by JPL, by other nonprofit institutions or organizations such as universities and private laboratories, or by other Government agencies.

2) Cost-plus-fixed-fee contracts amounted to 82% of the total. Fees averaged 6.56% of the estimated costs.

3) Small business received 66% of the contracts directly awarded by NASA, amounting to 12% of the available funds. Reports on subcontracting indicated that 16% of the dollars going to large business was subcontracted to small business.

To assure adequate supervision of contract projects, we have been building a staff of managers, scientists, and engineers. Thus far, we have been successful in attracting to our ranks the kind of people we need--despite the fact that Government salaries are substantially below those offered by industry. In the last year, 60% of our new appointments have come from outside the Government, 20% directly from colleges, and 20% from other Government agencies.

However, it should be emphasized that there is a serious impending manpower shortage unless more students enter the fields of science and technology. The enrollment in this country is dropping, while the Soviet enrollment is increasing and is apparently twice that of this country in equivalent fields. We must provide the opportunity for skilled teachers and research scientists to remain on our college campuses to educate and excite the curiosity of future scientists and engineers. NASA is attempting to assist in this regard by grants to universities involved in space science and engineering related to our programs.

In another paper in this volume, D. Brainerd Holmes, Director of NASA's Manned Space Flight Office, discusses in detail the NASA program of manned space flight. Therefore, only a few observations in this field are necessary.

We have been almost certain for a long time that man can exercise in space important functions that it would be difficult to program into mechanical devices. Since the flights of John Glenn and Scott Carpenter, we know this to be the case.

One pound thrusters are used for stabilization of the Mercury capsule. During the flight of Friendship 7, the yaw thrusters became erratic in operation, necessitating manual control by John Glenn. He had no difficulty holding the capsule in the correct orientation both during orbital flight and during re-entry. When the ground telemetry indicated that the heat shield had been prematurely deployed, it was decided not to jettison the retropack before re-entry in order to keep the heat shield in place with the retropack straps. This necessitated procedural changes that could not have been preprogrammed nor could they have been introduced by ground commands.

Scott Carpenter noted that Aurora 7 had the wrong pitch angle prior to retrofire. He manually set the pitch angle using the horizon as reference with sufficient accuracy. The yaw angle was in error by about 25°, causing the capsule to land well beyond the intended landing area. We are investigating the possibility of a yaw reference to be used by Walter Schirra on the next Mercury flight to minimize the chances of this type of error occurring again.

The role of the crew during rendezvous operations is under active investigation. How effectively can an astronaut steer the spacecraft toward another vehicle? Can an astronaut visually judge position and speed precisely enough for rendezvous and docking? Scott Carpenter observed the booster after it was jettisoned, and also trailed a balloon behind Aurora 7. He has stated that there was no more difficulty observing objects in space than when carrying out a refueling operation in the Earth's atmosphere.

Both astronauts demonstrated man's ability to control orientation of their craft in space and to make a variety of scientific observations.

Earlier, the consequences that this Nation might face should space technology be used against us in military ways were indicated. For this reason, NASA and the Department of Defense work in the closest cooperation.

It is not appropriate to discuss military missions here. However, the policy of the United States is to make every effort to preserve space as a peaceful resource from which all mankind can draw benefits. Consequently, manned space flight involves facilities, vehicles, skills, and techniques that may well be significant for national defense.

Launch vehicles are an obvious example. Inherently a rocket is neither peaceful nor warlike. It is a device for accelerating objects to certain speeds, enabling them to fly on suborbital trajectories, into orbit around the Earth, or out into the solar system, never to return.

NASA and the Department of Defense have established a national launch vehicle program to provide this country with the rocket power it requires. In the area of manned space flight, the Air Force Systems Command works in close cooperation with the NASA Office of Manned Space Flight. We are confident that these working arrangements and cooperative efforts will go far toward squeezing the utmost in value for the Nation from every dollar invested in space activities.

NASA and DOD also must cooperate closely and draw upon one another to the fullest in programs to learn human abilities to maneuver spacecraft, change courses in space, rendezvous with other objects in space, and to hook up with them.

The President has aptly said that the United States must learn to sail the new ocean of space. We must master the rendezvous technique if we are to sail that ocean. Mastering that technique would be essential even if we had not selected rendezvous as the means by which we expect to land the first man on the Moon.

When we become skilled in rendezvous and docking, we shall be able to employ it for many purposes. Through rendezvous we shall be able to assemble and maintain manned and unmanned craft, refuel them, and even rescue astronauts in difficulty. The operational techniques will be available to carry out any task required in the national interest.

Recently, NASA announced that major emphasis is being placed on lunar orbit rendezvous using the Advanced Saturn. Brainerd Holmes describes this method for manned lunar exploration in his paper. He explains how careful analyses indicate that this mode will enable us to carry out the mission with the least development effort, in the shortest time, at the lowest cost, and yet with advancement of the national technology on a broad front.

Another guiding consideration should be noted -- retention of flexibility. We are engaged in research and development in an area where definitive knowledge is lacking. Each day's efforts produce information, ideas, insight, and problems we may not have foreseen. Prudent management, therefore, dictates that in every decision we take into account the possibility that what we learn may change plans. We are prepared to make such changes.

In this connection we will soon begin an in-depth study of an unmanned lunar logistic vehicle to determine how such a vehicle might be used to support the manned lunar program. We feel that this technique can provide navigation aids and emergency supplies in the early missions and will permit longer stays in later missions by caching fuel, oxygen, and food. We also are continuing studies of the feasibility of Earth orbit rendezvous, using the Advanced Saturn with a two-man command module. The module may be small and light enough to permit direct flight to the Moon with an uprated Advanced Saturn. This possibility also will be carefully analyzed during the time

when industry is preparing proposals on the lunar excursion vehicle.

Inherent in our decision is an expanded role for the Nova launch vehicle, which will no longer be planned for our first manned expedition to the Moon. We now have the time to develop a larger Nova than we had previously contemplated. During the present fiscal year, we shall conduct intensive configuration studies to determine just how large and powerful the Nova should be. We shall investigate everything available in the fields of liquid propulsion, solid propulsion, and nuclear rockets.

We want to build a Nova powerful enough to carry out space missions of the early 1970's. These may well include transportation of heavy payloads of equipment to prepare for and maintain a manned base on the Moon. Nova also may be employed to lift very large objects into orbit for rendezvous and assembly into spacecraft for planetary exploration.

As world-shaking and dramatic as our space activities seem to us now, they are but primitive first steps into the fathomless reaches of space. We are entering a strange and hostile environment that will tax the best abilities of all mankind. We face a common challenge in space, and, if the great nations can work together to meet this challenge, we may learn cooperation that could help solve our earthbound problems. That is why we place great hope in the negotiations in progress between the United States and the Soviet Union, negotiations which have the goal of reaching agreements for peaceful cooperation in space.

Other cooperative projects have already borne fruit. The first international satellite--Ariel, a package of British instruments launched by an American rocket--has been in orbit since April 1962. You are familiar with the international cooperation involved in the Telstar communication experiment. In all, the United States now has agreements for cooperative space activity with 55 countries. Let us hope that we can add the Soviet Union to the list.

Space will put man to the test as never before. The late William Faulkner spoke of the nature of man in his Nobel Prize lecture a dozen years ago. He said:

"I believe that man will not merely endure; he will prevail. He is immortal. . .because he has a soul, a spirit capable of compassion and sacrifice and endurance."

In space exploration, I am convinced with Faulkner that man will prevail.