there were no unambiguous indications of the new administration's views on space policy. In fact, the opposite was true. The signals of Kennedy's attitude not only toward NASA manned flight programs but even towards the continued existence of NASA as a government agency with a large operational program were ambiguous. When Kennedy took the oath of office on a snowy January 20, the future of the American space program seemed likely to become one of his first orders of business.

2 Planning for a Lunar Journey

This is a book about the politics of space decision-making, and the following two chapters describe the political forces that converged on John Kennedy in April and May 1961 and led him to approve plans to send Americans to the moon. But the idea of a manned lunar landing mission was not invented almost out of whole cloth one weekend in May, as some observers have intimated.[1] Kennedy did approve *plans*, plans based on existing knowledge and forethought. This chapter contains a relatively brief summary of some of the planning for a manned journey to the moon which took place before Kennedy's decision. On the basis of this planning, NASA in 1961 was able to tell Kennedy that a manned landing was technologically feasible by 1967, given policy approval and adequate funding.

Although the decision was indeed primarily political, this chapter will demonstrate that it rested on a relatively firm technological and scientific foundation. In the process of attempting to establish a military requirement for a manned lunar expedition or lunar base, the Air Force, the Army, and the industrial contractors associated with them devoted much of their resources to examining the technical problems associated with flight to the moon. Their conclusions, in general, proved to be overly sanguine about the costs and time schedules involved in the enterprise, but they also found that there were no inherent technological reasons why such a journey could not be made. Because the services were first of all interested in obtaining authorization to conduct an active manned space flight program, the criteria they used to determine whether man *should* go to the moon tended to be phrased in terms of the military objectives that such a feat might serve, and other and more basic justifications for attempting it remained largely unexamined. By contrast, the environment in which NASA technical planners operated as they attempted to select objectives for a national manned space flight program was more permissive and open-ended. Charged only with the responsibility of choosing an objective that would best serve the purposes of exploring the full range of scientific and technological problems and opportunities involved in space flight, and operating without any preset policy guidance limiting their choice for political, economic or other "external" reasons, NASA planners, in mid-1959, chose a manned lunar landing as the appropriate goal of the second-generation NASA manned space flight program. *That is, almost two years before the Kennedy political decision to attempt a manned lunar landing program, NASA had chosen such a program on technological grounds as the logical successor to Project Mercury, the nation's first manned space program.*

Of course, it is entirely reasonable to argue whether national resources should be invested in any program of manned space flight, or whether those resources should be devoted to some other purpose. This point has, I think, been sufficiently debated over the past ten years or so, and arguments over the wisdom of an active manned space program will undoubtedly continue into the 1970s. My point here is somewhat different; it is that, granted that the United States should have a manned space flight program at all, the majority of those deeply involved in planning such a program in the 1950s agreed that a landing on the moon offered the best focus for the effort to develop a capability for man to operate in all regions of outer space.

The material in this chapter could also serve as something of a case study of how different kinds of organizations, with different purposes, are likely to respond to an emerging set of technological possibilities. Military planning for a lunar landing was aimed primarily at convincing the nation that national security required the United States to establish military capabilities at a lunar distance; perhaps this "sales-oriented" rationale explains the rather unrealistic time schedules and cost estimates that characterized military plans for space. It may also explain the appearance, and perhaps the existence, of greater coherence and focus in the military plans, and a greater sensitivity to the full range of political, strategic, psychological, and economic, as well as technical, issues involved in a decision to initiate a lunar landing program. By contrast, the NASA approach to selecting the lunar objective and subsequently examining what was involved in achieving it was characterized by the rather measured pace of numerous intraorganizational committees and by wide divergences of opinions on important aspects of the overall problem. NASA's planning also produced more conservative and eventually more realistic estimates of the time and funds needed and the technological hurdles which would have to be overcome in order to get men successfully to the moon and back.

Before examining lunar mission plans developed in the early years after Sputnik, one should bear in mind how man thought about going to the moon before the technology to make such a trip was developed, for the conquest of space and especially a journey to earth's nearest neighbor have been persistent literary themes over a long span of time. Arthur Clarke remarks that "it can hardly be doubted that these stories —and not merely those few with a carefully scientific basis—have done a great deal to bring closer the achievement of what they told."[2]

MOON JOURNEYS: FICTION AND FACT

In 1609, Galileo looked through his telescope and first saw that the moon was in fact a solid body, with mountains and valleys and craters and plains. Within a decade, the first story of a journey to the moon was written by perhaps the greatest astronomer in history, Johannes

[1] For example, Amitai Etzioni in *The Moondoggle: Domestic and International Implications of the Space Race* (Garden City, N.Y.: Doubleday & Company, 1964), comments (p. xiv) that "never had a more important peace-time decision been based on less research and deliberation."

[2] Arthur C. Clarke, *The Promise of Space* (New York: Harper & Row, 1968), p. 11. Much of my account of early thoughts about lunar journeys is taken from the first two chapters of Clarke's book, which is perhaps the best single introduction to the whole topic of space.

Kepler. Kepler used supernatural techniques to propel his space vehicle to the moon; since he lacked knowledged of any other mode of propulsion adequate to operate in the airless void between the earth and the moon, and considering that Kepler's mother had been accused of being a witch, perhaps the choice was logical.

Between the mid-seventeenth century (Kepler's book was finally published in 1634) and the mid-nineteenth century, there were a number of books about space flight and lunar journeys. Cyrano de Bergerac wrote *Voyages to the Moon and Sun* in 1656; he was perhaps the first to suggest the use of rocket propulsion to accomplish the trip. Voltaire in 1752 wrote *Micromegas,* using visitors from other worlds to satirize earthly behavior.

Perhaps the two outstanding and influential books about manned lunar flight written after 1850 were Jules Verne's *From the Earth to the Moon* (1865) and H.G. Well's *The First Men in the Moon* (1901). Verne's book, especially, seems to have influenced the dreams of the three great pioneers of modern rocketry: the Russian Konstantin Tsiolkovsky, the American Robert Goddard, and the German-Hungarian Hermann Oberth.

All three of the men who developed the theoretical foundations of modern rocketry—Tsiolkovsky, Goddard, and Oberth—had "taken it for granted that men would be the most important payloads that rockets would carry into space."[3] Such a thought is explicit in most of the writings of Tsiolkovsky and Oberth. Goddard, publicly more cautious, considered the problems of manned space flight in his private notebooks.

Tsiolkovsky, who had derived the fundamental laws of rocketry by 1898, also wrote science fiction in an attempt to spread his ideas as widely as possible; of his fiction, only a novel called *Beyond the Planet Earth* was ever published, in 1918. In a preface to Tsiolkovsky's collected works, Soviet Academician M. E. Tikhonrarov commented: "Tsiolkovsky dreamed of sending men to the entire solar system; he dreamed of the possibility of a total realization of solar energy; he dreamed of a more comfortable life in a medium without gravity and of cities in interplanetary space."[4]

Robert Goddard, by nature a loner and secretive about his work, in the years after 1914 obtained patents based on his theories and experiments that covered almost every possible aspect of rocket design, propulsion, and guidance. Goddard's plans were aimed at providing the means to send unmanned and manned space vehicles to the moon and planets, but he never stated so publicly. His private notebooks, however, contain discussions of refueling spacecraft on the moon and other highly advanced concepts.

[3] Clarke, *Promise of Space,* p. 110. A remarkable example of the way in which history has become compressed in the twentieth century was the attendance of Oberth, a founder of modern rocketry, at the launch of the Apollo 11 moon landing mission.
[4] Quoted in *ibid.,* p. 14.

According to Oberth's own testimony, Jules Verne's moon novel was the direct stimulus to his thoughts regarding the use of rockets for space travel. Working in the 1920s, without knowledge of Tsiolkovsky's work of two decades earlier, Oberth covered much of the same ground as the Russian. Oberth's works received a great deal of publicity in Germany and led to the founding in 1925 of the German rocket society *Verein für Raumschiffart* (Vfr), which was a pioneering organization in developing and launching liquid-fueled rockets. The VfR experimental program was taken over by the Army of the Third Reich in the early 1930s and provided the basis for the development of the German V-2 rocket used in World War II.

By the end of World War II, a small core of individuals and groups scattered around the world realized that space travel would be possible in the not-too-distant future. When, in 1945, U.S. government representatives questioned Wernher Von Braun after his surrender to them, he told them that future uses of rockets included "multistaged piloted rockets for use as satellite 'observation platforms' " and that "when the art of rockets is developed further, it will be possible to go to other planets, first of all the moon."[5]

In November 1948 the British Interplanetary Society heard H. E. Ross read a paper that outlined in some detail the technical requirements for a manned lunar landing mission; Ross even anticipated the use of the lunar orbit rendezvous technique that became a source of controversy 14 years later as NASA developed its Project Apollo plans.[6]

Not only rocket enthusiasts but also the general public began to show interest in space exploration by this time. In 1949 Willy Ley, a disciple of Oberth's, published *The Conquest of Space*. Featured in this book was a detailed description of a manned lunar landing. In the same year the technicolor film *Destination Moon* went into production. The movie premiered in New York City in 1950 and was an immediate popular success. On October 12, 1951, the First Symposium on Space Flight was held at the Hayden Planetarium in New York City. *Collier's* published papers from this Symposium on March 22, 1952, under the title "Man Will Conquer Space Soon." Among the topics discussed were an orbiting astronomical observatory, problems of survival in space, circumlunar flight, a manned orbiting space station, and the question of sovereignty in outer space. In 1952, Arthur Clarke's *The Exploration of Space* became a Book of the Month Club selection.

Public interest and theoretical papers are one thing: the initiation of a program actually aimed at manned space flight and manned travel to the moon is quite another. Only a government of a large nation-state can command the resources to undertake such a program, and thus only

[5] F. Zwicky, *Summary Report: Report on Certain Phases of War Research in Germany* (Wright Field, Ohio: Headquarters, Air Material Command, 1946), pp. 38–42.
[6] H. E. Ross, "Orbital Bases," *Journal of the British Interplanetary Society* 8 (1949): 1–7.

planning for manned space flight conducted by government agencies had a chance of being translated into an operational program. The rest of this chapter contains a summary of such planning conducted by the military and civilian agencies of the United States government as they examined the opportunities presented by the initiation of the Space Age.[7]

MILITARY PLANS FOR A MANNED LUNAR MISSION

The military services have sponsored some of the great exploratory journeys in American history. As the space age opened, they hoped to continue this tradition by sponsoring the first exploratory trip beyond man's own planet. In addition, and perhaps more importantly, some portions of the military services saw outer space as a possible arena of international military competition and as offering a variety of opportunities for significant military applications. Thus examination of possible military operations in space was intense in the 1950s. Manned space flight programs, and particularly the goal of a manned lunar landing, figured importantly in these examinations. Military planning for manned space flight up to 1961 was most notable for advancing ambitious concepts and for underestimating the time and costs required to realize them.

AIR FORCE PLANNING At the end of World War II, the military services and the scientific community were anxious to preserve the effective partnership between them which had developed during the war. As one response to this problem, the Air Corps (then still part of the Army) created Project RAND (later the RAND Corporation).[8] Project RAND, which employed civilian scientists under civilian management, was expected to perform long-range research that might form the basis for a future Air Corps weapons system. The first study that RAND undertook, in March 1946, was on the subject of possible space vehicles. Its initial report, issued in May 1946, carried the title "Preliminary Design of an Experimental World-Circling Spaceship." Although the 342-page report was primarily hardware-oriented, it did contain some remarkably perceptive remarks about the probable psychopolitical effects of a satellite launching:

> The achievement of the satellite craft by the United States would inflame the imagination of mankind, and would probably produce repercussions in the world comparable to the explosion of the atomic bomb . . . . Since the mastery of the elements is a reliable index of material progress, the nation which first makes significant achievements in space travel will be acknowledged as the world leader in both military and scientific techniques. To visualize the impact on the world, one can imagine the consternation and admiration that would be felt here if the U.S. were to discover some other nation had already put up a successful satellite.[9]

Throughout 1946 Project RAND continued to study problems of space flight, but its reports had little influence in the upper echelons of the Air Corps, who had been dubious about the concept of an independent civilian research group in the first place. The Air Force became an independent service in 1947; in the following years it was involved in vigorous interservice competition, first of all to establish the concept of strategic bombing as the core of the nation's deterrent strategy and then to get authority to develop intercontinental and intermediate-range ballistic missiles. It was not until 1956 that high-level Air Force attention again turned to future space flight programs. Although in late 1956 the Air Force was to win Department of Defense approval for operational jurisdiction over all military missiles possessing greater than a 200-mile range, many Air Force officers still hoped to maintain the glamorous image of flying the most advanced aircraft and, they hoped, spacecraft. The idea of an Air Force limited to manning ground-level or underground missile control centers and to flying tactical aircraft was not an appealing concept to career officers of the service.

On February 15, 1956, the staff of the Air Force Research and Development Command met.[10] ARDC responsibility was to develop new weapons systems and aircraft for the Air Force. General Thomas Power, ARDC Commander, asked his staff to begin planning on approaches to advanced flight systems beyond the X-15 high-altitude rocket airplane. One approach, he suggested, might examine the feasibility of a manned vehicle that would operate outside the atmosphere, and another the idea of a manned ballistic rocket for possible intercontinental military and commercial transport and cargo operation. Following this meeting, the ARDC staff developed two research projects, one for a manned glider rocket that would operate at 400,000 feet altitude and a speed twenty-one times that of sound (and which eventually became the Air Force Dyna-Soar program) and the other for a manned nose cone as the final stage of an ICBM (which might be able to place it in orbit). This latter proposal became the basis for a concentrated study effort aimed at establishing the requirements for and the feasibility of an Air Force manned orbital capability.

Department of Defense funds for these studies were not forthcoming, and ARDC encouraged contractors who thought they might eventually want to bid on Air Force space contracts to conduct their own studies. Several contractors spent considerable company funds during 1956 and 1957 studying the ballistic approach to manned space flight.

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[7] This chapter contains no discussion of Soviet planning for manned lunar flight. Perhaps someday a volume like this one will be written in the Soviet Union, and we will learn the technical and political factors that have determined the pace and goals of the Russian space program.

[8] Bruce L. R. Smith, *The Rand Corporation: A Case Study of a Nonprofit Advisory Corporation* (Cambridge, Mass.: Harvard University Press, 1966), Chap. 2.

[9] Quoted by R. Cargill Hall, "Early U.S. Satellite Proposals," in Eugene M. Emme, ed., *The History of Rocket Technology* (Detroit: Wayne State University Press, 1964), p. 70.

[10] Loyd S. Swenson, Jr., James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, D.C.: National Aeronautics and Space Administration, 1966).

The Air Force in May 1957 established an ad hoc committee of its top-level Scientific Advisory Board which concerned itself with, among other things, the military implications of space technology.[11] This committee was chaired by H. Guyford Stever, Associate Dean of Engineering at M.I.T.; its report reached Air Force Chief of Staff General Thomas White five days after the Sputnik I launch in October. Included in this report were recommendations that the Air Force develop a second-generation ICBM that could also be used as a space booster and eventually could launch a manned lunar mission.[12] A few days later, a fifty-six man prestige-laden panel was formed to advise the Air Force with regard to its reaction to Sputnik. Its mandate, as formulated by Secretary of the Air Force James Douglas, was to propose "a line of positive action" for the Air Force in space exploration. This panel was chaired by Edward Teller and included members of the Scientific Advisory Board, industry experts, and ARDC technical personnel. The Teller Committee made its recommendations on October 28; not too surprisingly, its principal conclusion was that the nation required a unified space program under Air Force direction.[13]

Members of both the Stever and the Teller committees combined in December to recommend that the Air Force "establish a vigorous space program with an immediate goal of landings on the moon."[14]

Sputnik II, much larger than its predecessor and thus an even more impressive demonstration of Soviet booster and space capability, was orbited on November 3. In its wake, Air Force Headquarters ordered ARDC to prepare a comprehensive five-year astronautics program. The portion of ARDC responsible for the development of an Air Force space capability was the Ballistic Missile Division (BMD), commanded by Major General Bernard Schriever. Schriever ordered his staff to compress a portion of the fifteen-year plan for space they had already been preparing into a five-year plan, the first of many subsequent Air Force five-year plans for space. The plan that BMD proposed called for the expenditure of $1.7 billion over its duration and for the eventual (mid-1960s) development of a manned lunar base. Air Force Headquarters approved the plan, but the Director of Guided Missiles in the Office of the Secretary of Defense, who was the top DOD official with respect to space, did not.[15]

In March, as rivalry for control of the national space program became intense, BMD submitted an eleven-step program aimed at the ultimate objective of "Manned Space Flight to the Moon and Return." The steps included instrumented and animal-carrying orbital missions; a manned orbit of earth (called "Man-in-Space-Soonest"); circumnavigation of the moon, first with instruments and then with animals; instrumented landings on the moon; an animal landing on the moon; manned lunar circumnavigation; and finally a manned landing on the lunar surface. A refinement of these BMD proposals published on April 25 called for a high-priority effort under Air Force management to land a man on the moon by the end of 1965; the cost of such an effort, which involved concurrent development (a concept developed by BMD as a way of accelerating the nation's ICBM program by paralleling research and development efforts ordinarily performed in sequence), was estimated at $1.5 billion.[16] BMD emphasis on a lunar mission at this time was not prompted primarily by a belief that the moon was militarily important. General Schriever recalls that

> we had no military arguments. People tried to dream up things we could do on the moon from a national security standpoint and nothing tangible ever came out of it. We felt this would put a focus on the space program; it would accelerate technology. We knew there were a lot of applications in space that did have security implications and we wanted to have a major effort going.[17]

During the summer of 1958, with a presidential assignment of responsibility for manned space flight still not forthcoming, the Air Force primarily tried to win permission to attempt the "Man-in-Space-Soonest" program as a means of getting an American into space before the Soviets. Even this request was not granted; the newly formed National Aeronautics and Space Administration was given responsibility for the nation's manned space flight program in August 1958. Between 1958 and 1960, the Air Force pursued, with a relatively low budget, an alternate manned space flight program based on the concept of the Dyna-Soar space glider, but the Air Force never completely reconciled itself to sole civilian responsibility for other manned orbital and deep-space missions and continued to sponsor studies aimed at establishing military requirements in these areas.

In 1959, ARDC provided funds for industry studies of the possible need for a manned lunar base with the capability of launching nuclear-tipped missiles toward earth and of the need for "strategic interplanetary systems." A trade journal reported, with respect to the latter study, that "one premise . . . is that, if bases for exploration on near planets are established, an obligation would evolve to protect them. Coupled with this is the philosophy that scientific findings on planetary bases may bring out a prime necessity of holding these stations." Contractors for the lunar base study were North American Aviation, Aerojet-General Corporation, and Douglas Aircraft. Douglas, the Air Arms Division of Westinghouse Electric, and the Allison Division of General Motors were the contractors on the strategic interplanetary system analysis.[18] Air Force contracts were particularly attractive to industry at this time

[11] Thomas A. Sturm, *The USAF Scientific Advisory Board: Its First Twenty Years, 1944–1964* (Washington, D.C.: Government Printing Office, 1967).
[12] *Ibid.*, pp. 81–82, and Swenson, Grimwood, and Alexander, *This New Ocean*, p. 73.
[13] Swenson, Grimwood, and Alexander, *This New Ocean*, p. 73.
[14] Sturm, *Scientific Advisory Board*, pp. 82–83.
[15] Swenson, Grimwood, and Alexander, *This New Ocean*, pp. 73, 77–78.
[16] *Ibid.*, pp. 79–82. Compare this $1.5 billion cost estimate with the $24 billion that the less ambitious Apollo program will end up costing.
[17] Interview with Bernard A. Schriever (General, USAF, retired), November 3, 1967.
[18] *Aviation Week and Space Technology*, May 4, 1959, p. 23; September 28, 1959, p. 26.

both because of their size and because of the Air Force philosophy of maximum reliance on the contractor for overall responsibility for its programs. The Air Force did not possess a significant in-house technical management capability, in contrast to the Army system of service-run arsenals which were able to conduct in-house research, development, and even some fabrication, and which had a history of close supervision over Army contractors in industry. The Air Force philosophy was that most effective contractor performance could be obtained by selecting highly skilled firms to develop Air Force systems and by allowing them maximum freedom consistent with producing an acceptable product at an acceptable cost.[19]

With the change of administrations in 1961, Air Force hopes for an enhanced role in space grew, and there was an attempt to increase the Air Force share in the national space program. Even at the time when the consultations leading to the lunar landing decision were under way in April and May 1961, the Air Force was proposing a five-year space program to its Pentagon superiors which included an Air Force lunar expedition aimed at a 1967 manned lunar landing. Such an Air Force program was justified on the grounds that it would provide the basis for manned planetary exploration, for preventing unilateral Soviet space exploration, and for developing possible strategic military capabilities.[20]

Although the Air Force was not able to get executive approval to begin a program of manned space flight in the years from the Sputnik launch to 1961, the studies of potential lunar landing missions conducted by the Air Force and its contractors provided an extensive reservoir of technical expertise which those charged with accomplishing the lunar landing mission were able to tap. Even in the 1960s, the Air Force continued to plan for manned space flight, and in 1963 finally gained approval for a Manned Orbital Laboratory (MOL) program to investigate military capabilities in orbit. In June 1969, however, the Department of Defense canceled the MOL program. This seemed to mark the unsuccessful climax of a long attempt by the Air Force to demonstrate that it should be allowed to develop an operational spaceflight capability and thereby to resurrect the Air Force blue from the hidden Minuteman Launch Control Centers buried beneath the prairies of the American Midwest.

