THE WHITE HOUSE

WASHINGTON

April 20, 1961

MEMORANDUM FOR

VICE PRESIDENT

In accordance with our conversation I would like for you as Chairman of the Space Council to be in charge of making an overall survey of where we stand in space.

1. Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man. Is there any other space program which promises dramatic results in which we could win?

2. How much additional would it cost?

3. Are we working 24 hours a day on existing programs. If not, why not? If not, will you make recommendations to me as to how work can be speeded up.

4. In building large boosters should we put out emphasis on nuclear, chemical or liquid fuel, or a combination of these three?

5. Are we making maximum effort? Are we achieving necessary results?

I have asked Jim Webb, Dr. Weisner, Secretary McNamara and other responsible officials to cooperate with you fully. I would appreciate a report on this at the earliest possible moment.

14.

April 29, 1961

The Vice President of the United States
The White House
Washington 25, D. C.

My dear Mr. Vice President:

This is an attempt to answer some of the questions about our national space program raised by The President in his memorandum to you dated April 20, 1961. I should like to emphasize that the following comments are strictly my own and do not necessarily reflect the official position of the National Aeronautics and Space Administration in which I have the honor to serve.

Question 1. Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man? Is there any other space program which promises dramatic results in which we could win?

Answer: With their recent Venus shot, the Soviets demonstrated that they have a rocket at their disposal which can place 14,000 pounds of payload in orbit. When one considers that our own one-man Mercury space capsule weighs only 3900 pounds, it becomes readily apparent that the Soviet carrier rocket should be capable of

- launching several astronauts into orbit simultaneously. (Such an enlarged multi-man capsule could be considered and could serve as a small "laboratory in space".)

- soft-landing a substantial payload on the moon. My estimate of the maximum soft-landed net payload weight the Soviet rocket is capable of is about 1400 pounds (one-tenth of its low orbit payload). This weight capability is not sufficient to include a rocket for the return flight to earth of a man landed on the moon. But it is entirely adequate for a powerful radio transmitter which would relay lunar data back to earth and which would be abandoned on the lunar surface after completion of this mission. A similar mission is planned for our "Ranger" project, which uses an Atlas-Agena B boost rocket. The "semi-hard" landed portion of the Ranger package weighs 293 pounds. Launching is scheduled for January 1962.

The existing Soviet rocket could furthermore hurl a 4000 to 5000 pound capsule around the moon with ensuing re-entry into the earth atmosphere. This weight allowance must be considered marginal for a one-man round-the-moon voyage. Specifically, it would not suffice to provide the capsule and its occupant with a "safe abort and return" capability, - a feature which under NASA ground rules for pilot safety is considered mandatory for all manned space flight missions. One should not overlook the possibility, however, that the Soviets may substantially facilitate their task by simply waiving this requirement.

A rocket about ten times as powerful as the Soviet Venus launch rocket is required to land a man on the moon and bring him back to earth. Development of such a super rocket can be circumvented by orbital rendezvous and refueling of smaller rockets, but the development of this technique by the Soviets would not be hidden from our eyes and would undoubtedly require several years (possibly as long or even longer than the development of a large direct-flight super rocket).

Summing up, it is my belief that

a) we do not have a good chance of beating the Soviets to a manned "laboratory in space." The Russians could place it in orbit this year while we could establish a (somewhat heavier) laboratory only after the availability of a reliable Saturn C-1 which is in 1964.

b) we have a sporting chance of beating the Soviets to a soft-landing of a radio transmitter station on the moon. It is hard to say whether this objective is on their program, but as far as the launch rocket is concerned, they could do it at any time. We plan to do it with the Atlas-Agena B-boosted Ranger #3 in early 1962.

c) we have a sporting chance of sending a 3-man crew around the moon ahead of the Soviets (1965/66). However, the Soviets could conduct a round-the-moon voyage earlier if they are ready to waive certain emergency safety features and limit the voyage to one man. My estimate is that they could perform this simplified task in 1962 or 1963.

d) we have an excellent chance of beating the Soviets to the first landing of a crew on the moon (including return capability, of course). The reason is that a performance jump by a factor 10 over their present rockets is necessary to accomplish this feat. While today we do not have such a rocket, it is unlikely that the Soviets have it. Therefore, we would not have to enter the race toward this obvious next goal in space exploration against hopeless odds favoring the Soviets. With an all-out crash program I think we could accomplish this objective in 1967/68.

