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Address

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Good afternoon.

I am extremely grateful for this opportunity to talk with you about NASA's manned flight programs which constitute the biggest, most complex engineering, scientific and technical undertaking ever attempted by the United States.

The present programs--Gemini and Apollo--will require nearly a decade to complete. And in this respect, I envy you. Every day is a new day for the editorial writer, with fresh subjects or at least new developments on old subjects. But in any case, you have the satisfaction of seeing your day's work completed and printed on the editorial page within hours after the copy has come out of your typewriters.

Those of us working on Gemini and Apollo can't point to a finished product at the end of a work day. Our goal in the present manned space is a development of technology, facilities, hardware and trained personnel that will enable the U. S. to make a manned lunar landing and return by 1970.

The research and development requiredto launch men into space and bring them back safely is a long, arduous and painstaking process. A day's progress is hard to measure and the job does not end at sundown.

Because of the long-term nature of the NASA manned space flight program, it is difficult to maintain in the public mind the perspective that was established with the national decision in 1961, to undertake Project Apollo. Any long interval in our manned flight program or a new Soviet flight seems to cloud the national perspective with envy for the most recent Russian accomplishment. This was the case with the three-man Voskhod flight.

I am not downgrading Soviet accomplishments in space. Rather, I want to review our own progress and discuss with you why we believe there is no reason for pessimism concerning the U. S. space effort.

United States space objectives evolved from four important national decisions in 1954, 1955, 1958 and 1961.

The U. S. decision in 1954 to carry out a crash intercontinental ballistic missile program followed our discovery that the Soviet Union was conducting a program to develop an ICBM. We know now that Stalin had ordered the beginning of this work seven years earlier, in 1947, but the Soviets managed to keep it secret for some time. Therefore, our ballistic missile program had to be conducted on a crash basis to gain back some of this lost time.

The second major United States decision, that of 1955, was to begin the Vanguard program to develop a small scientific earth satellite. However, because of the urgency of the ballistic missile program and the fact that we were far behind the Soviets, this program was carried out separately from the missile program and at a lower priority.

One result of these two decisions is well known to everyone. In 1957, the Soviets succeeded in placing in orbit the

the first satellites, the Sputniks, gaining for their country important benefits in national prestige.

The Soviet successes with Sputniks led to our third important nationaldecision, the passage of the National Aeronautics and Space Act of 1958. This act declared a national policy that the United States would engage in space activities, to exercise leadership in this area, to advance science and technology, and to share practical benefits both for the people of this country and for all the world. It is worth noting at this time that the prime mover in the Senate with respect to this act was the Majority Leader, the then Senator from Texas, Lyndon B. Johnson.

During the debate on the Space Act two facts clearly emerged--first, that some of the benefits from space activity might be in the area of national security, and second, that it takes a very long time to develop space capability. It was recognized that the work to develop space capability must be begun before firm requirements for military systems could be established.

Following approval of the Space Act, the country got to work on the development of this capability. We undertook to build very large rockets and to advance the technology required for space flight. We carried out those experiments that were possible with modification of existing military rockets. We developed practical applications of space flight, in such areas as weather observation, communications, and navigation. And we began the Mercury program to demonstrate the feasibility of manned space flight.

Some of this work was directed by the Armed Services. Some of it was managed by the new civilian agency established by the Space Act, the National Aeronautics and Space Administration. Much of it required very close cooperation between NASA and the military services.

We made good progress in the three years following the passage of the Space Act, but the Soviet's seven-year advantage in rocket development enabled them to continue to score spectacular "firsts."

The United States accomplished important "firsts" in this period, too, but, in general, the American people found second position in space unsatisfactory and painful to national pride.

On April 12, 1961, the Soviets orbited Yuri Gagarin, the first man in space. But some of our national self-esteem was restored six weeks later, when Alan Shepard became the first American in space even though his mission was merely a sub-orbital flight 300 miles into the Atlantic Ocean from Cape Canaveral.

These two 1961 events--the Soviet and American manned flights--together with the general progress in rocket development and space technology that we had achieved by that time--provided the backdrop for the fourth of our major national space decisions.

On May 25, 1961, President Kennedy proposed, and Congress endorsed a long-range program to expand and accelerate U. S.

space activity so that, by the end of this decade the United States would be pre-eminent in space and this fact would be clearly evident to the world.

This program called for expansion and acceleration of space activity in all areas--in manned and unmanned flight, in scientific investigations, advancement of technology, and practical applications, and in the development of rocket power. It included the advancement of manned space flight to a stage at which, by the end of this decade, it would be possible to fly outward a quarter-million miles from the earth, to land on and take off from the moon, and return safely to earth.