ARMY PLANNING The Army was also heavily involved in lunar mission planning in the late 1950s, but its rationale for such planning and its approach to the overall issue of obtaining a significant role in the evolving national space program were rather different than the Air Force approach. This difference owed much to the Army's having in its employ perhaps the most talented group of rocket engineers in the world and wanting to develop the missile or rocket programs to justify their continued operation under Army management. This engineering team was led by Wernher Von Braun and included many of the best men who had worked with him at the German rocket base at Peenemünde to develop the rocket that Goebbels christened the *Vergeltungswaffe Zwei* (Vengeance Weapon No. 2), or "V-2." But, "for the space-travel devotees" clustered around Von Braun, "the rocket remained . . . a step in the climb toward space," or at least one set of authors so asserts.[21] Clearly, the developers of the V-2 did envision the application of their achievements to space travel.

As the war came to an end, Von Braun and about 125 other German rocket specialists fled from Peenemünde to the American war zone and were eventually sent to the United States under "Project Paperclip," carried out by the Army. Von Braun and his associates told the Americans to whom they surrendered that they had chosen to offer their services to the United States rather than to the Soviet Union because "they were favorably disposed to this country generally" and also because the United States "was the one [country] most able to provide the resources required for interplanetary travel."[22] By contrast, the Soviets captured few top German rocket engineers. This infuriated Stalin, who is reported to have said that, "This is absolutely intolerable. We defeated the Nazi armies; we occupied Berlin and Peenemünde; but the Americans got the rocket engineers." The Soviets did capture enough technicians, parts, and plans to manufacture some V-2's and to help in their own rocket program.[23]

Von Braun, under Army direction, began work in the early 1950s on a battlefield missile, eventually called the Redstone after the Army arsenal in Huntsville, Alabama, where he and his team were finally located.[24] When the need for an intermediate-range ballistic missile to fill the military gap until an ICBM could be developed became evident, the Army was given responsibility (for a time jointly with the Navy) for upgrading the Redstone into an IRBM, called Jupiter. To expedite Jupiter development, the Army in early 1956 established the Army Ballistic Missile Agency, under whose jurisdiction Von Braun's team would work. Later that year, Secretary of Defense Charles Wilson issued a "roles and missions" memorandum which gave the Air Force jurisdiction over operational deployment of ICBMs and land-based IRBMs and which restricted Army operations to weapons with ranges less than 200

19 H. L. Nieburg, *In The Name of Science* (Chicago: Quadrangle Books, 1966), Chaps. 10–12 and especially pp. 187–189. Nieburg, while perhaps overly polemical, points out the difficulties of effective governmental control of large-scale R & D contracts.
20 Interview with John Rubel, former Deputy Director of Defense Research and Engineering, August 27, 1968.

21 Swenson, Grimwood, and Alexander, *This New Ocean*, pp. 16–17.
22 Wernher Von Braun and Frederick I. Ordway, III, *History of Rocketry and Space Travel* (New York: Thomas Y. Crowell Company, 1966), p. 116.
23 *Ibid.*, pp. 17–18.
24 Much of the following information regarding the development of the Army's large booster program is taken from Appendix B of U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Manned Space Flight Program of the National Aeronautics and Space Administration: Projects Mercury, Gemini, and Apollo*, 87th Cong., 2d sess., 1962.

miles. This decision removed much of the Army interest in the Jupiter program, and Von Braun and ABMA commander Major John Medaris resumed a campaign to gain DOD permission to use the Jupiter as a booster for an unmanned satellite. Such suggestions had been turned down in 1955 by those responsible for choosing a booster for the U.S. satellite to be launched as part of the International Geophysical Year. Only after the two Sputnik launches in the fall of 1957 was the Von Braun team permitted to attempt a satellite launching with their booster, and on January 31, 1958, the first American satellite, Explorer I, was orbited by a Jupiter C vehicle.

Restriction to developing 200-mile military missiles meant that the Army, if it could not fully employ the talents of the Von Braun team in other ways, would have to gain some kind of significant space mission. Only in this way, especially, could it justify developing the next series of boosters Von Braun had in mind. In April 1957, ABMA began studies of a booster intended to provide 1.5 million pounds of thrust by clustering existing engines together in a first stage. Such thrust compared with the 75,000 pounds produced by Redstone (which was also used as the Jupiter first stage) and the 360,000 pounds produced by the Atlas ICBM. Thus the vehicle ABMA was planning was an extremely large one, with the ability to orbit substantial military payloads if the requirements for them could be established. This booster concept was the basis of what later became the Saturn launch vehicle.

For the next three years, Von Braun campaigned in every possible forum first to obtain and then to retain (which proved difficult) approval to develop the Saturn. In doing so, he and his team developed a series of elaborate technical, military, and political justifications for the project. Throughout 1957, ABMA worked at preparing "A National Integrated Missile and Space Vehicle Development Program," in which the large booster was pictured as "the key to space exploration and warfare." In April 1958, General Medaris told a House committee, "I believe that the U.S. Army must make long-range plans for the transport of small combat teams by rocket. I also believe that cargo transport by rocket is economically feasible." A 1958 version of the "National Integrated Missile and Space Vehicle Development Program," issued under Von Braun's name, argued that a national space program was "not only feasible but mandatory for national security. . . ." The report called for performing a manned lunar landing in advance of the Soviets. . . . It is believed that the United States will be capable of performing this feat not later than August of 1966 with a back-up vehicle to insure maximum possible human safety. There is a possibility that a manned lunar landing, on an emergency basis without a back-up vehicle, could be accomplished as early as July 1965.

The total space program in the time period 1958–1970 would cost $17.2 billion, suggested the report. It recommended that "the objectives established . . . be accepted as goals for the national program, with particular emphasis on a manned lunar landing within the next nine years."[25]

By this time, although he was still officially working for the Army, Von Braun may have sensed that the future of his large booster program would be tied to the development of the new civilian space agency, NASA, which would be established that fall. At any rate, Von Braun was already on the record as being much less convinced than his military colleagues of the necessity for Army, or even military, control of the program.[26]

The large booster program did receive DOD approval in August of 1958, but its existence continued to be perilous as the process of developing a governmental structure for running the civilian and military space programs and of formulating a national space policy continued. A three-way tug-of-war between the Army, the Air Force, and NASA over who should manage the national large booster program, and for whom Von Braun and his team should work, lasted from mid-1958 until October 1959, when Eisenhower decided to transfer the Von Braun team and its projects to NASA.

After the Army was able successfully to reject a NASA request in October 1958 that it be given control of the Von Braun team, it undertook an intense planning effort to demonstrate that it required such a large space booster. That such an effort was needed, from the Army's viewpoint, was confirmed in April 1959, when Director of Defense Research and Engineering Herbert York voiced his intention "to cancel the Saturn program on the grounds that there is no military justification."

The 1959 Army task force which studied the military uses of the Saturn booster was called "Project Horizon." Organized on March 20, it submitted a first-draft four-volume report to Army headquarters in early June. A briefing on the report was given to the secretary of the Army on July 28. On the basis of this briefing, the Army leadership concluded: (1) the earliest possible U.S. manned lunar outpost was vital to U.S. interest; (2) Project Horizon represented the earliest feasible capability for the United States to establish a lunar outpost; (3) the extensive and in many cases exclusive Army capabilities in this field should be used in the nation's service, regardless of who had responsibility for establishing the lunar outpost; (4) the general reception accorded U.S. Army proposals of space operations had not been uniformly enthusiastic; (5) the source of the proposal should not be allowed to prejudice the reception of the proposal.

This somewhat disingenuous line of reasoning led to the conclusion

25 U.S., National Advisory Committee for Aeronautics, Special Committee on Space Technology, Working Group on a Vehicular Program, *A National Integrated Missile and Space Vehicle Development Program* (Washington, D.C.: National Advisory Committee for Aeronautics, 1958), pp. iii, 5, 31, 35. Note that this version of the ABMA planning was given to NACA, not the Army.

26 Enid Curtis Bok Schoettle, "The Establishment of NASA," in Sanford A. Lakoff, ed., *Knowledge and Power: Essays on Science and Government* (New York: Free Press, 1966).

that the report should be recast to eliminate any suggestion that the Army manage the lunar operation, to eliminate all possible military implications and inferences, and to emphasize the scientific and inherently peaceful intent of the United States in space operations. In September, a revised, two-volume version of the Project Horizon report was submitted to the secretary of the Army, who forwarded it to the secretary of defense. After the transfer of the Von Braun team to NASA, the report was forwarded by the secretary of defense to the NASA administrator.

The revised Project Horizon report outlined a program aimed at "the establishment of a lunar outpost by the United States," in order to:

1. demonstrate American scientific leadership in space;
2. serve as a communications relay station, as a laboratory for space research and development, and as a stable, low-gravity launch site for deep space operation; and
3. provide an emergency staging area, rescue capability, or navigational aid for other space activity.[27]

The report predicted that, if the project were approved immediately, cargo delivery to the moon would begin in January 1965, and the first manned launching would occur in April 1965. A "buildup and construction phase," lasting until November 1966, would follow until a lunar outpost suitable for occupancy by 12 men was ready. This phase would require 149 Saturn launchings, an average of 5.3 per month. In the year following the opening of the lunar outpost, another 64 Saturn launchings would bring additional cargo to the outpost. The total cost of the program from 1959 through 1967 was estimated at $6 billion.[28] These numbers seem truly remarkable for their naïvete with the hindsight of ten years time, when *five Saturn launches a year,* not a month, is above normal activity, and when the cost of Project Apollo has been placed at $24 billion.

The report recognized military, psychological, and political reasons for undertaking such a program.

From the viewpoint of national security the primary implication of the feasibility of establishment of a lunar outpost is the importance of being *first.*

For political and psychological reasons, anything short of being first on the lunar surface would be catastrophic. Being first will have so much political significance that no one can say at this time what the absolute effects would be. However, it is apparent from past space accomplishments that being second again cannot be tolerated.[29]

This extremely ambitious program to justify military use of the Saturn booster was just one of the Saturn-use proposals reviewed by DOD during 1959. The necessity of justifying a military requirement for Saturn became somewhat academic, however, in October, when President Eisenhower, reversing his position of the previous year, decided to authorize

27 U.S., Department of the Army, Army Ordnance Missile Command, *Project Horizon: A U.S. Army Study for the Establishment of a Lunar Outpost* (Huntsville, Ala.: Army Ordnance Missile Command, 1959), Vol. I, pp. 1–2.
28 *Ibid.,* Vol. II, p. 7.
29 *Ibid.,* p. 59.

the transfer of the Von Braun team to NASA. This shift was formally accomplished on July 1, 1960, although NASA assumed technical direction of the Saturn program the preceding November. With the loss of the Von Braun team, Army plans for manned space flight came to an end. Further discussion of the development of the Saturn program within the context of NASA's planning for manned space flight missions is contained in the following section.

Only the Navy did not propose a lunar mission during this period. Navy interests in space were primarily in the area of unmanned satellites for reconnaissance, navigation, and communications applications. During 1958, the Navy did propose a program for manned earth reconnaissance based on a complex and novel spacecraft which could be flown to a water landing after reentry from orbit, but it was not given funds for this program.[30] Since 1958 there have been no Navy proposals for manned flight.

CIVILIAN PLANNING FOR A MANNED LUNAR MISSION

EARLY PLANNING Although the Wright brothers were the first to fly an airplane, American research in aircraft technology lagged in the years following 1903. No plane of American design or manufacture flew in combat during World War I.[31] In 1915 President Wilson established the National Advisory Committee for Aeronautics (NACA), with the directive to "supervise and direct the scientific study of the problems of flight."[32] In the years between 1915 and the end of World War II, NACA developed in its Langley Laboratory at Hampton, Virginia, Ames Laboratory near San Francisco, and Lewis Laboratory at Cleveland, Ohio, an impressive capability to conduct advanced research in all aspects of aeronautics. NACA research is usually given credit for the reliable performance of Allied fighter planes in World War II. In the postwar period, the contributions of NACA to the development of U.S. advanced aircraft technology continued to be substantial.

Basic policy for NACA was set by a seventeen-member, presidentially appointed Main Committee. These seventeen members included a minimum of ten government officials (five from DOD) and up to seven nongovernment members. The committee was also responsible for choosing the director of the organization, who was responsible for coordinating the work of the rather autonomous laboratories so that it was conducted along the directions deemed desirable by the advisory committee. NACA served, as the composition of its "board of directors" indicates, both a civilian and a military clientele, providing advanced research and basic

30 Swenson, Grimwood, and Alexander, *This New Ocean,* pp. 100–101.
31 Eugene M. Emme, "Historical Perspectives on Apollo," *Journal of Spacecraft and Rockets,* April 1968, p. 369. This essay is the best short summary of the technological and political events preceding the lunar landing decision published to date. Emme is the NASA Historian.
32 For the history of NACA, see Swenson, Grimwood, and Alexander, *This New Ocean,* Chaps. 1 and 3, and Michael Keller, "From Kitty Hawk to Muroc: A History of the NACA Langley Laboratory, 1917–1947" (unpublished Ph.D. dissertation, University of Arizona, 1968).

technology development services to them but not becoming involved in managing large-scale development or production operations, which remained the responsibility of the users of NACA research.

An example of the division of responsibilities between NACA and the military services was the high-altitude "x-series" research aircraft program begun in the closing years of World War II. The Air Force and the Navy funded the program, and NACA provided the technical supervision. The job of building the test plane as well as the initial testing was given to a private contractor. Following contractor tests the Air Force and NACA jointly performed the flight research which was the object of the program. The military services concentrated on the area of military applications, and NACA conducted highly instrumented and detailed flight research, reporting the results to the entire aircraft industry. (It was this kind of relationship that the military services suggested in 1958 for the new national space program, with NACA providing basic research and technical services and the military in operational control of actual flight system development.)

It was logical that NACA, as the agency most directly involved in flight research, would eventually turn its attention to the problems of space flight. But at the start, "regarding the inchoate discipline of astronautics, especially rocket propulsion research, the agency . . . was skeptical, conservative, reticent."[33] In the early 1950s, however, NACA began to consider the problems of space flight and what contributions the organization could make to them. In July 1952, the NACA Main Committee approved a resolution setting up a study group on "space flight and associated problems," which would "devote a modest effort to problems associated with unmanned and manned flight at altitudes from 50 miles to infinity."[34] The activities of this study group, and NACA attention to space flight, remained at a relatively modest level until 1956, when NACA began studying the Air Force glide-rocket concept for manned space flight, work that continued throughout most of 1957.

The Sputnik I launch that October stimulated the NACA leadership to reexamine the role it wanted the agency to play in what would obviously be the much larger national space program developing in response to the Soviet challenge. As part of an effort to ensure that NACA not be "ruled out of the field of space flight research," the NACA Main Committee on November 22 established a Special Committee on Space Technology. The committee was directed "to survey the whole problem of space technology from the point of view of needed research and development and advise the National Advisory Committee for Aeronautics with respect to actions that NACA should take." The committee included an impressive cross section of the space science community, men such as Von Braun, NACA Director Hugh Dryden, William Pickering of the Army's Jet Propulsion Laboratory, and James Van Allen of the University of Iowa. The chairman of the committee was H. Guyford Stever (who had chaired an earlier advisory committee on space for the Air Force).[35]

[33] Swenson, Grimwood, and Alexander, *This New Ocean*, p. 55.
[34] *Ibid.*, p. 56.

The Stever committee report requested by NACA was not completed until October 28, 1958; by this time NACA no longer existed as such, since the new National Aeronautics and Space Administration with the NACA organization as its core had begun operation on October 1. Thus the committee report was the first comprehensive survey of the proper directions for a civilian space program available to the new agency. The committee concluded that

> the major objectives of a civil space research program are scientific research in the physical and life sciences, advancement of space flight technology, development of manned space flight for human benefit. Inherent in the achievement of these objectives is the development and unification of new scientific concepts of unforseeably broad import.

The report recommended both the development of a large booster based on clustering existing engines (the Saturn concept) and the further development of a "single-barrel" high-thrust engine to provide booster growth potential.[36]

NASA PLANNING NASA's immediate concern in late 1958 and early 1959 in the area of manned space flight was to get started on Project Mercury, which aimed at placing an American in orbit by 1961. NASA had been given responsibility for the nation's manned flight program in August 1958, ending temporarily the active intergovernmental struggle for that assignment.

Responsibility within NASA for executing Project Mercury went to the newly formed Space Task Group (STG), located at the Langley Air Force Base at Hampton, Virginia, and directed by Robert Gilruth. STG was purposely kept organizationally distinct from the existing Langley Research Laboratory, since many of the "research types" at Langley wanted little to do with the problems of organizing and managing a large-scale development program. The difficulties of this group in bringing Project Mercury to its first manned flight provide the background for a general debate over the future of U.S. manned space flight programs which the events of early 1961 and the lunar landing decision were to end, at least temporarily. Mercury was a very narrow-gauge project, established in order to investigate as quickly and inexpensively as possible man's capability to operate in the space environment; it did not aim at exploring or exploiting space. Such further steps would require a manned space flight program to follow Project Mercury.

Planning for such an advanced manned space flight program was begun by NASA personnel during 1959 and 1960, and led to the development

[35] *Ibid.*, pp. 75–76.
[36] U.S., National Aeronautics and Space Administration, Special Committee on Space Technology, *Recommendations Regarding a National Civil Space Program* (Washington, D.C.: National Aeronautics and Space Administration, 1958), pp. 1–2.

of Project Apollo.[37] This planning was conducted in the absence of any national policy goals for manned space flight other than the general directive given to NASA in its legislative charter to conduct its activities so as to contribute to "the expansion of human knowledge," "the development and operation of vehicles capable of carrying . . . living organisms through space," and "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."[38] Since there was no specific objective for post-Mercury manned space flight, the first task of NASA was to choose one.

To do this, NASA formed, in April 1959, a Research Steering Committee on Manned Space Flight. This committee, chaired by Harry Goett of the Ames Laboratory, came to be called the Goett committee. Members of the committee were drawn from NASA headquarters in Washington and from all NASA field centers. The committee met for the first time at the end of May, with the stated purpose of taking "a long-term look at man-in-space problems, leading eventually to recommendations on future missions."

The committee proceeded by reviewing existing manned flight and launch vehicle programs and the programs of research related to manned space flight then in progress in NASA centers. George Low of the Office of Space Flight Programs in NASA Headquarters recommended to the committee that a manned lunar landing mission should be adopted as the long-range objective of the NASA manned space flight program.

At its second meeting the Goett committee made two decisions that had the broadest implications for the future NASA manned space flight program. First, it identified the studies and research NASA should emphasize if it wished to take the steps leading up to and including manned flight to the moon. Second, and more important, the committee chose a lunar landing mission as the appropriate long-term goal for NASA's manned space flight program. Such a mission, it concluded, was in itself a reasonable end objective which did not have to be supported on the basis that it was only a step toward some other useful end. Also, planning for such a mission would focus research on the problems of true space flight, rather than on only the problems of flights in earth orbit. In making this decision, the committee selected the lunar landing objective over an alternate suggestion discussed during their meetings, an orbiting space laboratory. *Operating pretty much in a political vacuum in terms of policy guidance, and basing their choice on what constituted a rational technical program of manned space flight development, NASA planners chose a lunar landing objective fully two years before President Kennedy announced his choice of the lunar landing as a national goal.*

Once the Goett committee had made its decision, more detailed planning for a manned lunar landing and for the most important intermediate step in accomplishing it, flights around the moon without landing, evolved at several levels within the NASA structure. In NASA's Washington headquarters, an Office of Program Planning and Evaluation was established during 1959 to assist Administrator Glennan in the development of long-range policies and programs. Throughout 1959, the office worked on the preparation of a "NASA Long-Range Plan." This plan attempted to integrate the various segments of the total NASA program in a unified scheduling and funding framework. The plan had no official standing, although it had been discussed in draft form at all levels of the government including the White House; its existence thus did not imply an executive commitment to approve the programs included in it. The first version of the long-range plan was presented in an unclassified version to Congress in early 1960. It assumed that the Saturn launch vehicle would be used for the manned space flight program to follow Project Mercury, and that manned circumlunar flight would take place in the 1966–1968 period, with the manned lunar landing to occur after the ten-year period covered by the plan. The planning date for the landing was apparently in the mid-1970s. The plan assumed that the NASA budget would rise to a maximum of about $1.6 billion in 1967. (The actual NASA budget for fiscal 1967, after the lunar landing goal was set, was almost $5 billion.) NASA believed that this plan "was adequate, in the long run, to win more gold medals in the space Olympics than any other nation," while conceding that the Soviet Union would continue to win also, especially in the early years of the decade.[39]

The choice of the lunar landing goal also made it possible for those within NASA responsible for spacecraft design to focus their plans on the requirements for an advanced manned spacecraft. Beginning in mid-1959, members of the Space Task Group began to discuss such advanced design concepts. A STG New Projects Panel, headed by H. Kurt Strass, held its first meeting on August 12. Strass summarized to the panel the philosophy behind the Goett committee choice of a lunar landing objective as being maximum utilization of existing technology in a series of carefully chosen projects, each of which would provide a firm basis for the next step and would be a significant advance in its own right. At a second meeting, the panel discussed the steps required to accomplish a lunar landing by 1970.