Question 2. How much additional would it cost?

Answer: I think I should not attempt to answer this question before the exact objectives and the time plan for an accelerated United States space program have been determined. However, I can say with some degree of certainty that the necessary funding increase to meet objective d) above would be well over $1 Billion for FY 62, and that the required increases for subsequent fiscal years may run twice as high or more.

Question 3. Are we working 24 hours a day on existing programs? If not, why not? If not, will you make recommendations to me as to how work can be speeded up.

Answer: We are not working 24 hours a day on existing programs. At present, work on NASA's Saturn project proceeds on a basic one-shift basis, with overtime and multiple shift operations approved in critical "bottleneck" areas.

During the months of January, February and March 1961, NASA's George C. Marshall Space Flight Center, which has systems management for the entire Saturn vehicle and develops the large first stage as an inhouse project, has worked an average of 46 hours a week. This includes all administrative and clerical activities. In the areas critical for the Saturn project (design activities, assembly, inspecting, testing), average working time for the same period was 47.7 hours a week, with individual peaks up to 54 hours per week.

Experience indicates that in Research & Development work longer hours are not conducive to progress because of hazards introduced by fatigue. In the aforementioned critical areas, a second shift would greatly alleviate the tight scheduling situation. However, additional funds and personnel spaces are required to hire a second shift, and neither are available at this time. In this area, help would be most effective.

Introduction of a third shift cannot be recommended for Research & Development work. Industry-wide experience indicates that a two-shift operation with moderate but not excessive overtime produces the best results.

In industrial plants engaged in the Saturn program the situation is approximately the same. Moderately increased funding to permit greater use of premium paid overtime, prudently applied to real "bottleneck" areas, can definitely speed up the program.

Question 4. In building large boosters should we put our emphasis on nuclear, chemical or liquid fuel, or a combination of these three?

Answer: It is the concensus of opinion among most rocket men and reactor experts that the future of the nuclear rocket lies in deep-space operations (upper stages of chemically-boosted rockets or nuclear space vehicles departing from an orbit around the earth) rather than in launchings (under nuclear power) from the ground. In addition, there can be little doubt that the basic technology of nuclear rockets is still in its early infancy. The nuclear rocket should therefore be looked upon as a promising means to extend and expand the scope of our space operations in the years beyond 1967 or 1968. It should not be considered as a serious contender in the big booster problem of 1961.

The foregoing comment refers to the simplest and most straightforward type of nuclear rocket, viz. the "heat transfer" or "blow-down" type, whereby liquid hydrogen is evaporated and superheated in a very hot nuclear reactor and subsequently expanded through a nozzle.

There is also a fundamentally different type of nuclear rocket propulsion system in the works which is usually referred to as "ion rocket" or "ion propulsion". Here, the nuclear energy is first converted into electrical power which is then used to expel "ionized" (i.e., electrically charged) particles into the vacuum of outer space at extremely high speeds. The resulting reaction force is the ion rocket's "thrust". It is in the very nature of nuclear ion propulsion systems that they cannot be used in the atmosphere. While very efficient in propellant economy, they are capable only of very small thrust forces. Therefore they do not qualify as "boosters" at all. The future of nuclear ion propulsion lies in its application for low-thrust, high-economy cruise power for interplanetary voyages.

As to "chemical or liquid fuel" The President's question undoubtedly refers to a comparison between "solid" and "liquid" rocket fuels, both of which involve chemical reactions.

At the present time, our most powerful rocket boosters (Atlas, first stage of Titan, first stage of Saturn) are all liquid fuel rockets and all available evidence indicates that the Soviets are also using liquid fuels for their ICBM's and space launchings. The largest solid fuel rockets in existence today (Nike Zeus booster, first stage Minuteman, first stage Polaris) are substantially smaller and less powerful. There is no question in my mind that, when it comes to building very powerful booster rocket systems, the body of experience available today with liquid fuel systems greatly exceeds that with solid fuel rockets.