The overall purposes of this program, however, have been generally misunderstood, Many people seem to believe that a landing on the moon, ahead of the Soviets, is the paramount objective. This is not so. The principal goal is to make the United States first in space. The manned space flight mission milestones provide a focus for the development of the capability required for pre-eminence.

In addition, the lunar flight will play a role in the development of space flight similar to the role Charles Lindbergh's flight from New York to Paris played in aviation. Let us remember that Lindbergh's purpose was not merely to get to Paris. His objective was to demonstrate the feasibility of flight across oceans.

Recently, I took the time to read again President Kennedy's speech of May 25, 1961, and the statements made at the time by

Mr. Webb, the NASA Administrator, and Dr. Dryden, the Deputy Administrator, regarding the objectives of this program and its prospects for success. What I found most remarkable about these statements is that three and a half years later our statements about objectives and prospects for success are almost identical.

It was stated in 1961 that this is a broad program to improve our capability and not merely one to race the Soviets to the moon. It was also stated in 1961 that we could anticipate that the Soviets would place the first three-man spacecraft in orbit, an event that occurred just last month. It was further stated that the Soviets might also carry out the first manned flight around the moon, an event that still has not occurred but which remains a possibility.

Dr. Dryden's exact words, in response to a press conference question on May 25, 1961, were:

"If you think of the forthcoming things which might be done by the Russians, such as three men in orbit for a longer time, or a manned station, they can do that at any time. By taking this goal of landing on the moon, which is a very considerable number of years away, we start more evenly with the Russians, so that we do have a chance of getting there first."

It would be sheer folly for the United States to react to each new Russian manned flight by attempting to change our own program. It is important that the government-industry team, which has hit its full stride in development, testing and manufacture of Gemini and Apollo hardware--maintain its goals, perspective and self-assurance. And there is every reason that this team should be confident and proud of its accomplishments. Here, briefly is what that team has done and where we stand in the manned flight program:

The first Gemini flight, an unmanned orbital mission, was successfully launched last April.

The second spacecraft is now mated to the Gemini launch vehicle and will be launched yet this year on a 2,000-mile suborbital mission. The purpose of this flight is to check out the spacecraft's systems in preparation for the first Gemini manned flight in spacecraft number three next year.

Spacecraft number three is undergoing final systems testing at McDonnell Aircraft in St. Louis now. Spacecraft four and five are nearly completed and spacecraft six through 12 are all in some stage of production.

Gemini-Titan launch vehicle production is on schedule and three launch vehicles are in assembly, or checkout at Martin Company, Baltimore. The time required to manufacture the Gemini launch vehicle has been reduced 30 percent since the first Gemini rocket rolled off the line.

Development is progressing on two vital state of the art subsystems--fuel cells and thrusters.

Fuel cells will provide the power supply necessary for long duration manned space flight. Thrusters--onboard rockets of about 100 pounds thrust--provide the capability of maneuvering spacecraft for rendezvous and docking with another vehicle in space. These items will be needed for all manned flight programs which may follow Gemini and Apollo.

Both of these subsystems are now in production and problems in development and testing have been overcome.

Development of the Gemini rendezvous-radar system is progressing satisfactory.

As you know, Gemini will be used in the Air Force Manned Orbital Laboratory program. Gemini is a very versatile and useful spacecraft which will permit us to fly two-man missions of up to two weeks and to develop rendezvous and docking techniques and capabilities.

I would now like to show a very short film which describes Gemini missions. I think it illustrates the vital importance of Gemini to Apollo and all future manned space operations requiring the joining of two or more spacecraft or modules.

In the Apollo program, construction of facilities is on schedule and 55 percent complete. You will see the most impressive part of this nationwide rocket and spacecraft testing, checkout, assembly and launch facilities network this afternoon on Merritt Island. What you see will be much more dramatic than any description I can give.

All Apollo spacecraft modules--the command, service and lunar excursion modules--and all stages of the Saturn IB and Saturn V launch vehicles are in test or production. The Saturn IB and Saturn V booster stages are being built at NASA's Michoud plant in New Orleans and upper stages are being manufactured, developed and tested on the West Coast.

The first of 12 Apollo checkout stations is in operation at North American Aviation, Inc., Downey, Calif., where the Apollo command and service modules are built.

Design of the lunar excursion module is essentially complete and production of test models is underway at Grumman Aircraft.