By the fall, the premises upon which the STG spacecraft designers were

[37] NASA is itself beginning an extensive historical program to document the origins and development of Project Apollo. The first publication resulting from this program is Ivan Ertel and Mary Louise Morse, *The Apollo Spacecraft: A Chronology*, Vol. 1 (Washington, D.C.: National Aeronautics and Space Administration, 1969). This volume covers developments in the Apollo spacecraft program through 1962. The following account is taken from material contained in this chronology unless otherwise noted.

[38] *The National Aeronautics and Space Act of 1958*, Section 102(b).

[39] Robert Rosholt, *An Administrative History of NASA, 1958–1963* (Washington, D.C.: National Aeronautics and Space Administration, 1966), pp. 130–131.

working had been somewhat altered. Guidelines for spacecraft design were now based on the assumption that the launch vehicles likely to be available within the 1960s were capable of supporting only a circumlunar flight rather than a lunar landing, and that the spacecraft should be designed to emphasize this mission, while still having the growth capability to be used as the basis for the lunar landing spacecraft. Further, after closer examination NASA research centers concluded that there were enough unknowns involved in flights to lunar distances so that the spacecraft should be equally capable of advanced earth orbital missions if lunar flights proved impracticable.

Based on these assumptions, the Space Task Group by early 1960 began to formulate more precise guidelines to assist in preparing specifications for the advanced spacecraft. The guidelines specified that the Apollo spacecraft should be:

1. capable ultimately of manned circumlunar reconnaissance (as a logical intermediate step toward future goals of lunar and planetary landing many of the problems associated with manned circucumlunar flight would need to be solved).
2. capable of earth orbit missions for initial evaluation and training. (The reentry component of this spacecraft should be capable of missions in conjunction with space laboratories or space stations. To accomplish lunar reconnaissance before a manned landing, it would be desirable to approach the moon closer than several thousand miles. Fifty miles appears to be a reasonable first target.)
3. designed to be compatible with the Saturn boosters for the lunar mission.
4. capable of flights of 14 days without resupply.

As these guidelines suggest, the interaction between mission objectives, spacecraft design, and likely booster capability had become crucial. With the Eisenhower decision to transfer the Von Braun team from Army to NASA jurisdiction, the Saturn program became the key to the pace at which the United States could attempt ambitious space missions requiring the weight-lifting capability the Saturn would provide. Accordingly, attention was focused on defining as precisely as possible the booster configuration, capability, and schedule so that this information could be used in planning the future manned programs.

On December 15, 1959, a Saturn Vehicle Evaluation Committee headed by NASA Director of Space Flight Development Abe Silverstein and composed of NASA and military representatives reached a decision on Saturn configurations. They also recommended a long-range development program for the vehicle. The key decision of the committee was to use the untested combination of liquid hydrogen and liquid oxygen (rather than the standard kerosene-oxygen combination) as the fuel for all upper-stage engines of the Saturn as soon as was feasible. The hydrogen-oxygen combination would provide much more thrust than previously available, but involved the development of new fuel-handling and engine technology. If this decision had not been made in 1959, it is unlikely space experts would have told Kennedy in 1961 a lunar landing was possible by 1967. The Silverstein committee defined two Saturn configurations; the initial vehicle was identified as the Saturn C-1 and was to be a stepping-stone to a larger, more powerful vehicle, the C-2, which would have the hydrogen-fueled upper stage. First stage for both vehicles would be the eight-engine cluster, fueled by kerosense and oxygen and developing 1.5 million pounds of thrust, which the Von Braun team had been proposing since 1957. NASA administrator Glennan approved the Silverstein committee recommendations on December 31, and the whole Saturn program received the highest national priority, "DX," on January 18, 1960, meaning that the program had top priority claim to scarce national resources. The Saturn C-1 was expected to become operational by the end of 1963 or the beginning of 1964; the expectation was that the C-2 would be operational sometime after 1966.[40]

Beyond the Saturn vehicle in NASA's planning at this juncture was the concept—and it was little more than that—of a Nova booster with a first stage using several of the giant 1.5-million-pound thrust F-1 engines already under development. Even the preliminary planning for a lunar landing mission had indicated that a booster of this size would be required to launch a manned spacecraft from earth for the direct flight to the lunar surface. No schedule for the Nova had been established by this time.

By now NASA felt ready to announce its plans for advanced manned flight missions to potential industrial contractors. Although the aerospace industry was well aware that NASA was formulating plans for post-Mercury manned space flight, details of the NASA planning had remained pretty much within the organization. Only one internal detail remained—naming the program. In late July Glennan approved an earlier suggestion by Abe Silverstein that the advanced manned program be called "Project Apollo." Silverstein had picked the name out of a Greek mythology book because he thought the image of the god Apollo riding his chariot across the sun gave the best representation of the grand scale of the proposed program.

On July 28 and 29, 1960, a "NASA-Industry Program Plans Conference" was held in Washington to give industrial management an overall picture of the NASA program, including plans for Apollo. This was the first public disclosure of the results of NASA's internal planning. George Low, Chief of Manned Space Flight in NASA headquarters, presented what he described as "a rational reasonable approach to a long-range development program leading to the manned exploration of outer space." Low outlined NASA's plans for a spacecraft capable of either circumlunar flight or use as an earth-orbiting laboratory, and which "should lead toward manned landings on the moon and planets, and toward a permanent manned space station." Low pointed out that "manned circumlunar flight is the ultimate manned mission consistent with our planned booster capability . . . ." He described the basic spacecraft design con-

[40] Emme, "Historical Perspectives on Apollo," p. 373; Senate Space Committee, *Manned Space Flight Programs,* pp. 180–182.

cepts, the spacecraft systems which would require development, and the problems involved needing further research. He told the industrial representatives that in the near future they would be "invited to participate, by contract, in a program of system design studies." Based on the results of these studies and continuing in-house definition, "a systems contract for the design, engineering, and fabrication of the manned spacecraft and its components will probably be initiated in fiscal year 1962." Low specified that the Apollo program he was describing had "no official standing as yet."[41]

This expectation—that NASA would be authorized to sign a contract to build hardware for a post-Mercury spacecraft in the fiscal year for which the budget estimates were then being prepared—was frustrated by the recommendations of the Bureau of the Budget and the decisions of President Eisenhower in late 1960. By September, NASA planners knew that the Fiscal 1962 budget would probably not contain funds for developing a spacecraft to follow Mercury unless the new president revised it the following year. Funds for the high-energy liquid-hydrogen-fueled upper stage for the advanced C-2 Saturn booster configuration required for circumlunar Apollo flights also were not approved by BOB.[42]

The process of choosing contractors for the Apollo spacecraft system design studies went on in the remaining months of 1960, even after NASA plans for continuing the program were disapproved by the Eisenhower administration. On October 25, contracts for six-month Apollo spacecraft feasibility studies were awarded to Convair/Astronautics, General Electric, and the Martin Company. These studies and an in-house intensive study by STG were intended to provide the basis for preparing the final specifications for the spacecraft hardware development and production contract, which would be let if and when approval to conduct the program could be obtained from the White House.

While these studies were getting under way, in NASA Headquarters on October 17 George Low notified Director of Space Flight Programs Abe Silverstein that:

1. It has become increasingly apparent that a preliminary program for manned lunar landings should be formulated. This is necessary in order to provide a proper justification for Apollo, and to place Apollo schedules and technical plans on a firmer basis.
2. In order to prepare such a program, I have formed a small working group. . . . This group will endeavor to establish ground rules for manned lunar landing mission; to determine reasonable spacecraft weight; to specify launch vehicle requirements; and to prepare an integrated development plan, including the spacecraft, lunar landing, and takeoff system, and launch vehicles.

Low had been the member of the Goett committee who had pushed hardest for the selection of the lunar landing objective, and he was still intent on ensuring that that objective was not lost in the concentration on planning for the circumlunar flight. Low and his group familiarized themselves with the plans for a lunar landing mission current in all NASA centers, in industry, and, to the degree it was possible considering the delicate relations between the two organizations, the Air Force.

By January 1961, Low thought it advisable to arrange a briefing for NASA's leadership on these plans. At a January 5 meeting of the top-management Space Exploration Program Council (SEPC), a series of nine presentations on various aspects of a manned lunar landing program were scheduled. These presentations, said Low, had not been coordinated in order to present a united front to the council; their purpose was to allow the SEPC itself to make a "first cut" at establishing policy for a NASA lunar landing program after hearing diverse views on the topic. After the briefings, the council decided that planning for a manned lunar landing should continue, but that it was too early to choose a specific approach to the mission. Administrator Glennan was particularly careful to stress that, although such planning had to be based on a premise that a lunar landing program would eventually be approved, it could be approved only by the president, and such approval had not yet been forthcoming.[43] Glennan, it seems, was trying to damp down the ardor of those in the group who were acting as if the program was already going full blast.

As an aftermath of the SEPC meeting, a further task force was established, with instructions to answer the question, "What is NASA's Manned Lunar Landing Program?" George Low was named chairman of the task force; the group became known as the Low committee. At a meeting the next day, NASA associate administrator Robert Seamans, the organization's general manager and number three man, instructed the committee to prepare a position paper for the NASA Fiscal Year 1962 budget presentation to Congress. The paper was to be a concise statement of NASA's lunar program for Fiscal Year 1962 and was to present the lunar mission in terms of both direct ascent and rendezvous. The rendezvous program would be designed to develop a manned spacecraft capability in near space, regardless of whether such a technique would be needed for manned lunar landing. In addition to answering such questions as the reason for not eliminating one of the two mission approaches, the group was to estimate the cost of the lunar mission and the date of its accomplishment, though not in specific terms. Although the decision to land men on the moon had not been approved, it was to be stressed that the development of the scientific and technical capability for a manned lunar landing was a prime NASA goal, though not the only one, said Seamans.

The Low committee made its final report on February 7. It concluded that "no invention or breakthrough is believed to be required to insure

[41] U.S., National Aeronautics and Space Administration, *NASA-Industry Program Plans Conference, July 28–29, 1960* (Washington, D.C.: Government Printing Office, 1960), pp. 79–85.
[42] See the previous chapter for further details on these decisions.
[43] Minutes of the Meeting of the Space Exploration Program Council, January 5 and 6, 1961. (Copy in NASA Historical Archives.)

the over-all feasibility of safe lunar flight."[44] The group found that the manned lunar landing mission could be accomplished during the decade, using either the earth-orbit rendezvous or direct ascent technique. Total funding for the program was estimated at just under $7 billion through Fiscal Year 1968.

CONCLUSION

The Low committee report, the ongoing studies of the Apollo circumlunar spacecraft, and the reservoir of thinking about the problems of manned lunar exploration summarized earlier were the technical resources available to the NASA leadership as they attempted to develop, under presidential directive, a program to obtain a preeminent position in spectacular space achievement. The principal contribution of the technical planning to the decision-making process was the general finding that there were no insuperable problems, or problems requiring the development of totally new technologies, involved in a manned lunar landing program. This finding was, of course, of crucial significance; it is unlikely that Kennedy could have announced publicly a national goal, with a time schedule attached, of a lunar landing if there had been outstanding technical unknowns. Further, the general consensus within NASA and in most segments of the aerospace community that the lunar landing goal was valid in terms of scientific and technological criteria influenced the direction of the decision-making process; both the White House and NASA were concerned that the program finally chosen would be technologically sound, not only aimed at enhancing national prestige.

Many of the details of the pre-1961 planning rapidly became obsolete as NASA launched an intense planning effort in the months after May 1961, but many others proved sound and have remained as the basis of the program to date. The general configuration of the current Apollo spacecraft, especially the command module, exists much as it was conceived by 1960. The Saturn and Nova concepts were merged, producing a Saturn V booster which is really a small Nova, using the giant F-1 engines in its first stage. The Saturn V uses the hydrogen-oxygen fuel selected by the Silverstein committee in its upper stages. The main approaches to lunar landing—direct ascent, earth orbital rendezvous, and lunar orbital rendezvous—were already being discussed as the early planning process progressed. This list could be made much more lengthy, but that is a task for the full technical history of the Apollo program. It is enough to note that by 1961, for some time and in some detail, Americans had been thinking about how to go to the moon. What the lunar landing decision did was to provide the political sanction without which planning of the enterprises involving big science and bigger technology produce only piles of paper, not human achievement.

[44] Quoted in John M. Logsdon, *NASA's Implementation of the Lunar Landing Decision,* Historical Note HHN-81 (Washington, D.C.: National Aeronautics and Space Administration, 1969), p. 5. This essay traces NASA's choice of the Saturn V booster and lunar orbital rendezvous mission profile for accomplishing the lunar landing.

3 Steps toward a Decision

4 "We Should Go to the Moon"

When John F. Kennedy assumed the duties of the presidency on January 20, 1961, he "seemed to know less" and to "be less interested in" issues of space policy than almost any other set of policy questions.[1] What Kennedy did bring to the presidency was "the idea that the power of the West and the Communist bloc were in a balance that required constant vigilance. . . ." This world view "drove Kennedy . . . to invest every direct Soviet-American problem with a high degree of passion . . . an intense desire to avoid giving the impression of weakness." In his view of Soviet-American relations, "Kennedy saw a contest of wills, an almost formal antagonism in which the prize was pride at least as much as any substantive outcome."[2] Until Kennedy became convinced that space achievement was linked closely to the power relationships between East and West, and was a symbolic manifestation of national determination and vitality, his lack of knowledge about space matters made him hesitate to make basic changes in the space policy developed by Dwight Eisenhower. Once Kennedy did make such a connection, however, he determined that that policy should be dramatically reversed, and that "we should go to the moon."

EARLY KENNEDY STATEMENTS ON SPACE POLICY

Kennedy's early speeches as president included appeals to the Soviet Union for cooperation in space. In his Inaugural Address, Kennedy spoke to the Soviets, saying "together let us explore the stars. . . ."[3] In his State of the Union Message ten days later, Kennedy invited the Soviet Union "to join with us in developing a weather prediction program, in a new communications satellite program, and in preparation for probing the distant planets of Mars and Venus, probes which may someday unlock the deepest secrets of the Universe."[4] In the same speech and in a press conference statement two weeks later, Kennedy echoed his science adviser's hope that the arms race could be kept out of space: "The development of space, preventing outer space from being used as a new area of war . . . is of the greatest possible concern to the people of this country."[5] The president also acknowledged that "the Soviet Union . . . is ahead of us in booster development and there is an indication that they are going to be ahead of us for some time to come . . . . It is a matter of great concern."[6]

In these speeches Kennedy seemed to reflect the advice of the Wiesner

1 Hugh Sidey, *John F. Kennedy, President* (New York: Atheneum Press, 1964), p. 59.
2 George Kateb, "Kennedy as Statesman," *Commentary,* June 1966, p. 57.
3 U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Documents on International Aspects of the Exploration and Uses of Outer Space, 1954–1962,* 88th Cong., 1st sess., 1963, S. Doc. 18, p. 189.
4 *Ibid.* See Don Kash, *The Politics of Space Cooperation* (Lafayette, Ind.: Purdue University Press, 1967) and Arnold Frutkin, *International Cooperation in Space* (Englewood Cliffs, N.J.: Prentice Hall, 1965) for discussion of U.S. cooperative space programs.
5 Senate Space Committee, *Documents on International Aspects of Space,* pp. 189, 191.

report, which had added international cooperation to the 1958 PSAC list of justifications for space activity, and the Eisenhower policy of denying the existence of a space race between the United States and the Soviet Union. Both of these approaches were essentially defensive, trying to limit the political gains accruing to the Soviets from their succession of space firsts. They were indicative of the limited diplomatic leverage afforded by the American space program up to 1961. There was little likelihood that the Soviets, who in the public mind were clearly ahead in space technology, would respond to American cooperative overtures and thereby risk sharing some of the political rewards from their own large investment in a substantial space program. The Soviet Union seemed in the space race to win, and Kennedy was soon to learn that, if he wanted to be successful in space politics, he needed a bigger space program of his own.

The administration made one concrete gesture toward attempting to initiate a policy of space cooperation with the Soviet Union. On January 31 the chief of the U.S. Weather Bureau sent a State Department-approved cable to his Soviet counterpart, inviting him to a World Meteorological Organization meeting in Washington which was to discuss the uses of satellites for weather prediction. The Soviet Union, without explanation, declined to attend. A presidential statement deploring the failure of the Soviet Union to indicate a willingness to cooperate was canceled at the last minute.[7] Then Khrushchev replied to the cooperative overtures by linking space cooperation to disarmament, a tactic which the Soviet Union had been pursuing in the United Nations for some time and which the United States had consistently opposed.[8]

In the early months of 1961, the attention of the president and his immediate staff focused on settling into their new jobs, on remedying faults in the nation's defense, on making some new foreign policy initiatives, on preparing legislation leading to domestic social welfare programs, and on combating the 1960–1961 recession. Kennedy's personal staff shared the president's lack of background in space issues; David Bell says that "most of us, when we came into office, didn't have any notion what the space program was all about, what the issues were. A lot of people needed to be educated."[9] Kennedy's own education in space began with his meeting with Lyndon Johnson and NASA officials on March 22.

When, in mid-March, NASA refused to accept the BOB decision not to recommend approval of the full amount of the $308 million supplemental request that the agency believed was needed and requested a

[7] *The New York Times,* February 11, 1961, p. 3.
[8] Senate Space Committee, *Documents on International Aspects of Space,* p. 190. See Kash, *Space Cooperation,* Chap. 7, for a discussion of Soviet and United States tactics regarding United Nations consideration of space-related questions.

meeting with the president to present its case for the budget increase, Budget Director Bell had told agency officials that Kennedy did not then have time to become involved in space issues. By the time that NASA made its request, Kennedy was deeply involved in the first crisis of his administration, the decision whether or not to intervene with American troops in Laos, where the pro-American government of Phoumie Nosavan seemed near military defeat by the Communist Pathet Lao forces. Arthur Schlesinger reports that in the first two months of his administration Kennedy spent more time on the Laotian problem than on any other matter. On March 20 and again on March 21, Kennedy met with the National Security Council to discuss whether immediate intervention was necessary or whether a "political" solution could be achieved. The Joint Chiefs, fearing another Korea unless intervention could achieve results quickly, told Kennedy that 60,000 troops, air support, and possibly tactical nuclear weapons would be needed to ensure the intervention would be a success. After these meetings, Kennedy decided not to intervene as yet, but to demonstrate his willingness to intervene unless the United States and the Soviet Union could find grounds for compromise on the future of Laos. On March 21 Kennedy ordered all the steps needed to mobilize for an intervention begun, and the Seventh Fleet steamed into the Gulf of Siam, a task force on Okinawa trained for fighting in Southeast Asia went on alert, and a Marine force in Japan, which had been serving as movie extras, vanished from the set and made ready for action. Kennedy scheduled a press conference for March 23 in order to issue a public warning to the Soviets that the United States would intervene in Laos unless a cease-fire could be arranged.[10]

This crisis was probably Bell's reason for trying to protect the president from having to turn his attention to space. In the face of NASA's refusal to accept the BOB offer of a $50 million addition to the Fiscal Year 1962, with further review postponed until the next budget cycle, Bell scheduled a meeting with the president on the NASA budget requests for March 22.

