

Apollo: How the United States Decided To Go to the Moon

Leonard Mandelbaum

The United States program to send a manned expedition to the moon and back has involved more scientists, engineers, and public attention than any other civilian research and development project. Certainly none has matched the \$20- to \$40-billion estimate of Apollo (1). An examination of the history of the approval of the Apollo decision should contribute to a better understanding of our national decision-making processes in the field of research and development.

History of the Apollo

Decision 1958-61

Through July 1960. Sputnik's flight in 1957 was the spacemark of this generation (2). With this act, the Russians undermined worldwide belief in the technical supremacy of the United States. Our confidence in the strength of our international diplomatic-military position was replaced by deep anxiety which made itself felt in our educational system and our national leadership. Pressure was on the Eisenhower Administration to produce in space. Priority was given to the Vanguard program, and the Army and Air Force were authorized to use military rockets for the launching of their satellite systems (2, p. 56). Shortly thereafter, the President appointed the chairman of his Science Advisory Committee (PSAC) as his Special Assistant for Science and Technology.

Probably the first considered statement of space policy was submitted by the PSAC in 1958. Accompanied by a Presidential statement declaring belief in the "peaceful use of space," this document outlined a rough timetable ("early," "later," "still later")

for projects such as orbiting solar observatories and unmanned exploration of near planets. Manned lunar exploration was placed well down on the timescale. The aim was to place space exploration in the perspective of a total national scientific effort. The names of those who signed will reappear frequently in any history of science and government: James R. Killian, Lloyd V. Berkner, James H. Doolittle, George B. Kistiakowsky, Edwin H. Land, Jerome B. Wiesner, and Herbert F. York (3).

A few months later, Congress passed the National Aeronautics and Space Act. A civilian space agency (NASA) was established with broad powers to pursue these objectives in cooperation with the Defense Department, industry, and the educational community. Majority Leader Lyndon Johnson, chairman of the Senate's Select Committee on Space, was very influential in the formulation and passage of the act.

A number of significant steps to exploration of the moon were taken even before NASA was organized. Mercury was the most popular program. As early as December 1957, an Army rocket technology team headed by Wernher von Braun submitted a "Proposal for a National Integrated Missile and Space Vehicle Development Program." It called for a booster of 1.5 million pounds thrust. This would provide a payload capability of 20,000 to 40,000 pounds for orbital missions (4). In August 1958, the Army officially authorized work on the booster which was to become the Saturn project.

In October 1959, the "von Braun team" at Huntsville, Alabama was transferred from the jurisdiction of the Army and became the George C. Marshall Space Center under NASA. This ended 2 years of interservice rivalry between the Air Force and Army for control of this phase of space research. The transfer was made possible

by a decision of the Department of Defense that the Saturn project did not offer sufficiently near-term military benefits to justify its cost.

In January 1960, the Eisenhower Administration submitted a \$50 million supplemental request to Congress for a large liquid hydrogen engine for the Saturn program. Although no missions were assigned, it was clear to those who cared enough to follow these developments that the United States was beginning to provide the capability for manned flight beyond Mercury.

In unmanned flights, the United States began to deliver more immediate results, successfully launching meteorological navigational communication and sun exploration satellites. Meanwhile, the Russians continued to demonstrate their lead in booster thrust by taking pictures of the back of the moon with Lunik III (October 1959).

NASA disclosed a 10-year plan which envisaged a manned permanent space station, orbiting between 300 and 1000 miles from the earth, manned circumlunar flights in 1966-68, and manned lunar landing and return in the early '70's.

The House Committee on Science and Astronautics took a more aggressive position (5). It adopted, with unnamed dissenters, a staff report which concluded that "NASA's 10-year program in space is a good program as far as it goes but it doesn't go far enough." Among other specific recommendations, the report called for a "manned expedition to the moon this decade." The major cause for concern was the Russian lead in booster propulsion.