There can be no question that larger and more powerful solid fuel rockets can be built and I do not believe that major breakthroughs are required to do so. On the other hand it should not be overlooked that a casing filled with solid propellant and a nozzle attached to it, while entirely capable of producing thrust, is not yet a rocket ship. And although the reliability record of solid fuel rocket propulsion units, thanks to their simplicity, is impressive and better than that of liquid propulsion units, this does not apply to complete rocket systems, including guidance systems, control elements, stage separation, etc.

Another important point is that booster performance should not be measured in terms of thrust force alone, but in terms of total impulse; i.e., the product of thrust force and operating time. For a number of reasons it is advantageous not to extend the burning time of solid fuel rockets beyond about 60 seconds, whereas most liquid fuel boosters have burning times of 120 seconds and more. Thus, a 3-million pound thrust solid rocket of 60 seconds burning time is actually not more powerful than a 1 1/2-million pound thrust liquid booster of 120 seconds burning time.

I consider it rather unfortunate that several solid fuel rocket manufacturers (with little or no background in developing complete missile systems) have recently initiated a publicity campaign obviously designed to create the impression that a drastic switch from liquid to solid rockets would miraculously cure all of this country's big booster ills. I am convinced that if we recklessly abandon our liquid fuel technology in favor of something we do not yet understand so well, we would be heading for disaster and lose even more precious time.

My recommendation is to substantially increase the level of effort and funding in the field of solid fuel rockets (by 30 or 50 million dollars for FY 62) with the immediate objectives of

- demonstration of the feasibility of very large segmented solid fuel rockets. (Handling and shipping of multi-million pound solid fuel rockets become unmanageable unless the rockets consist of smaller individual segments which can be assembled in building block fashion at the launching site.)

- development of simple inspection methods to make certain that such huge solid fuel rockets are free of dangerous cracks or voids

- determination of the most suitable operational methods to ship, handle, assemble, check and launch very large solid fuel rockets. This would involve a series of paper studies to answer questions such as

  a. Are clusters of smaller solid rockets, or huge, single poured-in-launch-site solid fuel rockets, possibly superior to segmented rockets? This question must be analyzed not just from the propulsion angle, but from the operational point of view for the total space transportation system and its attendant ground support equipment.

  b. Launch pad safety and range safety criteria (How is the total operation at Cape Canaveral affected by the presence of loaded multi-million pound solid fuel boosters?)

  c. Land vs off-shore vs sea launchings of large solid fuel rockets.

  d. Requirements for manned launchings (How to shut the booster off in case of trouble to permit safe mission abort and crew capsule recovery? If this is difficult, what other safety procedures should be provided?)

__Question 5.__ Are we making maximum effort? Are we achieving necessary results?

__Answer:__ No, I do __not__ think we are making maximum effort.

In my opinion, the most effective steps to improve our national stature in the space field, and to speed things up would be to

- identify a few (the fewer the better) goals in our space program as objectives of highest national priority. (For example: Let's land a man on the moon in 1967 or 1968.)

- identify those elements of our present space program that would qualify as immediate contributions to this objective. (For example, soft landings of suitable instrumentation on the moon to determine the environmental conditions man will find there.)

- put all other elements of our national space program on the "back burner".

- add another more powerful liquid fuel booster to our national launch vehicle program. The design parameters of this booster should allow a certain flexibility for desired program re-orientation as more experience is gathered.

Example: Develop in addition to what is being done today, a first-stage liquid fuel booster of twice the total impulse of Saturn's first stage, designed to be used in clusters if needed. With this booster we could

a. double Saturn's presently envisioned payload. This additional payload capability would be very helpful for soft instrument landings on the moon, for circumlunar flights and for the final objective of a manned landing on the moon (if a few years from now the route via orbital re-fueling should turn out to be the more promising one.

b. assemble a much larger unit by strapping three or four boosters together into a cluster. This approach would be taken should, a few years hence, orbital rendezvous and refueling run into difficulties and the "direct route" for the manned lunar landing thus appears more promising.

In addition, relief in certain administrative areas would be mandatory. In my opinion, the two most serious factors causing delays in our space program are:

1. Lack of flexibility in the use of approved funds and in adapting the program to the changes caused by rapidly acquired new knowledge and experience. After the Congress and The President have established the funding level at which the aforementioned national high-priority objective is to be supported, all restraints as to how these funds are to be applied should be removed. At the present time such restraints include:

- Funds assigned to "Research and Development" may not be used to build facilities in support of R&D, and vice versa.