KENNEDY'S FIRST SPACE POLICY DECISIONS

Before meeting with Kennedy, Webb, Dryden, and Seamans briefed Vice President Johnson on their supplemental request; Budget Director Bell, Deputy Budget Director Elmer Staats, and Deputy Chief of the Military Division Willis Shapley (who was the individual in BOB directly responsible for handling NASA requests) briefed the vice president on the bureau's reasons for opposing approval of most of the NASA request. The vice president had finally chosen Edward Welsh as Executive Secretary of the Space Council, his top aide on space; Welsh

[10] Arthur Schlesinger, Jr., *A Thousand Days: John F. Kennedy in the White House* (Boston: Houghton Mifflin Company, 1965), pp. 320–334 and Roger Hilsman, *To Move A Nation: The Politics of Foreign Policy in the Administration of John F. Kennedy* (Garden City, N.Y.: Doubleday & Company, Inc., 1967), pp. 124–125.

was also present at the briefings. Even though he had been assigned responsibility for the space program, this briefing was apparently Johnson's first involvement in substantive space policy questions since the inauguration.

After the vice presidential briefing, Kennedy, McGeorge Bundy, Jerome Wiesner, and Atomic Energy Commission Chairman Glenn Seaborg joined the group in the Cabinet Room. The agenda for the meeting indicated that

The future direction and level of the civilian space program primarily depends upon decisions to be made by this Administration concerning the rate at which it wishes to undertake the following:
1. increasing the rate of closure on the USSR's lead in weight-lifting capability;
2. advancing manned exploration of space beyond Project Mercury.[11]

Robert Seamans briefed the meeting on the effects of the requests for budget increases under consideration on NASA's future programs. These effects included

1. Moving the date for the first manned orbital flight in Project Apollo from 1967 to 1965.
2. Accelerating development of the advanced Saturn C-2 booster so that this development would be completed in 1966 and a manned flight around the moon, without a lunar landing, could be made in 1967 rather than in 1969.
3. Developing the 1.5-million-pound-thrust F-1 engines for the Nova booster required for direct flight from the earth to the lunar surface so that the first lunar landing could be made in 1970, rather than in 1973.
4. Developing a prototype flight nuclear engine for the upper stage of the Nova booster so that the heavier payloads required for lunar base operations or manned planetary flights could be provided.[12]

Kennedy was impressed by Seamans' presentation and asked that he prepare a memo summarizing it.

In presenting the issues involved in the approval of Project Apollo, Hugh Dryden stressed the project's capability of aiming either toward a two-week duration, multiman, orbital laboratory or at lunar landing flights, with the goal of a lunar landing by 1970.[13]

Webb had spent the evening of March 20 in his office preparing a paper from which he could make his presentation of NASA's case to the president.[14] Webb told the president

The U.S. civilian space effort is based on a ten year plan. When prepared in 1959, this ten year plan was designed to go hand in hand

11 Interview with Hugh Dryden, March 26, 1964.
12 Memorandum from Associate Administrator Seamans to Administrator Webb on "Recommended Increases in FY 1962 Funding for Launch Vehicles and Manned Space Explorations," March 23, 1961. (Copy in NASA Historical Archives.) Copies of this memo were forwarded by Webb to the president and vice president on the same day.
13 Interview with Hugh Dryden.
14 Jay Holmes, *America on the Moon: The Enterprise of the Sixties* (Phila-

with our military programs and permit a steady closing of the gap caused by Russian successes. Prior to this plan, U.S. procrastination for a number of years had been based on a very real skepticism by President Eisenhower personally as to the necessity for the large expenditures required, and the validity of the goals sought through the space effort.

In the preparation of the Fiscal 1962 budget, President Eisenhower reduced the $1.35 billion requested by the Space Agency to the extent of $240 million and specifically eliminated funds to proceed with manned space flight projects beyond Mercury. His decision emasculated the ten year plan, before it was one year old, and unless reversed guarantees that the Russians will, for the next five to ten years, beat us to every spectacular exploratory flight.

We have already felt the effects of the fact that they were the first to place a satellite in orbit, have intercepted the moon, photographed the back side of the moon, and have sent a large space craft to Venus. They can now orbit 7½ ton vehicles about the earth, compared to our 2½ tons, and they have successfully recovered animals from orbital flights lasting as much as 24 hours. Their present position is one from which further substantial accomplishments can be expected, and our best information points to a steadily increasing pace of successful effort, on a realistic timetable.

It is fair to say that the budget levels of the previous administration did permit extensive scientific investigation, and application of satellites to meteorological and communication systems, the Mercury man-in-space effort, and the support of these through advanced research and technological development. However, these levels have not been sufficient for the successful conduct of programs calculated to give us any substantial initiative in space exploration.

The first priority of this country's space effort should be to improve as rapidly as possible our capability for boosting large spacecraft into orbit, since this is our greatest deficiency. The present Russian booster has a 750,000 pound thrust compared with an Atlas thrust of 320,000 pounds. We are developing a cluster of 8 Atlas engines, known as Saturn, which will have a thrust of 1,500,000 pounds. Our request for additional funds to advance its available date one year (to 1966) has not been recommended to you by the Budget Bureau. In addition, we are asking funds to speed up work on the engines for a more advanced vehicle with 6 to 9 million pounds of thrust, which we call Nova. Our information shows that the Russians are continuing with booster developments, and we should not put ourselves in the position of having to start such a major project with its long lead time after they are in a position to exploit their possession of such a development.

The funds we have requested for an expanded effort will bring the entire Space Agency program up to $1.42 billion in FY 1962 and substantially restore the ten-year program. The future effect of our recommendations will be to increase expenditures to an annual rate of $2.0 billion by 1965 or 1966.

The Department of Defense benefits from the NASA space program just as NASA does from the military space program. NASA research centers are investigating re-entry physics, high temperature structures, and propulsion techniques for both military and civilian needs, to mention only a few major technical areas of common interest and effort. In addition, NASA-developed electronic equipment for telemetry, tracking, data processing, stabilization and guidance will have application to military systems. Most important of all, the boosters now under development and the launch facilities to be constructed will be used directly by the Department of Defense. NASA's Centaur launch vehicle will be used to place the Defense communications satellite, Advent, in orbit, and ultimately it can be expected that NASA's Saturn will make possible military missions not even foreseen at this time. We feel it is important

siderations but also to provide improved technological capability for the DOD.

Under the ten-year program, NASA will need the large boosters we are requesting sooner than the military will need them in order to achieve a number of major space exploration milestones. Among these are unmanned exploration of the moon and planets as well as manned space flight beyond Project Mercury. The Mercury vehicle carries a single man and can remain in orbit but a few hours. For important biomedical studies, we wish to make modifications that will extend the flight time to one day.

To make flights about the earth with multiple crews or trips to the vicinity of the moon, we must develop a new space vehicle and team it up with the Saturn booster. President Eisenhower eliminated from his budget the preliminary design studies to begin this effort. Unless research and development funds for an advanced design of this type are restored, the important milestone flights will be delayed at least a year.

The United States space program has already become a positive force in bringing together scientists and engineers of many countries in a wide variety of cooperative endeavors. Ten nations—Great Britain, France, Italy, West Germany, Japan, Australia, Canada, Sweden, Norway, Argentina—all have in one way or another taken action or expressed their will to become part of this imaginative effort. We feel there is no better means to reinforce our old alliances and build new ones.

The Soviets have demonstrated how effective space exploration can be as a symbol of scientific progress and as an adjunct of foreign policy. Without necessarily following the Soviet lead in this kind of exploitation, we should not fail to recognize its potential. We cannot regain the prestige we have lost without improving our present inferior booster capability, and doing it before the Russians make a major breakthrough into the multi-million pound thrust range.

Looking to the future, it is possible through new technology to bring about whole new areas of international cooperation in meteorological and communication satellite systems. These new systems will be superior to present systems by a large margin and so clearly in the interest of the entire world that there is a possibility all will want to cooperate—even the USSR. However, the extent to which we are leaders in space science and technology will in some large measure determine the extent to which we, as a nation, pioneering on a new frontier, will be in a position to develop this emerging world force and make it the basis for new concepts and applications in education, communication and transportation, looking toward more viable political, social and economic systems for nations willing to work with us in the years ahead.[15]

Kennedy listened to the NASA arguments, asking questions and discussing all the implications of the decisions he was being asked to make, but making no decisions then. The next day he called another meeting in his office attended by Johnson, Welsh, Wiesner, and Bell, but with no NASA representatives present. At this meeting, Welsh and Johnson argued in favor of NASA's request, especially with regard to the necessity of getting started on a big booster program without delay. Wiesner also supported a start on increasing booster capability.[16] The Wiesner report in January had concluded that "the rapid development of boosters

[15] James Webb, "Administrator's Presentation to the President," March 21, 1961. (Copy in NASA Historical Archives.)
[16] Holmes, *America on the Moon*, p. 196. Interviews with Jerome Wiesner, September 11, 1967, and Edward Welsh, August 14, 1967.

with a greater weight-lifting capacity is a matter of national urgency."[17]

Kennedy decided at this meeting that he would support an acceleration of the booster program. In accordance with this decision, he approved the NASA requests for $56 million for Saturn vehicle development, $25.6 million for Centaur vehicle development, $9.3 million for liquid propulsion R&D, $4 million for nuclear systems development, and $19.2 million for construction of launch and test facilities.

Johnson and Welsh did not suggest immediate approval of the NASA proposals for Project Apollo, and Kennedy approved none of the $42.6 million specifically requested for Project Apollo. The decision to approve acceleration of the Saturn program moved the availability date of the booster forward approximately two years. Other increments to the Eisenhower budget brought the approved supplemental to $125.7 million and raised the total NASA budget to $1.235 billion.[18]

One reason for the hesitance at this time to approve Project Apollo was uncertainty regarding the success of Project Mercury. The Hornig panel, which was reviewing the program, had not submitted its report. The first manned suborbital flight was scheduled for late April, and a second suborbital flight for a few months later. There was still hope that the first orbital flight would come before the end of 1961. Kennedy preferred to wait until some of these flights occurred, demonstrating NASA's capability to initiate successfully a large manned program.[19]

In addition, Kennedy had not made up his mind at this time what his general attitude toward manned flight would be. One official involved in the discussions believed that Kennedy was tending toward the approval of Apollo, but that he

wanted to know more about it. This was all pretty new as far as he was concerned, except in very general terms. He was a person who liked to involve himself in the material by discussion and by reading; I'm sure he felt he needed a little more time.[20]

Webb also recognized that "Kennedy was concerned about a tremendous range of problems as an incoming president," and that he was being asked to make a choice between the position of his budget director, who believed that the total NASA request should not be approved at that time, and the NASA position. Webb knew that Kennedy trusted Bell, and that he did not know Webb very well and thus was not able yet to evaluate his judgment. Kennedy probably realized that Johnson, on the basis of his Space Council role and past record as a supporter of a large space program, would support the NASA position.[21] Yet Kennedy himself did not have the background to make a final decision and

[17] *The New York Times*, January 12, 1961, p. 14.
[18] U.S., Congress, House, Committee on Science and Astronautics, *NASA Fiscal 1962 Authorization, Hearings*, 87th Cong., 1st sess., 1962, pp. 203, 620.
[19] *Missiles and Rockets*, April 3, 1961, p. 14.
[20] Privileged source.
[21]

further had to preserve his working relationships both with the BOB and with NASA.

Added to these factors, of course, were the immediate concerns over Laos, which made it impossible for Kennedy to take the time to study the issues thoroughly. All of these restraints on a definitive choice in space policy combined so that the president's action "was deliberately intended as a partial decision which would leave him free, within a considerable range, to decide later how much of a commitment to make."[22]

Kennedy's intention was to have the vice president, once he was officially designated chairman of the Space Council, use the council staff to conduct a study of "what should be done for the coming fiscal year 1963. Anything as large as a manned space program would need thorough study and that had not been done."[23] Most of those involved felt that the most likely time for Kennedy to decide on the manned flight projects would be during the development of the Fiscal 1963 budget in the fall of 1961.[24]

The NASA budget was transmitted to Congress on March 28; the increase of $126 million was part of a total increase of $3.2 billion in the nondefense portion of the federal budget. The *Washington Star* reported the next evening that "if the United States is to get a 'new look' in space, it will have to wait at least another year for the change to begin."[25]

Certainly very few people in Washington at the end of March 1961 expected the "new look" in the U.S. space program to come as soon as it did. But the events of April produced a time of crisis, a time in which a sense of urgency motivated space planners and government policy-makers to reexamine our national space goals and space programs. This reexamination resulted in a presidential decision to use the United States space program as an instrument of national strategy, rather than to view it primarily as a program of scientific research. This decision identified, for the world to see, a space achievement as a national goal symbolic of American determination to remain the leading power in the world. In so deciding, Kennedy reversed the Eisenhower space policy that had provided the guidance for space planning since 1957 and made a conscious decision to seek national prestige through spectacular space achievements and to compete with the Soviet Union in seeking such prestige. He decided that the national interest required the first men on the moon to be Americans.

GAGARIN FLIGHT SPURS SPACE POLICY CHANGES

As NASA officials began to appear before the House space committee to support their Fiscal 1962 budget request (as modified by the March

22 Interview with David Bell.
23 Interview with Edward Welsh.
24 House Space Committee, *Fiscal 1962 NASA Authorization*, p. 1036.

supplemental), external events were about to force a rapid reevaluation of national goals in space. The Soviet Union had orbited and recovered dogs in their "cosmic ships" on March 9 and March 25. That a Soviet manned flight was imminent was clear to informed observers. Kennedy was informed by his intelligence sources early in April that a Soviet manned flight attempt would come before April 15. On April 11, the president's press secretary, Pierre Salinger, began to draft a statement for the president to release once it was established that the Soviet flight had been successful. Before he went to bed on the evening of the 11th, Kennedy was told by Jerome Wiesner that the Soviet flight would probably occur during the night.[26]

Wiesner was correct. A dispatch from Moscow announced:

> The world's first space ship *Vostok* with a man on board, has been launched on April 12 in the Soviet Union on a round-the-earth orbit. The first space navigator is Soviet citizen pilot Maj. Yuri Alekseyevich Gagarin.[27]

Gagarin's flight, just short of a single orbit of the earth, lasted 89 minutes. The five-ton *Vostok* spacecraft was totally automatic; Gagarin was a passenger, not a pilot. His orbit carried him as much as 203 miles above the earth; he experienced weightlessness and reentry without impairing of his faculties.[28]

The Soviet Union was quick to capitalize on the propaganda significance of the Gagarin flight. In his first telephone conversation with Gagarin, Nikita Khrushchev boasted, "Let the capitalist countries catch up with our country!" The Central Committee of the Communist Party claimed that in this achievement "are embodied the genius of the Soviet people and the powerful force of socialism." East German leader Ulbricht said the flight "demonstrates to the whole world that socialism must triumph over the decaying system of yesterday." Soviet propaganda stressed three themes:

1. the Gagarin flight was evidence of the virtues of "victorious socialism";
2. the flight was evidence of the global superiority of the Soviet Union in all aspects of science and technology;
3. the Soviet Union, despite the ability to translate this superiority into powerful military weapons, wants world peace and general disarmament.

New York Times correspondent Harry Schwartz suggested that it appeared likely "that the Soviet leaders hope their space feat can further alter the atmosphere of international relations so as to create more pressure on Western governments to make concessions on the great world issues of the present day."[29]

26 Sidey, *Kennedy, President*, p. 111.
27 Loyd S. Swenson, Jr., James M. Grimwood, and Charles C. Alexander, *This New Ocean: A History of Project Mercury* (Washington, D.C.; National Aeronautics and Space Administration, 1966), p. 332.
28 *Ibid.*, pp. 333–334 and Holmes, *America on the Moon*, pp. 88–92.

INITIAL REACTIONS TO THE SOVIET FLIGHT The world was almost unanimous in its praise and admiration for the Soviet achievement. In Great Britain, "universal praise of the Soviet achievement from Cabinet ministers, diplomats, scientists, and the general public was accompanied by some anti-American barbs from men in the street." The French press "relegated all other news to a secondary position. . . . Even comments and reactions to President De Gaulle's news conference . . . were put into relative obscurity." In Italy, "news of the successful Russian space flight was heralded . . . in banner headlines. Romans snapped up the papers, empting kiosks in a matter of minutes, then stood around discussing the event." The Vatican newspaper called the flight "a universal good," and a Geneva paper termed the voyage "the number one event of the twentieth century."[30]

The American reaction to the Gagarin flight was disappointment and chagrin. No high official had prepared the general public to expect the Soviet flight, and thus for many it came as almost as much of a shock as the Sputnik I flight in 1957. The *Washington Post* commented editorially

The fact of the Soviet space feat must be faced for what it is, and it is a psychological victory of the first magnitude for the Soviet Union. . . . The general excitement from Europe to Asia, Africa and the Americas will not be diminished by the recognition that no immediate military, commercial or other actual advantage accrues to the Soviet Union. In these matters, what people believe is as important as the actual facts, and many persons will of course take this event as new evidence of Soviet superiority.[31]

The New York Times correspondent Schwartz commented that

The President, of course, had attempted to present himself as an image of a young, active, and vigorous leader of a strong and advancing nation. . . .

But none of Kennedy's . . . measures have had the effectiveness of the spectacular quality of Soviet efforts. Moreover, since he took office the President's image has been beset by the difficulties he has had with Congress, by his failure to spell out the promised "sacrifices" to be required of the American people and by the continued recession.[32]

The Times military correspondent Hanson Baldwin was even sharper in his criticism.

This same philosophy, which cost the nation heavily in prestige and marred the political and psychological image of our country abroad, hobbled our space program even before the Russians put the first sputnik into orbit. . . . It is high time to discard this policy. In fact, if the United States is to compete in space, we must decide to do so on a top-priority basis immediately, or we face a bleak future of more Soviet triumphs. . . .

. . . Even though the United States is still the strongest military power and leads in many aspects of the space race, the world—impressed by the spectacular Soviet firsts—believes we lag militarily and technologically.

The dangers of such false images to our military power and our diplomacy are obvious. The neutral nations may come to believe the wave of the future is Russian; even our friends and allies could slough away. The deterrent, which after all is only as strong as Premier Khrushchev thinks it is, could be weakened.

Baldwin concluded by pointing out that "only Presidential emphasis and direction will chart an American pathway to the stars."[33]

The most vocal demands for an immediate reaction to the Soviet flight came from the lower house of Congress. Hearings were conducted in an atmosphere of panic, almost hysteria, after the Gagarin flight.[34] On the morning of the Soviet feat, House space committee chairman Brooks said that "we ought to make a determination that we . . . are going to be first in the future, if we continue our space program." Republican James Fulton said that "we in the United States should publicly say we are in a competitive race with Russia and accept the challenge in science." Fulton was critical of the continuing justification of the space program on scientific grounds. "I would . . . work the scientists around the clock, and stop some of this WPA scientific business. . . ."[35] The next morning, Webb and Dryden appeared before the committee to testify on the impact of the Soviet manned flight. Fulton told them, "I believe we are in a race, and I have said many times, Mr. Webb, 'Tell me how much money you need and this committee will authorize all you need.' "[36] Congressman Anfuso of New York announced

To properly alert our people I am ready to call for a full-scale congressional investigation. I want to see our country mobilized to a wartime basis because we are at war. I want to see our schedules cut in half. I want to see what NASA says it is going to do in 10 years done in 5. I want to see some first coming out of NASA, such as the landing on the moon. . . .[37]

The next day, April 14, Robert Seamans appeared before the committee as it continued consideration of the NASA 1962 budget. After telling the committee that there were no plans at that time to ask for more money for Project Apollo, even though he believed that more funds for the project could be used, and that the total space effort was not proceeding as fast as it might,[38] the following exchange occurred.

Representative King: I would like to suggest that we are in a specific race with the Russians. Who will get to the Moon first? In our race for the exploration of space there are three major breakthroughs or dramatic successes. . . . The first satellite, the first man in space, and the first man to go to the Moon and back.

The score is two to nothing, favor the Russians. We still have the third prize to obtain. I think the third is probably worth more than the first two together. So we are still in the race. But I would like to know specifically, if the plans that we now have programmed . . . are such

30 *Ibid.*, p. 16.
31 *Washington Post*, April 13, 1961, p. A18.
32 *The New York Times*, April 16, 1961, Sec. IV, p. 8.
33 *Ibid.*, April 17, 1961, p. 5.
34 James R. Kerr, "Congressmen as Overseers, Surveillance of the Space Program" (unpublished Ph.D. dissertation, Stanford University, 1963), p. 402.
35 U.S., Congress, House, Committee on Science and Astronautics, *Hearing on H.R. 6169—A Bill to Amend the National Aeronautics and Space Act of 1958*, 87th Cong., 1st sess., 1961, p. 5.
36 U.S., Congress, House, Committee on Science and Astronautics, *Discussion of Soviet Man-in-Space Shot*, 87th Cong., 1st sess., 1961, p. 7. Hereafter cited as House Space Committee, *Discussion of Gagarin Flight*.
37 *Ibid.*, p. 13.

as will enable us to reach the Moon ahead of the Russians . . . . [Seamans replied that the target date for a lunar flight was 1969 or 1970.]