1960 Presidential Campaign

Candidate Kennedy attacked the Republicans for "letting us fall behind" in the space program and vowed that this was another field where he would "get this country moving again." Nixon conceded that we lagged in booster power but attributed the blame to the Truman Administration. He insisted that American achievement was impressive and promised to build upon it, and energetically pursue the NASA 10-year program, including the plan for manned lunar landing by 1971 (6).

The difference in the campaign promises occurred in matters regarding scheduling and the role of the military. While Kennedy urged a speedup, he

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nonetheless emphasized "elastic" target dates for goals such as the manned space platform, manned lunar landings, and nuclear power in space. But he called for these accomplishments as swiftly as possible. While standing for "preeminence" and "security," Kennedy did not call for military domination, and asserted that "freedom of space must be assured, preferably by mandate of the United Nations." Nixon was more explicit about giving the military the "mission" and the "necessary strength to defend freedom of space."

NASA, alert to the possibilities of change, added to the framework for future missions. Late in July, NASA representatives announced to an Industry Conference that the successor to Project Mercury would be "Apollo," a concept which then meant placing three men in sustained orbital flight and circumlunar flight.

On 17 October 1960, NASA's George Low, then program chief of Manned Space Flight Center, advised his superior, Abe Silverstein, that he had formed a study group to look into the question of manned lunar landing. No funds were needed and Silverstein approved. Later that year, NASA made a presentation on "NASA Long-Range Goals Using Saturn and Larger Vehicles" to the PSAC ad hoc Man-in-Space panel. In December 1960, the PSAC Man-in-Space panel reported an estimate of \$20 to \$40 billion for a manned lunar landing (7).

Eisenhower's Last Budget and the Wiesner Report

In preparing his final budget, President Eisenhower was apparently more impressed with the more cautious approach of his scientific advisor and the pressures of his Bureau of the Budget than with the arguments for an accelerated space program. The report of the President's Commission on National Goals warned against being "driven by nationalistic competition into extravagant programs which would divert funds and talents from programs of equal or greater importance" (8). It is also likely that Eisenhower's warning about the "military-industrial" complex was being prepared at this time.

The Budget Bureau called for a "bargain basement" figure for space. Only last minute protest from T. Keith Glennan (the first NASA administra-

tor) and Hugh Dryden (deputy administrator) prevented a statement in the budget message barring manned space flight beyond Mercury (9). The \$1.1 billion dollar figure in the proposed fiscal year 1962 budget was accompanied by the following statement in Eisenhower's budget message:

Further test and experimentation will be necessary to establish if there are any valid scientific reasons for extending manned space flight beyond the Mercury program.

Even before the Inauguration, the new Administration was presented with a fundamental critique of space leadership and priorities. After an admittedly hasty review of the national space program, the Wiesner ad hoc committee (including Donald F. Hornig, Land, and two members of the staff of the Senate Space Committee) concluded that:

1) The nation's ballistic missile program was lagging.

2) More effective management and coordination of the space effort was needed, and particularly in the top echelons of NASA.

3) A national booster program was encouraged "particularly for military projects." No distinction between civilian and military requirements was acknowledged.

4) Mercury should be downgraded since it "exaggerates" one phase of space activity.

5) Overall space program priorities should be reviewed.

6) The Space Council should be used for managing the space program (10).

Glennan prepared a briefing for the new Administration, but was not called upon. The inference of ineffectiveness in the Wiesner report contributed to widespread doubt as to whether NASA would continue as an independent agency (9, p. 3). The downgrading of Mercury and military emphasis in the Wiesner report fueled this type of speculation.

Between the Inauguration and 30 January 1961, NASA did not have an administrator. The job of finding one was assigned to Vice President Johnson. James Webb, a former colleague of Senator Kerr, was appointed and confirmed by the Senate. Despite the negative comments about space management in the Wiesner report, the two top technical personnel, Dryden and Robert C. Seamans, remained.

The First Kennedy Review

President Kennedy called upon NASA to recommend significant changes in the Eisenhower space budget. Administrator Webb proposed an increase of \$308 million, including \$173 million for vehicles and propulsion, \$48 million for Apollo (presumably spacecraft design) and \$25 million for interplanetary exploration. The agenda for the meetings on this subject, prepared by the Bureau of the Budget, focused on the "rate" the Administration wished to pursue in closing in "on the USSR's lead in weight lifting ability; and advancing manned exploration of space beyond Mercury" (11).