At the Manned Spacecraft Center near Houston, facilities for astronaut training as well as equipment for testing spacecraft is nearly complete.

The Integrated Mission Control Center at the Manned Spacecraft Center, which will be used to control both Gemini and Apollo mission flights, is well on toward completion.

The Apollo stabilization and control system has been successfully ground tested and the Apollo guidance and control system is in production.

All rocket engines for Apollo space vehicles are in test and development.

And, 28 astronauts are undergoing intensive training in preparation for Gemini and Apollo flights. NASA and the National Academy of Sciences are now screening applicants for a new class of astronaut candidates -- scientist-astronauts. Some time early next year, a number of these candidates will be selected for training.

While the pace of the manned flight program is brisk, it is not a "crash" program. Cost, good engineering practices and crew safety were primary considerations in planning the present program.

We conducted very careful and searching reviews of the Apollo program, investigating all of these points.

The Apollo schedule was compared with that of other major United States research and development programs carried out in the past. We examined the effect of the overall pace on the total cost. And we reviewed the possible impact on the schedule of the effect of the space envirnoment, studying such technical factors as meteoroids, space radiation, and the selection of a lunar landing site.

The Apollo development schedule is conservative. The Apollo spacecraft is being developed on a time scale four years longer than the Mercury spacecraft, two years longer than the B-58 bomber, and one year longer than the X-15. The Saturn IB and Saturn V launch vehicles are being developed on a schedule two years longer than that of the Atlas and one year longer than that of the Titan. The eight years alotted to carrying out the Apollo program constitute a longer period than the duration of any previous United States research and development effort.

We found that if the remaining six years of work were stretched out over 12 years the total cost of the presently approved manned flight program would increase by about 30 per cent, or about six billion dollars. Thus the economic considerations support the maintenance of the present well-paced schedule.

Finally, we looked into whether meteoroids, radiation, or conditions on the surface of the Moon would affect our ability to accomplish the Apollo program on schedule without undue difficulty.

With respect to meteoroids, considerable information is available from the Explorer XVI and other satellites and from visual and radar ground observations of meteor arrivals in the upper atmosphere. The results from Explorer XVI indicate that the rate of puncture of very thin metal by meteoroids is considerably less than had been anticipated on the basis of the ground observations. Further confirming information will become available when larger meteoroid-detecting satellites are orbited on the eighth, ninth and tenth flights of the Saturn I. However, it is not anticipated that meteoroids will constitute a major problem in the planning or scheduling of the first manned lunar exploration.

Regarding radiation, there are three forms of radiation with which we must deal--cosmic rays originating elsewhere in the galaxy, the Van Allen radiation belts trapped by the Earth's magnetic field, and high-energy protons and other particles ejected by the Sun during flares.

The command module effectively shields the astronauts against radiation. In the case of solar flares, we compared the allowable safe dose with what would have been produced within the Apollo command module by the worst flares on record, that of July 1959. If an Apollo spacecraft had been in flight on a lunar mission at this time, the astronauts would have received only 15 per cent of the safe dose, calculated on the basis of a report by a group established by the Space Science Board of the National Academy of Sciences.

Altogether, the present evidence indicates that radiation does not present a hazard that would prevent manned lunar exploration in this decade.

I'm sure you've heard disturbing reports predicting that prolonged weightlessness is harmful to man. There is no evidence from present flight experience to indicate that a well-conditioned, well-trained flight crew will suffer ill effects from flights up to two weeks. Present Apollo and Gemini missions are all two weeks or less.

But we know that future space flight missions will require much longer flight times and it is important to determine precisely how space flight affects the human body. A large number of medical experiments are planned in Gemini and Apollo.

The Gemini medical experiments include:

A cardiovascular reflex experiment to develop countermeasures for deterioration of blood distribution in the body caused by prolonged weightlessness.

A microphone will be used to record heart sounds which will be compared with the electrocardiogram to determine the time interval between electrical and mechanical contraction of the heart muscle. The purpose of this is to study any deterioration of the heart muscle during weightlessness.

Urine samples will be collected at specified intervals and stored on board for post-flight analysis to determine reaction to stress requirements and cardiovascular response mechanisms of space flight by means of hormone analysis. These analyses will be compared to flight and post-flight specimens.

Pre-flight and post-flight X-rays of the heel bone and the 5th digit of the right hand will be studied to establish occurrence and degree of bone demineralization from prolonged weightlessness.

A calcium balance study will be carried out in connection with the long-duration flights to establish rate and amount of calcium lost under orbital flight conditions.