King: Do you think it would be conceivably possible . . . to meet this target date of . . . 1967?

Seamans: This is really a very major undertaking. To compress the program by 3 years means that greatly increased funding would be required. . . . I certainly cannot state that this is an impossible objective. It comes down to a matter of national policy. I would be the first to review it wholeheartedly and see what it would take to do the job. My estimate at this moment is that the goal may very well be achievable. . . .

Representative Chenowith: Do you agree we face a rather serious national decision here? I think it is not for this committee to make, but to be decided at a much higher level, whether or not it is in the best interests of this country . . . to achieve this lunar shot, say in 1967 or even before. It is a question of whether such an accomplishment has that much national and international significance and importance. . . .

Seamans: I think it is a decision to be made by the people of the United States . . . through the Congress and through the President.

Chenowith: I disagree. The people of this country do not have the technical knowledge on that subject that you have. . . . We can't expect them to make that decision!

Representative Miller: Is it not our responsibility as representatives of the people?[39]

Perhaps the mood of the House committee is even better shown by an exchange which occurred seven weeks later, after the acceleration of the space program had been announced. Representative Fulton asked Dryden whether the Soviets could not aim a rocket at the moon to cause "an explosion on the Moon's surface which would create a red dust and turn the whole moon red." Dryden replied that he had seen "many discussions of putting a red spot on the Moon." Fulton replied: "Maybe we should have a project, a blue project to scatter blue dust so then the Moon is red, white, and blue."[40]

The initial reaction to the Gagarin flight by both Kennedy and top NASA officials was cautious. Kennedy still did not know, in his own mind, what he wanted to do about future American manned space flight programs, and this meant that he could not promise a specific reaction in space to the Soviet success. On the day of the flight, Kennedy issued a statement congratulating the Soviets on their "outstanding technical accomplishment"; he sent a congratulatory telegram to Khrushchev which again stressed the theme that "it is my sincere desire that in the continuing quest for knowledge of outer space our nations can work together. . . ."[41]

In a press conference that afternoon, one questioner reminded Kennedy that a member of Congress had been quoted as being tired of seeing the United States second to Russia in space. Kennedy replied:

> However tired anybody may be—and no one is more tired than I am—it is a fact that it's going to take some time. And I think we have to recognize it. . . .
>
> . . . As I've said in the State of the Union message, the news will be worse before it is better, and it will be some time before we catch up. *We are, I hope, going to go in other areas where we can be first and which will bring more long-range benefits to mankind. But here we're behind.* [italics mine][42]

Kennedy's hope proved to be in vain. After two day's reflection, he reluctantly came to the conclusion that, if he wanted to enter the duel for prestige with the Soviets, he would have to do so with the Russians' own weapon, space achievement. He found that there was no other means available to counter the propaganda advantage that space success had given the Soviet Union, and he was unwilling to grant the Soviets that advantage on a continuing basis, believing that both the international and the domestic political penalties of doing so were unacceptable.

In a press conference on the day of Gagarin's flight, Webb and Dryden attempted to place the Soviet accomplishment in (U.S.) perspective. Webb stressed that "the total programs that we have as nations must enter into this whole question of prestige" and that the United States had "a solidly-based program." Webb said that "the solid, onward step by step pace of our program is what we are more interested in than being first."[43]

Dryden was asked what the impact of the Gagarin flight on the U.S. space program would be. He replied that "as you know, our programs are determined by the democratic process of this country in very many forums . . . . I cannot predict what the ultimate effect will be."[44]

The next morning, in his testimony before the House Space Committee, Webb continued to stress the same theme—that the United States and Soviet Union were not engaged in a "point-by-point" competition in space and that it was important "to evaluate what the Soviets have done as against the yields from our own program . . . ." Webb also left the door open for a different approach to the space program, saying that "the decision which we all have to face as a nation is whether we now expect to proceed as we did in connection with the atomic bomb, with a substantial number of efforts going on in parallel, with all of the resources that may be required to do this."[45]

These initial administration responses to the Soviet flight were interpreted as indicating that "more money for the space program was not likely to be the Administration's reaction" and that the flight did not "seem likely to have the impact on the United States space program that the first Soviet Sputnik did. . . ."[46] *The Wall Street Journal* reported that "top policy makers . . . are resisting the idea of U.S. space program speedups" and that "present plans do not call for any further increases in the $1.2 billion civilian space budget. . . ."[47] *The New*

39 *Ibid.*, pp. 375–378.
40 *Ibid.*, pp. 1059–1060.
41 Senate Space Committee, *Documents on International Aspects of Space,*

42 *The New York Times,* April 13, 1961, p. 18.
43 NASA Press Conference on Russian Space Shot, April 12, 1961, pp. 11, 7.
44 *Ibid.*, p. 3.
45 House Space Committee, *Discussion of Gagarin Flight,* pp. 1–5.
46 *The New York Times,* April 18, 1961, p. 1.

York Times said that the testimony of Webb and Dryden before the House space committee made it apparent "that the Kennedy Administration was not planning a radical change in the national space program."[48]

KENNEDY DECIDES TO ACCEPT SOVIET CHALLENGE Kennedy soon acted to dampen charges that his administration was continuing the Eisenhower policy in space. Kennedy scheduled a meeting in the Cabinet Room for the evening of April 14 "to explore with his principal advisers the significance of the Gagarin flight and the alternatives for U.S. action."[49] He also scheduled a not-for-attribution interview with *Time-Life* correspondent Hugh Sidey on the same evening. In preparation for the meeting, Ted Sorenson, David Bell, and Jerome Wiesner met with NASA officials Webb and Dryden in the White House Cabinet Room to discuss "the next steps in the space race."[50] Then the president joined the meeting, and the group briefed him on their discussions. Rather than then meeting with Sidey separately, Kennedy had Sorenson bring the reporter into the Cabinet Room, and again discussed the next steps in space. Sidey later reported details of the meeting.

"Now let's look at this," said Kennedy impatiently. "Is there any place we can catch them? What can we do? Can we go around the moon before them? Can we put a man on the moon before them? What about Nova and Rover? When will Saturn be ready? Can we leapfrog?"

The one hope, explained Dryden, lay in this country's launching a crash program similar to the Manhattan Project. But such an effort might cost $40 billion, and even so there was only an even chance of beating the Soviets.

James Webb spoke up. "We are doing everything we possibly can, Mr. President. And thanks to your leadership we are moving ahead now more rapidly than ever. . . ."

"The cost," he pondered. "That's what gets me." He turned to Budget Director Bell questioningly. The cost of space science went up in geometric progression, explained Bell. . . .

"Now is not the time to make mistakes," cautioned Wiesner. . . .

Kennedy turned back to the men around him. He thought for a second. Then he spoke. "When we know more, I can decide if it's worth it or not. If somebody can just tell me how to catch up. . . ."

Kennedy stopped again a moment and glanced from face to face. Then he said quietly, "There's nothing more important."[51]

Whether this second meeting was intended merely to give Sidey an image of a president seriously concerned about doing something in space or whether it was also a reflection of Kennedy's reaction to the national and international impact of the Gagarin flight is not totally clear. He *was* successful in the first aim; Sidey's story, indicating that the president was "gravely concerned" and that Kennedy realized "it was more urgent than ever to define U.S. space aims" appeared in the next issue of *Life*.[52]

48 *The New York Times*, April 14, 1961, p. 10.
49 David Bell, letter to author, February 2, 1968.
50 Theodore C. Sorenson, *Kennedy* (New York: Harper & Row, 1965), p. 590. Interviews with Theodore C. Sorenson, October 5, 1967, and David Bell.
51 Sidey, *Kennedy, President*, pp. 121–128. Sidey, in his Introduction, says that

Bell remembers that, with Sidey in the room, "the President talked, I thought quite freely, about some of the issues we had been discussing" before the reporter entered.[53] Webb's impression was that Kennedy appeared anxious to make an impression on Sidey about the fact that he was *au courant* and was having serious discussions, but that Kennedy did not intend to reach any substantive solutions at the time.[54]

Sidey also reported that, after the meeting,

alone with Sorenson, Kennedy thought about the curious dilemma further. The cost was frightening. Yet the threat was there, and Yuri Gagarin's name still lingered in the headlines to emphasize it. To Kennedy it was inconceivable that there was no way to accept the challenge and win this race if it was worth it and the country wanted to do it. "I'm determined to get an answer," he said.[55]

Sorenson says of the April 14 meeting that "the decision wasn't made then so much as the stage was set for the full-scale inquiry which would be necessary before a final and precise decision could be made" and that the "Gagarin flight and the reaction to it around the world and in this country and in the Congress demonstrated to the President the importance of going ahead with an all-out space effort and the willingness of the country and the Congress to back such an effort."

The president had both "affirmative and negative" reasons for his belief that such an all-out effort was required:

affirmative in the sense that the United States intended to maintain its position of world leadership, its position of eminence in commerce, in science, in foreign policy, and in whatever else might develop from space exploration. The United States had to take the lead in this area just as it had taken the lead in other areas. The negative side was that we did not want to have the Soviets dominating space to a point where, at some future time, it could be a military threat to our security or, in any event, cause the rest of the world to draw away from the United States.[56]

Of Kennedy's thinking at this time, Wiesner says,

The rest of the world had been led to believe by Soviet space accomplishments, and particularly by the U.S. reaction to them, that the scientifically most competent, the technologically most competent nation, now was the Soviet Union, not the United States, because they could do this. We were paying a price, all kinds of ways—internationally, politically—and that was the issue that the President was dealing with, not was it time to go to the moon or not, but how to get yourself out of this.[57]

After the April 14 White House meeting, discussions among Kennedy

use of the press to further his policies. Thinking that Hanson Baldwin's article of April 17 cited earlier may have been prompted by the same kind of background briefing, I wrote Baldwin. He replied, "there was not then, . . . any direct communication between President Kennedy and me about this or any other topic. . . . The Kennedys expected too much tailoring of writing to make any such relationship palatable to me. . . . I was not a writer admired by the administration, particularly later on, when other articles were heavily criticized and investigated by the FBI." Hanson Baldwin, letter to author, September 21, 1967.
53 Interview with David Bell.
54 Interviews with James Webb.
55 Sidey, *Kennedy, President*, p. 123.
56 Interview with Theodore Sorenson.

and his advisers continued. While Kennedy probably had already decided to make a vigorous response to the Soviet space challenge, and may have even decided that that response had to be in the form of a stepped-up U.S. space program, he had to learn whether such a response was politically feasible and to find out what effect it would have on other portions of his New Frontier program. In seeking answers to these questions, Kennedy talked to "hundreds of people."[58] He could find little assistance among his personal staff, since his White House advisers, with the exception of Ted Sorenson, were dubious about the wisdom of initiating a prestige-oriented space program. Wiesner's caution was based on his doubts about the scientific merit of such an undertaking; Bell's, on the wisdom of investing so much money in the space program rather than in other activities he thought rated higher priority.

Kennedy was a good enough politician to realize that both public and congressional support were necessary in order to allow him to implement the activist concept of the presidency he held. He knew that the mass reaction to the Gagarin flight provided an opportunity for him to identify himself with a new space program with wide public appeal. He was less sure of congressional reaction to a faster-paced space program. If he did accelerate the space activity, would this help or hinder the progress of his other programs in Congress? He had already found the task of getting programs approved on Capitol Hill frustrating. The young men on the White House staff, fresh from university campuses and Eastern law firms, seemed unable to operate in the tradition-filled, slow-paced congressional environment. Enthusiasm and rational rhetoric, it appeared, were less effective ways of getting votes than more traditional techniques of influencing the legislature. Kennedy knew that powerful congressmen, both in the Senate and in the House, had favored a larger space program in the past. His vice president, Lyndon Johnson, was still closely allied to the Senate power structure; by approving the large space program Johnson favored, perhaps Kennedy could enlist the support of Johnson and his Senate allies behind other New Frontier measures. Another Johnson ally, Sam Rayburn, was the Speaker of the House.

Kennedy himself checked with enough congressmen to realize that he would probably reap substantial political benefits by going forward in space. Among these was Texas congressman Albert Thomas, who was in charge of NASA appropriations. Thomas and fellow Texan Johnson were not close, and thus Kennedy could not count on Johnson to solicit Thomas' support. In addition to his direct control of space funds, Thomas was one of the most powerful men in the House.

Kennedy's most important reasons for wanting to formulate a response to Gagarin were linked to foreign policy, and especially to maintaining

[58] Jerome B. Wiesner, *Where Science and Politics Meet* (New York: McGraw-

the American position as the leading world power. These calculations were largely a product of Kennedy's own world view. But Kennedy's concerns as related to domestic as well as international politics were as strongly influenced by Johnson and Thomas as by any other two people. Once he felt he had to move ahead, he could proceed vigorously because he knew these men could maintain a base of support that would give him a chance to succeed. Further, each of these men had strong interests outside the space field and positions of great power in many areas that were important to the President. There may have been a feeling on the part of Kennedy that he could proceed with his total program with a much greater chance of success if he had these men with him, and the inclusion of the space program was an important part of his association with them in a multi-faceted fluxing kind of common enterprise—political leadership.[59]

For over three and a half years, since the night of Sputnik I, space had been Lyndon Johnson's issue. In the Senate he had consistently pressed for a more aggressive space program than President Eisenhower had been willing to approve. Now, as vice president, he was serving under a man who was unfamiliar with space policy, but who had concluded that the Americans needed a new, preeminent space program. None of those who came to the White House with John Kennedy knew much about space; what they did know was, in general, not congenial to Kennedy's desires. So Kennedy turned to Johnson to give him the answers he sought.

On April 19,[60] Kennedy called Johnson to his office and asked him what his recommendations for an accelerated space program would be. Johnson outlined his views to the president, and suggested that he, as chairman of the Space Council, "have hearings, lay a background and create a platform for a recommendation to Congress." Johnson asked Kennedy to give him a memorandum "that would provide a charter for those hearings" and would be an "outline of what concerned him."[61]

Kennedy agreed to Johnson's suggestion, and on April 20, the day on which the Congress approved the revised Space Act empowering Johnson to act as chairman of the Space Council, Kennedy acted. "More convinced than any of his advisers that a second-place space effort was inconsistent with this country's security, with its role as world leader and with the New Frontier Spirit of discovery,"[62] Kennedy wrote a historic memorandum to Johnson.

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

[59] James Webb, letter to author, May 28, 1969. (Copy in NASA Historical Archives.)

[60] Presidential appointments with Lyndon Johnson and James Webb, April 12–May 10, 1961. Assistant Archivist for Presidential Libraries Herman Kahn, letter to author, September 22, 1967. Cited hereafter as *Presidential Appointment Calendar*.

[61] Transcript of Cronkite interview with Lyndon Johnson, July 5, 1966

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 our 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. Wiesner, Secretary McNamara and other responsible officials to cooperate with you fully. I would appreciate a report on this at the earliest possible moment.[63]

Kennedy had earlier indicated his intention to have the vice president study the manned space flight program to prepare for a fiscal 1963 decision on Project Apollo. This memorandum expanded the scope of the assignment—Johnson was to make "an overall survey of where we stand in space"—and sounded a note of urgency. Kennedy wanted "a report on this at the earliest possible moment." Kennedy had already decided that some acceleration of the space program was necessary, but he was not sure how much acceleration was needed or in what direction changes should be made.[64] Bell says that "the President would not have made such a request unless he expected a positive answer and a strong program, and therefore he was pretty sure before he made that request that that was what he intended to do."[65]

In a press conference on April 21, Kennedy announced that

We are attempting to make a determination as to which program offers the best hope before we embark on it, because you may commit a relatively small sum of money now for a result in 1967, '68, or '69, which will cost you billions of dollars. . . . When that determination is made we will then make a recommendation to Congress.

In addition, we have to consider whether there is any program now, regardless of its cost, which offers us hope of being pioneers in a project [italics mine]. . . .

. . . Now, I don't want to start spending the kind of money that I'm talking about without making a determination based on careful scientific judgements as to whether a real success can be achieved, or whether because we're so far behind now . . . we're going to be second in this decade.

Kennedy also said, for the first (and last) time in public, *"If we can get to the moon before the Russians, then we should."* [italics mine][66]

Critics of the lunar landing decision have suggested that Kennedy should have, and could have, chosen some other response to the challenge symbolized by the Soviet space success. Kennedy, before deciding to compete with the Soviets in space, *did* consider other possible responses. Wiesner recalls that

We talked a lot about do we *have* to do this. He said to me, "Well, it's your fault. If you had a scientific spectacular on this earth that would be more useful—say desalting the ocean—or something that is just as dramatic and convincing as space, then we would do it." We talked about a lot of things where we could make a dramatic demonstration—like nation building—and the answer was that there were so many military overtones as well as other things to the space program that you couldn't make another choice.

If Kennedy could have opted out of a big space program without hurting the country in his judgment, he would have. Maybe a different kind of man could have said to the country, "Look, we are going at our own pace. We are going to let the Russians be first. We don't care." But Kennedy said, "If we could afford to do something else, we would do it. If we can't we had better get back where we belong." I think he became convinced that space was the symbol of the twentieth century. It was a decision he made cold bloodedly. He thought it was right for the country.[67]

IMPACT OF BAY OF PIGS ON KENNEDY'S ATTITUDE One other series of events which occurred at this time has not yet been mentioned—the abortive Bay of Pigs invasion in which a group of Cuban exiles, trained and financed by the CIA, attempted to invade Cuba and overthrow the Castro government. Air strikes at Castro's planes began on April 15; the invasion force went ashore on April 17. On the night of April 18 and in the early morning of April 19 Kennedy met with his advisers and decided not to make an open commitment of American military power in support of the rapidly collapsing invasion. By April 19 the invasion was a total failure, and Kennedy could only give orders to rescue as many of the invasion force as possible.[68] To Pierre Salinger, Kennedy's press secretary, "the three days it took Castro to crush the rebels were the grimmest I can remember at the White House."[69] Sorenson describes the Bay of Pigs interval as one of "somber stock-taking"; he describes Kennedy on the morning of April 20 as "a depressed and lonely man," who knew that "he had handed his critics a stick with which they would forever beat him; that his quick strides toward gaining the confidence of other nations had been set back; that Castro's shouting boasts would dangerously increase the cold war frustrations of the American people. . . ."[70]

How much Kennedy's state of mind resulting from the Cuban fiasco influenced or reinforced his resolve to proceed rapidly in space is not completely clear. The Bay of Pigs was never *explicitly* linked to the acceleration of the space program in any of the meetings on space held at this time; Edward Welsh maintains that the invasion was, in his judgment "not a factor at all."[71] But Wiesner says of the Bay of Pigs, "I don't think anyone can measure it, but I'm sure it had an impact. I think the President felt some pressure to get something else in the foreground." He adds that, though the Bay of Pigs was never explicitly

63 Memorandum from John F. Kennedy to Lyndon B. Johnson, April 20, 1961. (Copy in NASA Historical Archives.)
64 Interview with Edward Welsh.
65 Interview with David Bell.
66 Senate Space Committee, *Documents on International Aspects of Space,*

67 Interview with Jerome Wiesner.
68 See Sorenson, *Kennedy,* pp. 326–346, and Schlesinger, *Thousand Days,* pp. 267–297, for history of Bay of Pigs.
69 Pierre Salinger, *With Kennedy* (Garden City, N.Y.: Doubleday & Company, 1966), p. 147.
70 Sorenson, *Kennedy,* pp. 344–346.

linked to space, "I discussed it with the President and saw his reactions. I'm sure it wasn't his primary motivation. I think the Bay of Pigs put him in a mood to run harder than he might have."[72] Sorenson says that Kennedy's attitude was influenced by

the fact that the Soviets had gained tremendous world-wide prestige from the Gagarin flight at the same time we had suffered a loss of prestige from the Bay of Pigs. It pointed up the fact that the prestige was a real, and not simply a public relations, factor in world affairs.[73]

McGeorge Bundy adds that "it is quite possible that, if the Bay of Pigs had been a resounding success, the President might have dawdled a little longer on the space decision."[74]

Schlesinger writes that in the wake of the Bay of Pigs, the president's "first problem was to contain the political consequences of the debacle" and "to divert the demand of action against Castro into a general strengthening of American purpose."[75] Perhaps it is in this context that the influence of the Bay of Pigs on Kennedy's space decision can best be evaluated. "Certainly it would not be surprising if his advisers thought that in such circumstances he might be especially likely to respond to proposals of a bold and dramatic sort, with considerable political appeal . . . ."[76]

The fiasco of the Bay of Pigs reinforced Kennedy's determination, already strong, to approve a program aimed at placing the United States ahead of the Soviet Union in the competition for firsts in space. It was one of the many pressures that converged on the president at the time, and thus its exact influence cannot be isolated. As president, Kennedy could treat few issues in isolation anyway, and there seems to be little doubt that the Bay of Pigs was in the front of his mind as he called Lyndon Johnson to his office on April 19 and asked him to find a "space program which promises dramatic results in which we could win."