There is broad agreement on what transpired at the key meetings of 22 and 23 March. The Bureau of the Budget was prepared to recommend an increase of only \$50 million. At 5:15 p.m., 22 March, the President entered the meeting. Present were David Bell (Bureau of the Budget), Glenn T. Seaborg (Atomic Energy Commission), Johnson, Webb, Dryden, Seamans (associate administrator of NASA), and Edward C. Welsh, who had just been designated executive secretary of the Space Council.

Dryden addressed himself to the advantages of space exploration: science, military "insurance," avoidance of technological obsolescence, and the economic return. Seamans explained that an early version of the Saturn vehicle would make possible Apollo flights in 1964, circumlunar effort in 1967-68, and lunar landing in 1970. Seaborg spoke up for a nuclear role in any accelerated space program. The President expressed disappointment over our second place in big space programs (11). Some idea of the President's attitude and of the pace of decision-making in this period was indicated when, half an hour after the meeting, the Bureau of the Budget called Seamans and asked whether the Saturn upper stage cost was estimated at \$67 or \$77 million (9, p. 6).

The final decision was to go ahead on the booster program. Important emphasis was given to the early Saturn stage and nuclear rocketry. This action was consistent with the Wiesner report. An additional \$125 million was requested of Congress. Apollo was deferred for a more comprehensive review.

Space Science Board Report

One week later, the Space Science Board of the National Academy of Sciences presented the government with a report entitled "Man's Role in the National Space Program." Lloyd Berkner, chairman of the group, communicated his views personally to Webb on 27 February. The Academy was performing a traditional role in providing advice to the government (upon request) on scientific and technological matters. The board adopted its position on this topic at its 10 and 11 February meeting (submitted in writing to the government on 31 March), but the paper was not made public until 7 August 1961, 2 months after President Kennedy announced the Apollo decision and one month after congressional approval.

The report recommended that "scientific exploration of the Moon and planets should be clearly stated as the ultimate objective of the U.S. space program." The board found that it was not then possible to "decide whether man will be able to accompany early expeditions to the Moon and planets." Planning should include provision for manned flight on the basis that his participation "will be essential." This planning should be "consummated only as fast as possible consistent with the development of all relevant information." Crash programs were rejected (12).

Gagarin and the Bay of Pigs

But history preempted planning. Gagarin's 108-minute ride (12 April 1961) set off another space crisis, and in responding to newsmen on the same day, the President reiterated his impatience about being "second to Russia in the space field." Two days later, the House Space Committee pressed Seamans on the subject of the schedule of the lunar program. They stressed that 1967 was the 50th anniversary of the Bolshevik revolution, a logical time for Russian astronauts to plant a red flag on the moon, and expressed impatience over the apparent lack of a sense of urgency in the Administration (13).

One week later, the American-supported Bay of Pigs fiasco took place. In a footnote to his detailed account of the Apollo decision, the NASA historian states that the "Bay of Pigs does

not emerge as relevant" (7, footnote 109). This might seem to be an overstatement, considering the fact that Cold War events of such significance as Gagarin's flight and Bay of Pigs are not dealt with in separate compartments. At the least, the Bay of Pigs entered into discussion of the prospective Shepard Mercury flight. According to one source, in a meeting attended by Welsh, McGeorge Bundy, and Wiesner, someone asked, "Could we stand another defeat?" Welsh's response was, "Could we stand a success?" (9, p. 9).

In a memorandum of 20 April, the President directed the Vice President to find out which activity would give the United States a real chance to get ahead, how much it would cost, the competitive possibilities of outer space programs, and whether we were making a maximum effort (2, p. 199). The President reported this activity to the press on the next day.

We have to consider whether there is any program now, regardless of its cost, which offers us hope of being pioneers in a space project. . . . If we can get to the moon before the Russians, we should.