- Government installations such as the Marshall Space Flight Center are unable to hire more personnel or establish a second shift because "personnel spaces" are lacking. Such "spaces" must, of course, be supported with adequate salary funds, but an increase in such funds alone does not yet provide the spaces.

2. Contracting procedures. Contracting procedures must be simplified. This probably requires some special directives from the highest level. To illustrate the present dilemma: If NASA plans to let a contract for a new stage of Saturn, the first step is a wide-open invitation to everybody interested to attend a bidder's briefing. Here, the interested parties are told what the stage looks like, that substantial facilities are required to develop it, and that each bidder must prepare a very detailed proposal (which might cost him as much as $300,000 to $500,000 to prepare) before the contractor can be selected. This first go-round will usually discourage 80 per cent of the original bidders, but takes approximately eight weeks. In the meantime, NASA must prepare detailed specifications.

For the actual preparation of the proposal the contractors must be given several weeks. Usually, six to ten companies will participate in the final bid. In order to be competitive, these bids must be prepared by the best scientists and engineers at the contractor's proposal. Evaluation of all these many proposals takes additional weeks. Before the contract can be signed, eight to ten months usually have elapsed since initiation of the contracting procedure, and several million dollars worth of efforts of the best rocket and missile brains have been spent.

While there is certainly some merit in this long, drawn-out competitive procedure, we must realize that our Soviet competitors are not faced with some of these problems, simply because the issue of possible favoritism does not exist in a country where all industry is government-owned.

My suggestion is not to switch to indiscriminate sole source procurement, but to limit the participation in important and difficult technological developments to those few companies who really have the resources, the experience and the available capacity to execute the job effectively. With a hungry aircraft and automotive industry, it is not surprising that at the present time the contracting NASA agency is subjected to all kinds of pressure aimed at giving additional contractors a chance to prove themselves. But the NASA agency involved usually knows very well the few companies which really possess the capabilities needed.

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Summing up, I should like to say that in the space race we are competing with a determined opponent whose peacetime economy is on a wartime footing. Most of our procedures are designed for orderly, peacetime conditions. I do not believe that we can win this race unless we take at least some measures which thus far have been considered acceptable only in times of a national emergency.

Yours respectfully,

Wernher von Braun

Wernher von Braun

The Decision to Go to the Moon:
President John F. Kennedy's May 25, 1961 Speech
before a Joint Session of Congress

On May 25, 1961, President John F. Kennedy announced before a special joint session of Congress the dramatic and ambitious goal of sending an American safely to the Moon before the end of the decade. A number of political factors affected Kennedy's decision and the timing of it. In general, Kennedy felt great pressure to have the United States "catch up to and overtake" the Soviet Union in the "space race." Four years after the Sputnik shock of 1957, the cosmonaut Yuri Gagarin had become the first human in space on April 12, 1961, greatly embarrassing the U.S. While Alan Shepard became the first American in space on May 5, he only flew on a short suborbital flight instead of orbiting the Earth, as Gagarin had done. In addition, the Bay of Pigs fiasco in mid-April put unquantifiable pressure on Kennedy. He wanted to announce a program that the U.S. had a strong chance at achieving before the Soviet Union. After consulting with Vice President Johnson, NASA Administrator James Webb, and other officials, he concluded that landing an American on the Moon would be a very challenging technological feat, but an area of space exploration in which the U.S. actually had a potential lead. Thus the cold war is the primary contextual lens through which many historians now view Kennedy's speech.

The decision involved much consideration before making it public, as well as enormous human efforts and expenditures to make what became Project Apollo a reality by 1969. Only the construction of the Panama Canal in modern peacetime and the Manhattan Project in war were comparable in scope. NASA's overall human spaceflight efforts were guided by Kennedy's speech; Projects Mercury (at least in its latter stages), Gemini, and Apollo were designed to execute Kennedy's goal. His goal was achieved on July 20, 1969, when Apollo 11 commander Neil Armstrong stepped off the Lunar Module's ladder and onto the Moon's surface.