LUNAR LANDING PLANS PREPARED

JOHNSON USES SPACE COUNCIL TO REVIEW PROGRAM Lyndon Johnson and Space Council Executive Secretary Edward Welsh immediately set to work organizing the hearings necessary to answer the questions Kennedy had asked. At this time, Welsh was the only staff member of the Council. The consultations were conducted under Space Council auspices, but they also reflected the "Johnson system"[77] of obtaining information through personal contacts rather than formal organizational channels. Johnson tried to make contact with all those whom he thought would contribute significantly to his examination of the space program.

72 Interview with Jerome Wiesner.
73 Interview with Theodore Sorenson.
74 Interview with McGeorge Bundy, October 4, 1967.
75 Schlesinger, *Thousand Days*, p. 287.
76 Vernon Van Dkye, *Pride and Power: The Rationale of the Space Program* (Urbana, Ill.: University of Illinois Press, 1964), p. 166.
77 See Rowland Evans and Robert Novak, *Lyndon B. Johnson: The Exercise of Power* (New York: New American Library, 1966), pp. 88–118, for a dis-

During the days following April 20, Johnson met with officials from NASA, the Defense Department, the Atomic Energy Commission, and Wiesner's office. At the suggestion of Welsh, a Bureau of the Budget representative attended most of the meetings so that the bureau would remain informed of the financial implications of the plans under consideration.[78]

The first meeting between Johnson and NASA took place on April 22. Based on internal NASA plans developed by Abe Hyatt, Director of Program Planning and Evaluation, from inputs from NASA program offices and research centers, and from the three industrial contractors conducting feasibility studies of Project Apollo, NASA officials briefed the vice president on various possible programs.

They told Johnson that "there is no chance of beating the Soviets in putting a multi-manned laboratory in space," and that "with a determined effort . . . , there is a chance to beat the Russians in accomplishing a manned circumnavigation of the moon." With regard to a manned lunar flight, the NASA position was that:

There is a chance for the U.S. to be the first to land a man on the moon and return him to earth if a determined national effort is made. . . . It is doubtful that the Russians have a very great head start on the U.S. in the effort required for a manned lunar landing. Because of the distinct superiority of U.S. industrial capacity, engineering, and scientific know-how, we believe that with the necessary national effort, the U.S. may be able to overcome the lead that the Russians might have up to now. A possible target date for the earliest attempt for a manned lunar landing is 1967, with an accelerated U.S. effort.

NASA also suggested that a sample of material from the lunar surface could be returned to earth by an unmanned spacecraft by 1964, and that U.S. superiority in communications and meteorological satellites should be used to enhance American prestige.

At the time of the meeting, NASA estimated that the cost of its ten-year program, through fiscal 1970, would be $22.3 billion. But "for an accelerated national program aiming toward achieving manned lunar landing in the 1967 period, it is estimated that the cost over the same ten-year period will be $33.7 billion. . . ." Thus the extra costs of accelerating the program, due mainly to achieving the manned lunar landing then scheduled for 1970 by 1967, would be $11.4 billion. NASA's budget under the accelerated program would peak at $4.7 billion in fiscal years 1965 and 1966.

NASA believed that "in order to provide the necessary assurance that we will have a large launch vehicle for the lunar mission, we must have a parallel development of both a solid and liquid fueled large launch vehicle."[79]

Johnson met separately with Secretary of Defense McNamara, Deputy

78 Holmes, *America on the Moon*, p. 199.
79 Memorandum from NASA to the vice president, April 22, 1968. (Copy in NASA Historical Archives.) This memorandum was prepared to answer the five questions posed by Kennedy in his April 20 memorandum to the vice

Director of Defense Research and Engineering John Rubel, and other DOD representatives. Earlier in the year, McNamara had asked his technical staff to prepare a comprehensive report on all U.S. space programs and to compare them with the Soviet program in space. This review was originally to be completed in June, but after the Gagarin flight McNamara ordered it accelerated. The Air Force was also asked to submit proposals for a space program to meet national defense requirements.[80]

On April 24, Johnson chaired a large meeting called to discuss alternative plans available for consideration. Johnson invited three prominent businessmen who were also close personal friends to this meeting. George Brown, of the Houston construction firm of Brown and Root, Frank Stanton, President of the Columbia Broadcasting System, and Donald Cook, executive vice-president of the American Electric Power Corporation in New York, were individuals who would have, thought Johnson, "a keen sense of public reaction" to the plans under discussion.[81] Cook believes that "the purpose of the meetings was to form judgments as to the direction in which the space program should go."[82] Also at the meeting were Webb, Dryden, Rubel, Wiesner, and Kenneth Hansen of the Bureau of the Budget.

Johnson asked three men who had been intimately involved in military space research and development since the beginning of the space age to present their personal views on acceleration of the space program to the meeting. These men were Wernher Von Braun, now Director of NASA's Marshall Space Flight Center[83]; General Bernard Schriever, Commander of the Air Force Systems Command established in the wake of McNamara's March directive assigning DOD space programs to the Air Force; and Vice Admiral John T. Hayward, Deputy Chief of Naval Operations for research and development. Johnson had sent each of them (directly, not through administrative channels) copies of Kennedy's April 20 memorandum and asked them to prepare replies.

Schriever urged that a program aimed at a manned lunar landing should be adopted, primarily because

> it would put a focus on our space program. If we had this sort of an objective, there were so many other things that would be required that you couldn't avoid having a major space program. I felt that we needed a major national space program for prestige purposes, for those things we could see as having national security implications and because of the need for advancing technology.

80 Interview with John Rubel, August 27, 1968.
81 Interview with Edward Welsh.
82 Interview with Donald Cook, October 5, 1967. Stanton says that his participation in the consultations was "minimal" (letter to author, August 18, 1967), and George Brown, when asked by members of the NASA Historical Staff for his recollections of the consultations, said that he did not remember them at all.
83 Apparently Von Braun was asked to participate in this meeting, not primarily because of his connection with NASA but because of his former position as the Army's leading space expert. Thus the panel represented all three

Schriever argued that the nation could well afford such a program, especially since expenditures for ICBM's would be slacking off about the same time as the space budget would be increasing. Schriever indicated that Air Force studies of the lunar mission favored using solid-fuel boosters and an earth-orbital rendezvous flight plan. His recommendations did not include a suggestion that the Air Force manage the program. "That never came up. At that point, there was no argument who was going to run the program."[84]

Hayward told the meeting that he also supported a large-scale U.S. space program with a lunar landing mission as a central goal. Hayward felt that, from a national point of view, only the lunar mission made sense as a means of accelerating the space program. The Navy was concerned, Hayward said, that practical applications of space technology which were aids to naval operations, such as the use of satellites for navigation, reconnaissance, communications, and weather prediction, not be neglected in any acceleration of the program. Hayward stressed the need for an integrated, orderly space program rather than emphasis on one project at the cost of neglecting others.[85]

Von Braun summarized his views, which he characterized as "strictly my own" and not necessarily reflecting NASA's official position, in a memorandum to the vice president on April 29. Von Braun told Johnson that "we have a sporting chance of sending a 3-man crew *around the moon* ahead of the Soviets" and "an excellent chance of beating the Soviets to the *first landing of a crew on the moon* (including return capability, of course)." This was because "a performance jump by a factor 10 over their present rockets is necessary to accomplish this feat" and "therefore, we would not have to enter the race toward this obvious next goal in space exploration against hopeless odds favoring the Soviets." Von Braun believed that, "with an all-out crash program," the United States could achieve a lunar landing by 1967 or 1968.

Von Braun advised that "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. . . .
> —put all other elements of our national space program on the "back burner."[86]

Kennedy, in his April 21 press conference, had indicated that he expected the vice presidential review to seek answers to two general questions. One was the proper level of national resources to be devoted

84 Interview with Bernard Schriever, November 3, 1967. Note that the Air Force in 1958 had proposed essentially the same idea that was now under discussion—establishing a lunar landing as the central feature of the space program in order to give focus and global impact to the program. See Chapter 2 for details.
85 Interview with Vice Admiral John T. Hayward, September 11, 1967.
86 Memorandum from Wernher Von Braun to

to the total space program; the other was whether there was "any program now, regardless of its cost," which would give the United States a chance to beat the Soviet Union to a spectacular space first, and at least deny the Soviets an unchallenged monopoly of space initiatives. Almost everyone to whom Johnson spoke at this time agreed that the country should build up an active and vigorous space program, funded at a significantly higher level than under the Eisenhower administration. There was little question, they agreed, that such a program would have considerable political, strategic, and economic payoffs for the nation.[87]

Donald Cook, a few weeks later, summarized his views in a letter to the vice president.

> Action in this field must, I believe, be based on the fundamental premise that achievements in space are equated by other nations of the world with technical proficiency and industrial strength. This proficiency and strength, is, in turn, equated with World power. And the conclusion reached by other countries on the question of our position in the world in terms of power is and will be of fundamental importance in their determination as to which group, the West or the East, they will cast their lot. . . .[88]
>
> On this premise, the goal that we must seek is the achievement of leadership in space—leadership which is both clear-cut and acknowledged. Our objective must be, therefore, not merely to overtake, but substantially to outdistance Russia. Any program with a lesser basic objective would be a second-rate program, worthy only of a second class power. And, most important, a lesser program would raise serious questions among other countries as to whether, as a nation, we had the will and the discipline necessary for leadership in the struggle to preserve a free society.[89]

The meetings produced agreement that there were several aspects of the space program, especially with regard to practical satellite applications such as communications, navigation, and meteorology, in which the United States would be able to achieve significant "firsts," and that work in these areas should be speeded up. There was also some feeling that the United States was ahead in the use of nuclear power for space propulsion, and that this was an area worth pursuing with increased vigor.

Welsh recalls that "running through the discussions was the theme, could we go to the moon, should we if we could, how much would it cost, what else did we need to do if we decided to go."[90] As the answers to these questions were sought, it became clear that the selection of a manned lunar landing mission as the principal feature of an accelerated space program would provide an answer to many of the other objectives most of those Johnson consulted thought desirable. In

[87] Interview with Edward Welsh.

[88] Note that the world image on which this argument is based, and indeed the image which seems to have pervaded all discussions of the space program at this time, was that of a bipolar world with East-West competition as its principal feature.

[89] Donald Cook, letter to the vice president, May 10, 1961. (Copy in Mr. Cook's files; provided by him to author.)

order to be able to send men to the moon, all the scientific and engineering capacity of the space program would have to be used to its utmost. Thus the lunar landing goal would provide the focus and rationale for an aggressive space program needed to maintain American technological superiority. The gap between the United States and the U.S.S.R. in space was primarily owing to the difference in booster lifting capacity; landing men on the moon would necessitate the development of much larger boosters than the Saturn C-2 that Kennedy had approved in March. The Space Science Board, in its position paper on manned flight, had agreed that, from a scientific viewpoint, exploring the moon was worthwhile. The internal NASA studies of a lunar landing, the three contractor feasibility studies for Project Apollo, and the PSAC study of a moon flight the previous December agreed that there were no technological breakthroughs required to accomplish the mission and that a well-organized, sufficiently funded, and integrated effort to solve the difficult technological problems involved would have a high probability of success.

Most important, the lunar landing was the first space spectacular which the United States had at least an even chance to accomplish before the Soviet Union. Most Soviet space flights at that time, including the Gagarin flight, had been launched using the same booster that had launched the early Sputniks. This booster had a capability of lifting some 10,000–14,000 pounds to low earth orbit, compared with the approximately 4,000-pound capability of the Atlas missile being used in Project Mercury. American estimates of Soviet booster development plans were that the next generation Soviet booster would not have the weight-lifting capability necessary for a manned flight to the moon. Thus the United States would not be initiating its lunar program with a significant booster disadvantage. Even though the Soviets might have a slight advantage because of their experience with large boosters, both nations would have to build a new rocket for a lunar project. By choosing a goal at least six years in the future and then by proceeding with its booster program at as rapid rate as possible, the United States would have a good chance of having its lunar booster ready before the Soviets did. Meanwhile, work on the other portions of the system could be scheduled so that flights could begin as soon as the booster became available.

Johnson kept Kennedy informed of the progress of the discussions. The president was primarily involved in the aftermath of the Bay of Pigs, but he signed the revisions to the Space Act on April 25 in a public ceremony, saying that "working with the Vice President, I intend that America's space effort shall provide the leadership, resources and determination necessary to step up our efforts and prevail on the newest of man's physical frontiers."[91] Johnson met with the president at least twice on April 24, on April 25 after the bill-signing ceremony,

on May 1, on May 2, and on May 5. In addition, Johnson was present at six National Security Council meetings between April 22 and May 5.[92]

On April 29 Johnson gave Kennedy a memorandum of five and a half pages which provided brief answers to the five questions the president had asked in his April 20 memorandum, summarizing the consultations to date and presenting a set of the recommendations which probably would result from them.[93] Among these recommendations were the setting of a manned lunar landing as a major objective of the space program and the acceleration of all areas of booster development—liquid and solid fuel and nuclear propulsion.[94]

At no time during these consultations was PSAC as a body asked for its opinion on the choice of the lunar landing as a central feature of an accelerated space program. Wiesner and some of his staff attended several of the meetings Johnson called but they did not contribute significantly to the discussion. Wiesner recalls that this was "a political, not a technical issue. It was not an issue of scientific versus nonscientific issues; it was a use of technological means for political ends. It was on these considerations that I did not involve PSAC." Wiesner did tell the president that PSAC "would never accept this kind of expenditure on scientific grounds" and recalls that the president understood this and very infrequently justified the program on scientific grounds.[95]

There was some interaction between the White House science adviser's office and NASA at this time. Throughout his consultations, Johnson had

[92] *Presidential Appointment Calendar*. Welsh says that, during these National Security Council meetings, "no major attention was given to the space program," but "this does not mean that there was no discussion of the subject. . . ." Letter to author, October 2, 1967.

[93] Secretary of State Rusk, who was a member of the Space Council, apparently did not become actively involved in Johnson's consultations. Johnson recalls that Rusk did agree to the contents of this memorandum, but Rusk did not attend any of the vice president's meetings. Robert Packard, chief outer space official in the Department of State, has suggested to me in several conversations that Johnson did consult Rusk by telephone to see if the secretary foresaw any negative foreign policy effects from a large space program and if he agreed that a program aimed at capturing leadership in space for the United States was politically desirable. Rusk apparently foresaw only positive effects. In a later letter to the Senate Space Committee, Rusk wrote that "under the conditions existing in the world today, achievements in outer space have to assume a special significance in the assessments made by other countries of the strength, vitality, and effectiveness of the United States and the free way of life we represent. These assessments can have a direct bearing on the political attitudes and conduct of the countries making them. We must respond to these conditions; otherwise we risk a basic misunderstanding on the part of the uncommitted countries, the Soviet Union, and possibly our allies concerning the direction in which power is moving and where long-term advantage lies."
Rusk's letter is printed in U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *NASA Authorization for Fiscal Year 1962*, 87th Cong., 1st sess., 1961, p. 257.

[94] Interview with Edward Welsh. I have not been able to obtain this memorandum, which will eventually be available in the Lyndon B. Johnson Presidential Library in Austin, Texas.

[95] Interview with Jerome Wiesner.

been pressing NASA to recommend specific and very ambitious programs, although he himself did not say what programs he favored. Webb realized that the program the vice president seemed to want went far beyond anything that NASA had ever proposed to the administration; in the NASA March submittal, neither funds for a spacecraft to take men to the moon's surface nor funds for the booster necessary to launch that spacecraft had been requested. Webb was reluctant to commit himself to a particular scheme until he was convinced that it was technologically sound, that NASA had the capability to execute it, and that the scheme "did not go beyond what I thought Kennedy was willing to approve."[96] Apparently Hugh Dryden took a more aggressive position, arguing for the lunar landing program as a means of accelerating key portions of the NASA program. Dryden had announced as long ago as January 1958, two months after the first Sputnik, that the goal of the American space program "should be the development of manned satellites and the travel of man to the moon and nearby planets."[97] Now Dryden, like Lyndon Johnson, sensed that approval of the kind of space program he had always thought needed was possible, and he was excited by the prospect.

Webb wanted to ensure that whatever program was ultimately recommended to the president was technologically valid. He did not want it to be only a response to the president's request for a way of performing spectacular space achievements before the Soviets could accomplish them and a product of the vice president's desire for a full-blast effort in space. Webb made sure that Wiesner knew of this attempt. He wrote Wiesner on May 2, noting that "the most careful consideration must be given to the scientific and technological components of the total program and how to present the picture to the world and to our own nation of a program that has real value and validity and from which solid additions to knowledge can be made, even if every one of the specific so-called 'spectacular' flights or events are done after they have been accomplished by the Russians." To this end, Webb told Wiesner that "it seems to me that one of the most important contributions that you and I can make together is to try to find a way to make sure that this component of solid, and yet imaginative total scientific and technological value is built in."[98] By acting to emphasize his concern with the underlying validity of the program, Webb hoped both to maintain his good working relationships with the president's science adviser and through him the scientific community and to influence the program recommendations so that he could later defend the program against charges that it was aimed only at prestige and was fundamentally distorted and unsound.

[96] Interviews with James Webb.

[97] Hugh Dryden, "Space Technology and the NACA," speech to the Institute of Aeronautical Sciences, January 27, 1958.

[98] James Webb, letter to Jerome Wiesner, May 2, 1961. (Copy in NASA Hi-

A second large meeting was held on May 3, with Webb, Dryden, Welsh, Brown, Cook, Stanton, and the vice president joined by Senators Robert Kerr, chairman of the Senate space committee, and the senior Republican on the committee, Styles Bridges. Members of the Senate committee staff also were present. No representative of the House space committee was present although Overton Brooks had been invited.

Earlier meetings had discussed the technical feasibility of an accelerated space program; this meeting was intended to make sure it was politically feasible. Kennedy's charge to Johnson had placed both these responsibilities on the vice president. Johnson, as a man who had made his reputation in the Senate, tended to identify congressional support with assurance that the Senate was in favor of a program. The two senators he called to the meeting were there not only because of their official roles on the space committee. Kerr and Bridges were formidable Senate powers and intimate associates of Johnson; the vice president believed that their support would be enough to ensure Senate approval of a vastly expanded space budget.

Kerr and Bridges thought that the Senate would give bipartisan support to any proposal which aimed at establishing U.S. superiority in space. Both senators were particularly interested in being sure that work on building large boosters was stepped up. Bridges had always supported the space program because of its potential military significance, and he believed the United States should have large enough boosters to launch any military space system that might become feasible. Kerr's motivations in supporting a speedup in space are not as clear, although he made sure that some of the installations needed as a result of the program acceleration were located in Oklahoma.

The meeting lasted over two hours. Webb was still not convinced that NASA and the United States were ready to take steps of the dimensions the developing consensus seemed to indicate. Johnson was pushing NASA, saying that if the United States was capable of beating the Soviet Union to the moon, then NASA officials should advocate a lunar landing program. Webb continued to insist that he wanted to be sure NASA had sufficient support and really was sure of what it was recommending. On May 2 NASA had established an internal study team to examine on an urgent basis and in detail the requirements for a program aimed at a 1967 manned lunar landing. This group, headed by William Fleming, was told to draw on all resources of NASA in accomplishing their task. Webb apparently would have liked to have waited for the conclusions of this study before making specific NASA recommendations to the vice president, but by the May 3 meeting, Johnson was "close to demanding"[99] that NASA come forward with definite programs.

Johnson completed his canvas of congressional support for an accelerated program the next day by telephoning Overton Brooks and James

[99] Interviews with James Webb

Fulton to learn whether the House would agree to a stepup in space. Fulton told Johnson, after checking with some other House Republicans, that he thought Republican support for the program would be almost unanimous.[100] Brooks responded to the vice president's call by submitting a ten-page memorandum of recommendations for the space program. Brooks said that he and his committee believed that "the United States must do *whatever is necessary to gain unequivocal leadership in Space Exploration.*" Brooks recommended an immediate acceleration of programs for communications, television, weather, and navigation satellites. He also suggested an orbiting astronomical observatory aimed at discovering "the origin, evolution and nature of the universe."

Brooks said that his committee also was "committed to a forceful and stepped-up long-range endeavor." He said that "we cannot concede the Moon to the Soviets, for it is conceivable that the nation which controls the Moon may well control the Earth." Brooks pointed out that the nation could well afford a larger space program, since the Soviets were devoting two percent of their GNP to space and "a $5 billion a year space program represents only about 1% of our gross national product, even half of which offers returns crucial to the leadership, the prestige, and perhaps even the survival of the United States."[101]

On May 4 Johnson learned that he would be out of Washington for two weeks on a tour of Southeast Asia. On May 5, the same day as the first American manned flight, Johnson ordered the agencies concerned with formulating plans for an accelerated space program to work out a set of formal and detailed joint recommendations for the vice president to consider and submit to the president if he concurred in them. Johnson wanted the recommendations by Monday, May 8, since he would be leaving Washington the next day. Johnson's abrupt order shortened by several weeks the time that NASA and DOD had anticipated they would have to prepare their recommendations.