State of alertness levels of consciousness and depths of sleep in flight will be studied through electroencephalogram readings collected by a miniature biomedical tape recorder.

A vestibular effects experiment will be determined by observing orientation capability under dark conditions during prolonged weightlessness.

An in-flight exerciser, consisting of a bungee cord with foot crossbar, will assess general capacity to perform physical work in space flight. Astronauts will be required to perform monitored control exercises prior to flight and during flight. Blood pressure measurements will be taken prior to and after exercise, and pulse rates will be monitored continuously.

One of the questions on possible hazards in a manned lunar landing has been partially answered by Ranger 7. It had been suggested that the Moon might be covered with monstrous, jagged rocks which would make a safe landing impossible.

Even before Ranger 7 sent back its pictures of the lunar surface, our studies indicted that the lunar excursion module landing gear design would make possible landings in even the roughest areas of the Moon.

Ranger 7 confirmed our beliefs and planning. It sent back to Earth more than 4,000 high-quality, close-up pictures which indicte that extensive areas of the Moon are relatively smooth.

We expect to obtain information on the bearing strength and physical makeup of the lunar surface from Surveyor spacecraft in 1966 and 1967. In this same time period, lunar orbiter spacecraft will be mapping the Moon's surface to provide even more information on possible Apollo lunar landing sites.

The emphasis on crew safety and well-being is nowhere more evident than in the work and money that goes into preparation of a man-rated Gemini-Titan II launch vehicle. The cost of a standard Titan II is about one-fourth that of a man-rated Gemini launch vehicle. At the Martin Company in Baltimore, where the Titan II for Gemini is built, assembled and checked out, they refer to man-rating the vehicle as "loving care," and it's just that.

In man-rating the Titan II, these modifications are made:

a. Additions for a malfunction detection system
b. Modifications of flight control system
c. Modification of electrical system
d. Substitution of radio guidance for inertial guidance
e. Deletion of retro-rockets and vernier bottles
f. New stage II equipment truss
g. New stage II forward oxidizer skirt assembly
h. Simplification of trajectory tracking requirements.
i. Modification of hydraulic system
j. Modification of instrumentation system

While the Soviet Union enjoys, through its early start, a temporary advantage in manned space flight, the United States has established and maintains a pre-eminent overall position and capability in space. Our record in all areas is a good one. Since 1958, the United States has:

Successfully completed Project Mercury with six orbital flights, the first of which (John Glenn's flight) was flown less than two-and-a-half years from the time the project was started.

Launched more than 225 Earth satellites, lunar and planetary probes, well over twice the number placed in space by the Soviet Union.

Made the first successful planetary fly-by with the Mariner II spacecraft on December 14, 1962.

Sent to Earth the first high-quality, close-up pictures of the Moon with Ranger 7 on July 31, 1964.

Orbited a number of highly successful weather and communications satellites which promise many economic benefits.

Carried out a continuing scientific space research program with the launch of dozens of Explorers, observatory and other satellites which have returned to Earth vast quantities of new information on the solar system space environment.

Created world-wide tracking and data collecting facilities, national research centers, increased private industrial space development capabilities and built new launch complexes.

The Apollo launch complex you saw today is typical of the investment the United States is making in permanent space exploration capability that is necessary to maintain the pre-eminence of our technology and scientific effort.

I recognize that it is difficult for the layman to know whether a program as big as the U.S. space effort is being run efficiently and whether we are progressing as fast as our rivals. But be assured that the NASA program is under constant scrutiny by Congress and independent government agencies. And NASA conducts its own continuous and critical examinations.

I believe the record of accomplishments which I cited a moment ago deserves the continued faith of the American people in the government-industry team which is carrying out United State's space program.

Despite a mission success rate of about 85 per cent, we will have failures and disappointments. And we must face even the sad prospect of possible fatalities in the manned flight program. Because our entire program is conducted in the open and is reported day by day, development by development, our difficulties and failures receive as much or more attention than our successes.

But I prefer to believe that Bob Hotz, editor of Aviation Week, was right when he wrote in an editorial following the Ranger 7 flight that earlier failures in that program "proves once again the necessity for dogged perseverance in pursuing any major exploration of the unknown," that our successes in space will overshadow our failures and "reduce them to a minor footnote in the technical history of our times."

Certainly if the United States is to maintain its world leadership this nation must participate wholeheartedly in man's exploration of space. For as President Kennedy said when he urged the Congress to support an accelerated Apollo program, "while we cannot guarantee that we shall one day be first, we can guarantee than any failure to make this effort will make us last."

Thank you.

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