FIRST MERCURY MANNED FLIGHT SUCCESSFUL One final event helped ensure that an accelerated space program would be accepted by the president and the country. On May 5, Astronaut Alan Shepard made the first American space flight, a fifteen-minute suborbital journey in the *Freedom 7* Mercury capsule. Soon after Shepard came aboard the aircraft carrier *Lake Champlain* after being recovered from the Atlantic, and much to the surprise of NASA officials and the Navy communications people (who had had difficulty making the connection), the astronaut received a congratulatory telephone call from President Kennedy.

The successful Shepard flight was the climax of a long period of difficulties for Project Mercury. Even after the Hornig panel had reported

[100] Telephone interview with Representative James Fulton, September 20, 1967.

[101] Overton Brooks, memorandum to Lyndon Johnson, "Recommendations re the National Space Program," May 4, 1961 (Copy in

to the White House that the first Mercury flight would not be unduly risky, doubts persisted about the probable success of the first manned flight. The Bay of Pigs fiasco made the risk of another spectacular public failure in a U.S. undertaking especially undesirable. When over 500 representatives of news media showed up at Cape Canaveral to report the first manned flight, fears of a failure before a worldwide audience soared in some Washington circles. Senators John Williams and William Fulbright urged Kennedy either to postpone the flight or to close it to the press.[102] Some of the president's advisers agreed, apparently including McGeorge Bundy, and advised Kennedy to delay the shot. Wiesner remembers that he, Ted Sorenson, and Robert Kennedy discussed whether it was worse to postpone the flight after the press buildup had reached such a peak or to go ahead with the flight and run risks of failure.[103] Lyndon Johnson, Robert Kerr, and Edward Welsh urged the president to trust the judgment of NASA that the flight was ready. Welsh told the president, "Why postpone a success?"[104]

On May 1, the day before the flight was scheduled, Webb and Pierre Salinger met with the president. Webb assured the president that, in the judgment of Project Mercury management, all precautions had been taken and the flight should go as scheduled. Kennedy called NASA information officer Paul Haney at the Cape to review plans for live television of the flight and the reliability of the launch escape system in the event of a booster malfunction. Salinger handled the call for the president and felt that Haney's replies would satisfy the president's inquiry.[105]

Webb also issued a statement attempting to place the Mercury flight in perspective. He said

> I think the press and public should be aware that . . . a free press frequently places a serious psychological burden on the United States all over the world. If any one flight is delayed or is not a success, every detail is completely reported and is contrasted to the Soviet space effort, the events of which do not become a matter of public record until a success is achieved. . . .
>
> Our first manned space flight is an important milestone in the program of our space effort, but we must keep the perspective that each flight is but one of many milestones we must pass. Some will completely succeed in every respect, some partially, and some will fail.[106]

Because of poor weather, the flight was postponed on May 2 and again on May 4. Finally, on May 5, Shepard was launched on what he described as a "pleasant ride." A wave of national relief and pride over an American success after the black news of April swept the country, from the White House down to the man in the street. Kennedy's shore-to-ship telephone call "was spontaneous and symbolic of the American mood that day."[107] If the Shepard flight had been a spectacular failure,

102 *Missiles and Rockets,* May 8, 1961, p. 11.
103 Interview with Jerome Wiesner.
104 Swenson, Grimwood, and Alexander, *This New Ocean,* p. 350. See also *The New York Times,* May 10, 1961, p. 23.
105 Swenson, Grimwood, and Alexander, *This New Ocean,* p. 350.
106 Statement of James Webb, May 1, 1961 (NASA Press Release).

it is unlikely that Kennedy would have, or could have, endorsed the lunar landing program; the unqualified success of the flight, both in technical and political terms, swept away any of Kennedy's lingering doubts with regard to the role of the man in space flight. In his statement on Shepard's flight, Kennedy said that "today's flight should provide incentive to everyone in our nation concerned with this program to redouble their efforts in this vital field."[108] At an afternoon press conference, Kennedy announced that he was going to accelerate the space program and that he planned to undertake "a substantially larger effort in space."[109]

FINAL RECOMMENDATIONS READIED On Saturday morning after Shepard's flight, a group met at the Pentagon to assemble a final set of recommendations for the vice president to submit to the president. Present were James Webb, Hugh Dryden, Robert Seamans, and Abe Silverstein from NASA, Secretary of Defense McNamara, Deputy Secretary Gilpatric, newly-appointed Director of Defense Research and Engineering Harold Brown, Deputy Director John Rubel, and Willis Shapley of the Bureau of the Budget. Glenn Seaborg of the AEC was present for a portion of the day. By the time the group met, it was clear that the lunar landing mission would be a central feature of whatever recommendations were adopted. Four days earlier, Seamans had established within NASA an *Ad Hoc* Task Group for a Manned Lunar Landing Study headed by William Fleming, but the group's report would not be available until early June. Thus the weekend discussions were based on earlier NASA and DOD studies of a lunar landing program.

Lyndon Johnson had arranged his consultations during the preceding two weeks so that NASA and DOD had never met jointly. Thus neither agency had a detailed idea of what the other had been doing in response to the April 20 Kennedy memorandum.[110] The morning was spent in briefings of the plans developed by the two agencies. NASA claimed that the program which would be a measure of space competence and would give the best chance of beating the U.S.S.R. to a space first was the lunar landing; NASA studies showed that the first landing could be accomplished by 1967, without a crash program of multiple shifts and long work weeks, if sufficient booster funding were provided. Lunch was brought in, and the group continued its discussion until late afternoon. Three categories of programs were considered: near-earth undertakings like communications and meteorological satellites; manned lunar flights; and manned planetary flights. Most of the group agreed that the lunar landing was a good choice, and that the goal of a lunar landing should be publicized in some dramatic fashion, both in order to have the world impact desired and to provide a clear focus for

108 Senate Space Committee, *Documents on International Aspects of Space,* p. 200.
109 *The New York Times,* May 6, 1961, p. 12.

the space program as a whole. Department of Defense participants even speculated whether the lunar landing was a large enough step to guarantee beating the Soviets to its achievement, and asked the group whether the manned planetary mission should be considered; by the close of the meeting, there was consensus that the lunar program would be sufficient to achieve the desired purpose.[111] The group agreed that the United States "had to face the fact that national prestige as measured by other nations was a factor in national undertakings" and that large space projects "reflect the capacity and the will of the nation to harness its technological, economic, and managerial resources for a common goal." For this reason, they postulated, "a successful space program validates your claim to other capacities."[112]

In choosing the lunar landing mission as the central feature of its recommended program, the group had no firm intelligence regarding whether the Soviet Union was already embarked on a similar program.[113] Much in the same way as national defense programs are formulated, the group evaluated Soviet capabilities, not intentions, and decided the United States could probably beat the U.S.S.R. to the moon.

The Space Council discussions had agreed that all methods of rocket propulsion should be pursued, and the Pentagon group concurred. Specifically, the decision to choose either a liquid-fuel or a solid-fuel booster for the lunar mission was postponed for several years; work on both forms of boosters was to proceed concurrently until one was chosen for the lunar flight. NASA's planning had been based on the use of liquid-fuel rockets; this was understandable because Von Braun, NASA's primary booster engineer, had always worked with liquid fuels. The Air Force and Navy both were experienced in the solid-fuel techniques used in the Minuteman and Polaris missiles. The group agreed that NASA would continue to develop a liquid-fuel booster with some 12 million pounds of thrust, and that the Department of Defense would begin work on a 260-inch-diameter solid-fuel booster to provide the equivalent lifting capacity. This would allow DOD to gain experience with large solid rockets in the event some military requirement for them developed, and would not eliminate the solid rocket from consideration as the lunar booster. NASA was not as interested in solid-fuel technology at this time as the Air Force was. DOD management of the large solid program was some compensation to the Air Force, which was largely excluded from the consultations at this time and was given no other new projects to pursue as a result of the program review.

111 Robert C. Seamans, Jr., "Action and Reaction," the 1969 Minta Martin Lecture (Cambridge, Mass.: Massachusetts Institute of Technology with the American Institute of Aeronautics and Astronautics, 1969), p. 12 and Leonard Mandlebaum, "Apollo: How the United States Decided to Go to the Moon," *Science*, February 14, 1969, p. 651.
112 Interview with John Rubel.

The group also agreed that work on a nuclear rocket should be pursued, but that it was unlikely that nuclear propulsion would be available by the 1967 target date for the first manned lunar flight. Increases in the pace of other portions of the program in the scientific and applications areas were also approved.

At the end of the meeting, McNamara suggested that Seamans, Shapley, and Rubel meet over the weekend to consolidate the decisions reached and to put them in the form of a memorandum for the vice president to give to the president. As a basis for this memorandum, they agreed to use the introductory chapter of the space study that Defense Research and Engineering had been preparing for Secretary McNamara. John Rubel had drafted this chapter, and it contained the idea of a manned lunar landing before 1970 as a national goal even before Rubel brought it to the Saturday meeting.[114] Webb agreed, but added that he wished personally to be involved in drafting the memo.[115]

Until about midnight Saturday and all day Sunday, Seamans, Shapley, and Rubel prepared the memorandum. About 10:00 P.M., Webb joined the group after taking Astronaut Shepard's family to dinner. Webb spent about two hours editing the draft memorandum. Finally, at about midnight, Webb approved the memo and signed the covering letter.

Copies of the memorandum, "Recommendations for our National Space Program: Changes, Policies, Goals," were delivered to the vice president Monday at noon; the memorandum was a joint recommendation by Webb and McNamara, who approved it early Monday morning. The vice president and Edward Welsh reviewed the memorandum, and Johnson decided to recommend the programs contained in the memorandum to Kennedy without modification. Johnson joined Kennedy on the White House lawn as he welcomed Alan Shepard; after Shepard addressed a joint session of Congress, Johnson was host at a luncheon for Shepard at the State Department. After toasting Shepard, Johnson left, taking the recommendations to Kennedy.

In their memorandum, which was classified Secret, Webb and McNamara argued that manned flights in space could be effective means of enhancing national prestige.

> It is man, not merely machines, in space that captures the imagination of the world. All large-scale projects require the mobilization of resources on a national scale. They require the development and successful application of the most advanced technologies. Dramatic achievements in space therefore symbolize the technological power and organizing capacity of a nation. It is for reasons such as these that major achievements in space-contribute to national prestige.[116]

114 *Ibid.*
115 Interviews with James Webb.
116 The memorandum has not been made public, but it is quoted in Hugo Young, Bryan Silcock, and Peter Dunn, "Why We Went to the Moon: From the Bay of Pigs to the Sea of Tranquility," *The Washington Monthly*, April

They further argued that such prestige was an important component of the power struggle between the United States and the Soviet Union, and that for this reason the United States should undertake a manned mission to the moon even if such a flight were not justified on scientific or military grounds.

> Major successes, such as orbiting a man as the Soviets have just done, lend national prestige even though the scientific, commercial or military value of the undertaking may by ordinary standards be marginal or economically unjustified. . . . Our attainments are a major element in the international competition between the Soviet system and our own. The non-military, non-commercial, non-scientific but "civilian" projects such as lunar and planetary exploration are, in this sense, part of the battle along the fluid front of the cold war.[117]

KENNEDY SETS LUNAR LANDING AS NATIONAL GOAL

Kennedy received the Webb-McNamara memorandum from Johnson on the afternoon of May 8. The next day, Johnson left for a trip to the Far East; he did not return to Washington until May 24. Word of the recommendations was leaked to the press by Senator Kerr on May 9. *The New York Times* reported that Kennedy planned to add $600 million to the civilian and military space budget.[118] On May 10, Kennedy met to ratify the recommendations with his advisers Sorsenson, Bundy, and Wiesner, Webb and Dryden from NASA, McNamara representing Defense, Edward Welsh from the Space Council, and budget officials Bell and Staats. McGeorge Bundy remembers that "the President had pretty much made up his mind to go" and was not by then particularly interested in hearing arguments to the contrary.[119] Kennedy approved the program exactly as it had been set out in the Webb-McNamara memorandum.

The program Kennedy approved provided for setting a lunar landing goal as its central feature. The major deviation from earlier discussion of lunar missions was the provision for concurrent development of two boosters, one liquid fuel and the other solid fuel. The Air Force would develop the solid-fuel rocket to specifications set by NASA. By 1964 or before, NASA would choose which system would be used for the moon voyage. The program also provided funds for developing as soon as possible:

1. the spacecraft for the lunar flight and for the unmanned flights to survey the moon prior to manned landings;
2. the Rover nuclear rocket;
3. satellites for global communications;
4. satellites for weather observation;

The NASA budget was increased by $549 million for Fiscal 1962. Coupled with the $126 million March increase, this represented a 61 percent increase in the NASA budget over the Eisenhower figure of $1.1

117 *Ibid.*, p. 38.
118 *The New York Times*, May 10, 1961, p. 1.
119 *Presidential Appointment Calendar;* interview with McGeorge Bundy.

billion. The Department of Defense was given $62 million for work on solid-fuel boosters.[120]

One remaining area of controversy was the schedule that Kennedy should announce for the lunar landing. Budget plans were based on a 1967 target date, and the first draft of the speech in which Kennedy would announce his decision apparently mentioned that year as the goal, even though the Webb-McNamara memo had not specified a target date. NASA, realizing the difficulty in meeting distant targets from its experience with Project Mercury, suggested that the president should announce an attempt to land men on the moon within the decade; the White House accepted the suggestion.[121]

There is some evidence that during the two weeks between the time Kennedy approved the lunar landing plans and the time he announced them to the nation the president's economic advisers analyzed the economic impact of the acceleration in space spending. Their conclusion was that these expenditures were neither sufficiently large nor properly designed to inject enough stimulus into the economy to avoid the recession they were predicting. The Council of Economic Advisers and Secretary of Labor Arthur Goldberg proposed that Kennedy approve a substantial public works program rather than the new space spending; such a program, they believed, would provide sufficient stimulus to the economy. Kennedy turned down this suggestion; one author suggests that Walter Heller, chairman of the Council of Economic Advisers, viewed Kennedy's decision to spend money on the space program rather than on public works as one of his worst defeats during the Kennedy administration.[122]

The president decided to combine his announcement of the space decisions with a series of other proposals then under consideration. After originally intending to send his message to Congress, he decided to make the address in person. He had worked on the speech himself; in the portion dealing with space he had added emphasis on the costs and long-term commitments he was proposing that the nation undertake.[123]

On May 25, in a speech on "Urgent National Needs" billed as a second State of the Union Address, Kennedy told Congress that "these are extraordinary times. We face an extraordinary challenge." He warned that "this Nation is engaged in a long and exacting test of the future of freedom. . . ."

Kennedy spoke of Communist subversion in developing nations, economic and social problems at home and abroad, worldwide information programs, alliances, military and intelligence organization, civil defense,

120 Statement of James Webb, NASA Press Release, May 25, 1961.
121 Interview with Robert Seamans.
122 Hobart Rowen, *The Free Enterprisers: Kennedy, Johnson, and the Business Establishment* (New York: G. P. Putnam's Sons, 1965), pp. 169–172.
123 Sidey, *Kennedy, President*, p. 172 and interview with [illegible]

and disarmament. Nearing the end of his speech, he turned to space, and, in words which expressed his attitude more precisely than any others, declared:

> Finally, if we are to win the battle that is going on around the world between freedom and tyranny, if we are to win the battle for men's minds, the dramatic achievements in space which occurred in recent weeks should have made clear to us all, as did the sputnik in 1957, the impact of this adventure on the minds of men everywhere who are attempting to make a determination of which road they should take. . . . Now it is time to take longer strides—time for a great new American enterprise—time for this Nation to take a clearly leading role in space achievement which in many ways may hold the key to our future on earth.
>
> I believe we possess all the resources and all the talents necessary. But the facts of the matter are that we have never made the national decisions or marshaled the national resources required for such leadership. We have never specified long-range goals on an urgent time schedule, or managed our resources and our time so as to insure their fulfillment.
>
> Recognizing the head start obtained by the Soviets with their large rocket engines, which gives them many months of leadtime, 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 find us last. We take an additional risk by making it in full view of the world—but as shown by the feat of Astronaut Shepard, this very risk enhances our stature when we are successful. But this is not merely a race. Space is open to us now; and our eagerness to share its meaning is not governed by the efforts of others. We go into space because whatever mankind must undertake, free men must fully share.
>
> I therefore ask the Congress, above and beyond the increases I have earlier requested for space activities, to provide the funds which are needed to meet the following national goals:
>
> *First, I believe that this Nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to earth* [italics mine]. No single space project in this period will be more exciting, or more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish. . . . In a very real sense, it will not be one man going to the moon—we make this judgment affirmatively—it will be an entire nation. For all of us must work to put him there. . . .
>
> Let it be clear—and this is a judgment which the Members of the Congress must finally make—let it be clear that I am asking the Congress and the country to accept a firm commitment to a new course of action—a course which will last for many years and carry very heavy costs, $531 million in the fiscal year 1962 and an estimated $7–$9 billion additional over the next 5 years. If we are to go only halfway, or reduce our sights in the face of difficulty, in my judgment it would be better not to go at all. This is a choice which this country must make, and I am confident that under the leadership of the space committees of the Congress and the Appropriations Committees you will consider the matter carefully. It is a most important decision that we make as a Nation; but all of you have lived through the last 4 years and have seen the significance of space and the adventures in space, and no one can predict with certainty what the ultimate meaning will be of the mastery of space. I believe we should go to the moon. But I think every citizen of this country as well as the Members of Congress should consider the matter carefully in making their judgment, to which we have

> and there is no sense in agreeing, or desiring, that the United States take an affirmative position in outer space unless we are prepared to do the work and bear the burdens to make it successful. If we are not, we should decide today.[124]

In his car returning to the White House, Kennedy told Sorenson that he thought Congressional reaction to his lunar pledge was "something less than enthusiastic." Kennedy had deviated extensively from his prepared text, something he rarely did in formal speeches, in stressing the dimensions of the commitment he was requesting.[125]

Kennedy need not have worried. Congress approved his requests, almost without a murmur. Members of the space committees reported no significant increase in their mail following the May 25 Kennedy speech.[126] Senate hearings on the NASA budget were perfunctory; no policy questions were asked.[127] The House space committee, though annoyed that it had been excluded from the development of the new program, also approved the Kennedy figures in a conference with the Senate committee.[128] The Senate approved the total Kennedy request by a voice vote, with little debate, late on the night of June 28. In defending the request, Senator Kerr said that he contemplated "this program as one which will enable Americans to meet their destiny." The House approved the authorization on July 20 by a 354 to 59 vote. During the appropriations process, Congress on August 7 voted only $113 million less than Kennedy had requested.[129]

SUMMARY

Kennedy's recommendations for setting a lunar landing as a national goal found immediate and almost unanimous support not only in Congress but also in the nation. In the eight months between September 1960 and May 1961 the status of manned space flight had been elevated from an uncertain future as part of a scientifically oriented space program to a key instrument of national strategy. This shift was the result of a process in which many factors were involved; whether the May decision would have been made if any portion of that process had been different either in outcome or timing is the kind of "iffy" question that can rarely be answered in theory and never in practice.

It is even difficult to determine the relative importance to the lunar landing decision of the influences arising out of changes occurring in those eight months. The change in administrations was certainly vital. In addition to putting a new president and his advisers into the White House, the election brought about a change in the leadership of NASA. NASA planners were able to convince James Webb that plans for

124 Senate Space Committee, *Documents on International Aspects of Space,* pp. 202–204.
125 Sorenson, *Kennedy,* p. 592.
126 *Aviation Week and Space Technology,* June 19, 1961, p. 27.
127 U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *NASA Authorization for Fiscal 1962, Hearings,* 87th Cong., 1st sess., 1961. These hearings contain details on all aspects of the May program acceleration.
128 House Space Committee, *Fiscal 1962 NASA Authorization,* p. 1036.

manned flight should be supported by the new administration. The support of the Space Science Board helped allay some of the criticism that the manned space flight program had little scientific value. The success of the first manned flight of Project Mercury demonstrated man's ability to operate in space and his usefulness as a scientific instrument. The ability of NASA to withstand an Air Force and industry challenge to its role as the nation's primary space agency strengthened NASA's claim that it could carry out a program as ambitious as Project Apollo. Lyndon Johnson's personal conviction of the political importance of space, coupled with his assignment as head of the Space Council, placed an advocate of larger space programs at the side of the president. The consistent support of Congress for a strong space program eliminated one constraint on the president's freedom to choose as he did. The flight of Yuri Gagarin provided a strong impetus to make the space decisions quickly; the Bay of Pigs added to that pressure. All of these factors converged on the White House and on the president. John Kennedy, at first uncertain but finally convinced that the United States should accept the Soviet challenge in space, calculated the costs, weighed the needs, and finally decided that "whatever mankind must undertake, free men must fully share." The politics of the moment had become linked with the dreams of centuries and the aspirations of the nation, and the result was the identification of space success as a crucial factor in fostering the American national interest.

Part II

Analysis and Evaluation of the Decision

6 The Lessons of Apollo

It is probably too soon after the first landing on the moon to evaluate all of the consequences of this achievement and, by implication, of the decision that led to it. The long-term results of the lunar landing are likely to have widespread impact on American society. One student of the influence of technology on social phenomena suggests that there are many examples where technology triggered vast areas of accomplishments in its wake, extending over periods of times measured in decades. Unfortunately the most significant byproducts in the longer term are the most difficult to define in contemporary times. The really profound influences may require decades to assert their importance.[1] This position is certainly arguable, and it indeed may be possible to develop at least an interim assessment of the scientific, technological, economic, political, and social costs and benefits of Project Apollo. But such an assessment would require another study at least the size of this one to accomplish, and I will not attempt it here.

What can be evaluated now is whether the way in which Project Apollo was conceived and initiated has any relevance to an understanding of how other such large-scale undertakings can be begun and successfully sustained. There has been, in the wake of the Apollo 11 mission, a plethora of discussion about using for other purposes the techniques for organizing and directing "the massed endeavors of scores of thousands of minds in a close-knit, mutually enhancive combination of government, university, and private industry," techniques that some suggest constitute "potentially the most powerful tool in man's history."[2] Before such a transfer of techniques can be effected, a decision on whether they can be used, and for what purposes, must be made. This account of the lunar landing decision indicates conditions under which such a decision is possible, if that decision is to initiate an undertaking which has a high chance of being successful.

One important element of the legitimacy of a government is its record of success in achieving objectives to which it becomes committed. In selecting specific objectives for governmental action (as opposed to enunciating very broad goals such as racial equality or world peace), political leaders must be concerned about the likelihood of their being successful in the actions they initiate. In the case of the lunar landing decision, this type of consideration was of central importance to those considering possible new programs in space. After President Kennedy had first tentatively decided that the United States should enter a space race with the Soviet Union with the aim of coming out ahead, his next concern was whether such an outcome was feasible. He asked Vice President Johnson to find a space program "which promises dramatic results in which we could win." Johnson's consultations with space experts established that a project aimed at a manned lunar

[1] Raymond Bisplinghoff, Speech to NATO Advisory Group for Aerospace Research and Development, September 2, 1966 (published by NASA Office of Public Affairs as *Speaking of Space and Aeronautics*, Vol. 3, No. 3).
[2] Tom Alexander, "The Unexpected Payoff of Project Apollo," *Fortune*,

landing was technologically feasible. No "technological breakthroughs" were required for its accomplishment; what was needed was an extension of the basic technological capabilities already under development or study in 1961.

When Kennedy asked whether there was a feasible way of winning the space race, he could expect an answer with a high probability of its being correct. This was because he was dealing with an engineering problem, the question of whether a particular technological feat could be accomplished. If Kennedy had asked whether something that involved control over human behavior, rather than control over things, could be accomplished, he would likely not have been able to get nearly as precise an answer. He thus would have had to run much more of a risk of failure in committing his administration and the United States to accomplishing this "softer" kind of objective than he did in committing himself to the lunar-landing goal.

This suggests that "Apollo-like" undertakings, ones committing the nation to achieving a challenging objective on a specific timetable, should be begun *only when the feasibility of the objective sought can be determined with some degree of confidence at the time the decision to seek it is made.*

Obviously, the kinds of undertakings most susceptible to this type of judgment are technological, *i.e.,* ones in which the basic principles upon which action is to be based are established and the problem is applying these principles to specific ends. This need not be a severely limiting qualification. Alvin Weinberg argues that "many problems that are traditionally viewed as being primarily social possess stronger technological components than one at first suspects. They therefore may admit to technological palliatives, or even 'fixes,' which hopefully can buy the time necessary to get at the cause of the social problem."[3] Among the candidates that Weinberg lists for such "technological fixes" are many of the "great and pressing questions, upon whose resolution the future stability of our society depends . . . ," such as poverty, all-out war, air pollution, water supply, food, population control, and transportation.[4] I would add to the list aspects of health, education, and housing. Solutions to these problems involve breaking them down into identifiable and feasible tasks and deciding to allocate the resources needed to accomplish them. But a basic requirement for such a decision is the knowledge that these tasks are feasible.

This raises a further point. How is it possible to know whether in fact a particular technological task can be done successfully? At what point and on what basis can the government commit resources to a specific project?

[3] Alvin M. Weinberg, "Social Problems and National Socio-Technical Institutes," in U.S., Congress, House, Committee on Science and Astronautics, *Applied Science and Technological Progress* (Washington, D.C.: Government Printing Office, 1967), p. 416.

The post World War II response of the American government to these questions has been the continuing investment of significant national resources in supporting scientific research and preliminary development. This investment has been justified on the basis of a number of rationales, but a primary justification has been the "utility of basic research as the foundation of all technological development."[5] The leaders of American politics have realized that many of the activities which the government undertakes cannot be sustained in the contemporary world without a healthy basic science base upon which to draw. This has of course been particularly so for national defense purposes, but also holds true for other aspects of government activity. The lunar-landing decision could be made in 1961 because for several years previously space scientists and engineers in government service, in universities, and in industry had been examining the problems of such an undertaking, had isolated the areas in which further research was required, and had done enough exploratory work to conclude that there were no knowledge barriers to carrying out a lunar mission.

Similar reservoirs of knowledge exist, largely as a result of continued governmental support, in other areas of potential governmental action. This is especially true with respect to the "harder" physical sciences and life sciences, but is also coming to be so with respect to many of the social sciences. A recent report recommended that the government increase its support of behavioral science research in order that "the knowledge and methods of the behavioral sciences, devoted as they are to an understanding of human behavior and social institutions" can be applied "as effectively as possible to the programs and policy process of the federal government."[6] If such an investement were to prove successful, then the level of confidence in decisions involving "social engineering" might be raised nearer to that involved in non-human engineering operations.

A frequent criticism of the lunar landing project related to this analysis is that the investment of significant resources in developing the capability for manned space operations is not justified in terms of a valid distribution of resources among various scientific and technological fields. Typical of this type of criticism is the testimony of geophysicist Philip Abelson, who is also editor of the influential weekly *Science,* before the Senate space committee. After telling the committee that an informal straw poll of "scientists not connected by self-interest to NASA" had resulted in a 110 to 3 vote against the manned lunar program, Abelson attempted to evaluate "the scientific potential inherent in space studies . . . against the background of challenges

[5] Michael D. Reagan, *Science and the Federal Patron* (New York: Oxford University Press, 1969), p. 36. Reagan discusses the various criteria advanced for federal support of science on pp. 34–70.

[6] National Academy of Sciences, Advisory Committee on Government Programs in the Behavioral Sciences, *The Behavioral Sciences and the Federal*

in other areas of science and technology." Abelson concluded that "manned space exploration has limited scientific value and has been accorded an importance which is quite unrealistic" and that "the diversion of talent to the space program is having or will have direct and indirect damaging effects on almost every area of science, technology, and medicine" and might "delay conquest of cancer and mental illness."[7] Nobel Prize winner Polykarp Kush told the same hearing that he did not think that "the new knowledge which will arise from our exploration of space will yield major new intellectual constructs which is, after all, the business of science to produce." Kush was also "doubtful of the procedures that are employed. There is a certain flamboyance, a mood of haste which is attached to the program which is not, to my mind, the mark of first-class scientific research."[8] The AAAS "Committee on Science in the Promotion of Human Welfare" complained that there had never "been an opportunity for our society to make a conscious choice to sacrifice the advantages of free development of basic scientific research even temporarily, for the purpose of winning a purported race to the moon."[9]

The thrust of this study has been to emphasize that the lunar landing decision involved using science and technology for broad policy purposes, rather than setting policy for allocating resources among different scientific and technological fields. Of course, the decision did have the effect of setting research and development priorities, and to that degree there was a need to assess the relative value of investments in space science and technology versus other possible scientific and technological uses of the same resources. Such an assessment *was* made with respect to the lunar landing program by PSAC in 1960, leading to the conclusion that the cost of the program *was not* justified in scientific terms. Kennedy was well aware of this judgment, and consciously decided that other reasons related to the national interest for undertaking a lunar landing program were compelling enough to justify overriding the negative factor of scientific opposition. Further, Kennedy was advised that, although the decision might not result in the optimum distribution of R & D resources, the likely scientific and technological payoffs of lunar exploration were significant enough to ensure that the resources would not be completely wasted even in these terms. One might say, with respect to Kennedy and the decision to go to the moon, what Don Price has said of President Truman in another context: "When the President made at Potsdam the fateful decision to use the bomb he may have been right or wrong, but whether he

7 U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Scientists' Testimony on Space Goals*, 88th Cong., 1st sess., 1963, pp. 3–4, 8.
8 *Ibid.*, p. 63.
9 American Association for the Advancement of Science, Committee on Science in the Promotion of Human Welfare, "The Integrity of Science," *American Scientist* 53 (June 1965): 184.

was right or wrong was surely not the result of a lack of scientific advice or understanding."[10]

Criticisms of the lunar landing program based on its lack of scientific value can best be understood as criticisms of allowing other motivations than scientific value to have priority in the allocation of resources to an undertaking with significant scientific elements. This criticism is a manifestation of what Daniel Greenberg calls the "old politics" of science, in which the principal political objective is to maintain independence from governmental control in allocating resources to scientific research despite the government's major role in providing those resources. In 1961, this political strategy had succeeded; American science was "affluent, highly productive, and the *de facto* sovereign of its own most vital affairs."[11] This state of affairs led Price to conclude that "science has become the major Establishment in the American political system; the only set of institutions for which tax funds are appropriated almost on faith, and under concordats which protect the autonomy, if not the cloistered calm, of the laboratory."[12]

The lunar landing decision was to many scientists an unwelcome intrusion in their "free development of basic scientific research"; their call for a societal choice between the moon program and basic research was rather disingenuous, given the record of the scientific community in attempting to maintain tight control over its own affairs. In fact, Kennedy, in announcing the lunar decision, told the Congress that "this is the choice which this country must make . . . a most important decision that we make as a Nation. . . . I think every citizen of this country as well as the members of Congress should consider the matter carefully in making their judgment . . . ."[13] Criticisms of the scientific merit of the program appear in this light to be the legitimate but parochial efforts of one interest group in the American political process to claim priority for their interests over those of other groups and over the general interests of the society at large.

The decision-making process in 1961 resulted in a conclusion that the nation, primarily for foreign policy purposes, should make an investment in the technology of manned space flight. Advocates of similar investments in other areas of basic research and applied technology will have to participate in the political process and to gain support for their views if they hope to receive the kind of governmental

10 Don K. Price, *Government and Science: Their Dynamic Relation in American Government* (New York: New York University Press, 1953).
11 Daniel Greenberg, *The Politics of Pure Science* (New York: New American Library, 1967), p. 270.
12 Don K. Price, "The Scientific Establishment," in Robert Gilpin and Christopher Wright, eds., *Scientists and National Policy Making* (New York: Columbia University Press, 1964), p. 20.
13 U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Documents on International Aspects of the Exploration and Use of Outer Space, 1954-1962*, 88th Cong., 1st sess., 1963, S. Doc. 18, pp. 203–204.

support that has been provided to the space program. (Supporters of a continued large space effort in the 1970s find themselves in a similar position.)

"Apollo-like" decisions are thus in the first account likely to be feasible only when those making the decision can confidently expect success in its outcome. This qualification eliminates a wide variety of undertakings. For example, the United States has found that, at least in Vietnam, it does not know how to achieve the outcome it desires in an insurgency situation. The elimination of racial prejudice, as deeply seated in human emotion as it is, is another unlikely candidate for a "technological fix." So is the replacement of the nation-state by some other form of political organization. Other examples could be added to this list, but these should suffice to make my point, that the "Apollo approach" will not work when the end desired requires significant changes in deep-seated behavior patterns.

The range of undertakings which *are* susceptible to engineering solutions remains, however, certainly wide enough to absorb the energies and resources of the United States. Finding objectives with high social utility which can be achieved by a specific time using technologies, either physical or social, which are based on existing knowledge is not difficult. What is difficult is creating a base within the political system which makes it possible for the system's leaders, while they are considering whether or not to act, to determine if they can obtain and keep the support necessary for a given program to be accomplished.

To create such a base within the American political system is an exceedingly difficult task. Because of the pluralism of American society and of its republican political institutions, it involves combining and keeping together individuals and groups with a wide variety of interests and perspectives. Without assurance that such a combination can be created, political leaders will hesitate to make a long-range but specific commitment, even though they have identified a desirable and feasible objective. A corresponding strength of our system is that such a base of support, made up as it is of diverse elements, provides a flexible and powerful means of getting things accomplished on a large scale. The various institutions of modern American society—government, industry, and the universities, especially—have become so interwoven that they together form a single reserve of skill and resources which, if it can be channeled by the society's leaders toward a common goal, can achieve much.

The arena in which the separate interests comprising American society interact is the political process. This nation does not have, and probably never will have, a single agreed-upon set of priorities for governmental action. Instead we have a representative political system through which the range of interests concerned with a specific issue area can obtain access to and a hearing before those few individuals in leadership positions who must make the actual decisions that determine national

priorities. The Apollo experience suggests that, for the successful adoption of a significantly new policy, this process must go on long enough prior to a top level commitment to a particular course of action so that the sectors of society interested in the specific issue can be identified, their views heard and evaluated, potential sources of support solicited, and potential sources of opposition identified. For example, the relationship between space achievement and the national interest had been debated for over three years prior to Kennedy's decision. The alignment of forces favoring and opposing a politically oriented space program was clear, as was their relative political strengths. The issue had already been pushed up to the President for decision twice prior to April 1961.

There may be an analogy here between the notion of "technological sweetness," *i.e.*, a technological possibility in which the plans for its accomplishment are so attractive that a decision to act on it is hard *not* to make, and some concept of "political sweetness." There may be an identifiable period of time in the life history of an issue in the political process during which the leadership, if it so decides, can seize upon the issue and transform it into government policy. Examples which come to mind are civil rights legislation in 1964 and perhaps draft reform, control of environmental pollution, and tax reform in the near future, as well as space policy in 1961.

A crucial environmental factor determining whether the time is ripe for action in a particular issue area is the "occasion for decision," especially with respect to presence of or lack of a crisis atmosphere. Successful new policies are seldom conceived in a crisis setting, but often a crisis serves to terminate a political process and to produce a policy outcome. An almost coincidental juxtaposition of a crisis setting and the political maturity of an issue, however, seems required to create a viable political base of support for a very ambitious government enterprise like the moon project. The centrifugal forces of pluralism are so strong that some clear challenge, either from the external world or from the domestic sector outside the political system, is needed to allow the political leadership to choose among contending positions and groups on an issue and adopt goals representing significant changes in national policy. Without a challenge and subsequent crisis atmosphere, the American political system usually makes only incremental, adaptive shifts in policy.[14]

It is thus clear that *the timing of an "Apollo-like" decision is vitally important.* The political environment within which such a decision can

[14] One could be Machiavellian here and suggest that, if a crisis is lacking at a time when an issue is ripe for decision, the political leadership can fairly easily create one. This may well be true, given the nature of the government-media relationship today. I am not sure that a manufactured crisis would be as effective as an actual one in bringing together diverse interests in support of a common objective, but there is room for further ex-

be made with some confidence that it will be supported by influential political elements is conditioned by two factors: the political maturity of the issue under consideration and the presence of some challenge which dramatizes the need for action and removes political obstacles to its initiation. When these two factors are present, new enterprises can be successfully begun; when they are not, a decision to act runs a high risk of eventual failure. In 1961, both of these conditions were fully met. There had been enough debate to identify the lunar landing project as the likely candidate for the central feature of any politically motivated space program, and the Gagarin flight and the Bay of Pigs demonstrated to the political leadership that such a program was in the American national interest.

Finally, an "Apollo approach" to the solution of national problems requires the kind of leadership that is able to combine broad vision with an expert political sense. The preceding discussion suggests that decision-makers must be able to identify and seize upon brief opportunities when the technological feasibility and the political feasibility of a particular undertaking which is in the interest of the nation are in optimum balance. To do this, the leader must be able to convince influential individuals and groups in the political system that it is in their interest to support a program he believes needed. Equally, he must be able to select an objective and a program that serves interests broader than those of specific interests and groups. The objective must represent more than a limited response to a specific challenge or a response which does not have long-term benefits to society at least equal to the societal resources the program to achieve it will consume.

This type of leadership was present when the lunar landing decision was made. It was not limited to President Kennedy. Lyndon Johnson and James Webb both labored through several weeks of intense effort to ensure that the new space program for Kennedy's approval had merit beyond being a response to the political challenge symbolized by Gagarin's orbital flight. They made sure that the program would result in developing a preeminent capability for space operations of all kinds, and in all areas of outer space, a capability they believed would constitute a national asset for years to come. They also made sure that this program would be structured so that it would receive the continuing support of an already existing aerospace constituency and would also create the larger constituency which would provide a continuing basis of political support.

However, the final choice was Kennedy's. Many of his advisers told him that money spent on a large manned space flight program would not produce benefits for the United States as great as other possible uses of the same resources. Kennedy considered this advice, but ultimately decided that the power and pride of the American nation and its state required a program to establish the United States as the leading spacefaring country. He committed himself to that objective and came

to view it as representative of some of the most basic motivations and aspirations of the people who had chosen him as their leader.

The circumstances under which other decisions like the one to send Americans to the moon can be made and carried out seem, on the basis of the preceding analysis, to be these:

1. The objectives sought must be known to be feasible, with a high degree of probability, at the time the decision to seek it is made.
2. The objective must have been the subject of sufficient political debate so that the groups interested in it and opposed to it can be identified, their positions and relative strengths evaluated, and potential sources of support have time to develop.
3. Some dramatic "occasion for decision," such as a crisis resulting from an external or domestic challenge, must occur to create an environment in which the objective and the policies to achieve it become politically feasible.
4. There must be in leadership positions in the political system individuals whose personalities and political philosophies support the initiation of new large-scale government activities aimed at long-term payoffs and who have the political skill to choose the situations in which such activities can be initiated successfully.

The lunar landing decision reflected a belief basic to the liberal philosphy that is the core of the American world view. The idea that men can cooperate in a common endeavor to better their individual conditions is based on assumptions about human nature and society which, as I remarked in the Introduction, are at the core of liberal thought. The "Apollo approach" to the achievement of social objectives can only be adopted in a society where this belief is held both by the general population and by the society's leadership. It may turn out that this approach can in fact only be used in the United States, where both confidence in our ability to attack and solve major problems and a preference for technological, "engineering" means to achieve our objectives are deeply ingrained. In this sense, the decision to go to the moon may have been a uniquely American phenomenon. If this is so, then the United States may also be uniquely able to decide to use the techniques of organizing and directing energy that were so successful in Project Apollo for other worthwhile societal objectives. But this potential for achievement carries with it the danger of subverting the democratic principles upon which American society is based.

The essence of the "Apollo approach" is concentration of effort and a corresponding concentration of control. There is a constant tension between this concentration of control, which seems required if objectives of the scope of the lunar landing are to be chosen and implemented successfully, and the democratic ethic, which distrusts such a concentration of control and power. The final lesson of Apollo may be that such a tension can be maintained without either destroying democratic values or making concentrated government efforts

impossible. To do this requires a watchful caution on the part of those called upon to support large-scale government-initiated enterprises that require central control over significant societal resources and activities. The purpose of government is to do things for a society which cannot be done by individual or combined private efforts. Sending men to the moon was one such thing. There are many others which are worth doing. But the organized energy which government can command must be applied in the interests of the whole society and ultimately of each individual in it. To make sure that this happens is a challenging assignment for each of us, for

> modern organization makes demands on the individual to learn something he has never been able to do before: to use organization intelligently, purposefully, deliberately, responsibly. If he runs away from this task and his decisions, organizations will indeed become the master. If the individual accepts this responsibility, he will be free and in control.[15]

The experience of Project Apollo shows it is indeed possible to organize other "great new American enterprises," intended to achieve objectives equal or greater in human significance than landing on the moon. It is up to us as citizens of this country to make sure that such enterprises do not in seeking their objectives destroy or diminish the values or beliefs they are intended to foster.

15 Peter Drucker, *The Age of Discontinuity: Guidelines to Our Changing Society* (New York: Harper & Row, 1969), p. 259.

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