Meanwhile, the Vice President was consulting with key advisers. Early meetings included officers of BOB, DOD, NASA, AEC, and PSAC. The first significant recorded meeting was held 22 April. NASA advised the Vice President that the Russians would beat us to a manned circumlunar flight. A manned lunar landing and return required a new generation of boosters, so that chance of success was believed good (11).

On 23 April, the Vice President and other government officials briefed Frank Stanton, president of CBS, George R. Brown, president of a large Texas construction firm, and Donald Cook, then executive vice president for the American Electric Power Service Corporation, as a test of "public reaction." Wiesner was reportedly meeting with scientific panels and coordinating with Welsh. Johnson also touched base with Senator Kerr, Congressman Brooks, and the ranking minority members Senator Bridges and Congressman Fulton (2, p. 199).

The businessmen were assertive in their call for a vigorous program. The military people agreed on the technical feasibility. By 3 May, the Vice President felt it was about time for NASA to come forth with a specific recom-

mendation. Until that time, NASA was assuming the role of an adviser on the technical questions, ready to work within the framework of a policy decision (11). Given the Vice Presidential directive, Seamans, Webb, and Secretary McNamara spent the weekend on 6-7 May working on a program. Just before the weekend started, the reaction to the successful completion of Alan Shepard's flight finally eliminated any doubts there might have been about the direction of America's space program.

The Shepard flight, unlike Gagarin's, was not one of the proximate causes of the Apollo decision. It is quite possible that had it been less successful or less tumultuously received, the decision may have been delayed for more comprehensive review and it may have been presented differently. Welsh felt that the event now served to convince the doubtful few (14).

During the weekend, DOD and NASA representatives first agreed that "national security or national prestige" in a broad sense was involved, and that we had to do something that appeared to be significant on a worldwide basis. Secretary McNamara wondered if the lunar landing was a big enough jump. He suggested the possibility of manned planetary exploration. It was rejected as the central objective, but the overall supplemental \$750 million appropriation which they recommended included support for a nuclear rocket and a communications satellite program (9, p. 10).

A major cost item stemmed from the parallel development of two large boosters. One, fueled by a solid propellant, was to be developed by the Air Force. The other, liquid-fueled, would be developed by NASA. The \$750 million package also included substantial amounts for a nuclear rocket (Project Rover) and for weather and communication satellite programs. Of this total amount, \$549 million was to be allocated to NASA, and the rest divided among DOD (solid fuel propulsion), AEC (nuclear rocket), and the Weather Bureau.

The report was completed at 2:00 a.m. on Monday and presented to the Vice President later that morning. It was the day of the hero welcome for Shepard in Washington. There are different recollections as to when the President approved the package for submission to Congress as a supple-

mental request for FY 62. One source reported the next day. In any event, there was no change of any significance (9, p. 10).

In his address to Congress, President Kennedy presented this decision that before the end of the decade, Americans would be landed on the moon and returned. He also covered a broad range of subjects including Communist activities in the uncommitted nations, defense alliances, civil defense, and disarmament. Later, Kennedy described the Apollo decision as his "most significant."

Congressional Review

Before Kennedy announced the Apollo decision, the House Science and Astronautics Committee completed its review of the earlier request for the \$1235.3 million supplemental budget allocation. The committee recommended an increase of \$1417.8 million or \$130 million more than the Administration request (15). Most of the additional funds were earmarked for Apollo (\$42.6 million).

Congressman George Miller (D-Calif.), now chairman, filed a separate report with Congressman Bass (R-N.H.). This minority of two "deplored the manner in which the increased funds were authorized by the Committee. . . ." They concluded that "none of the increases have been adequately or cogently explained in detail or justified by a sufficiently itemized explanation. . . ." (15). Review by the Space Council was suggested as an alternative.

Congressman Fulton (R-Pa.), however, summarized the prevailing view prior to the President's May decision:

My feeling is that you, NASA, are like the ballplayer who is hitting a lot of long flies and doing a pretty good job, but you aren't in the same ballpark with the Russians. You are not in competition—seems to us we are in a race. . . . I feel we are, and I feel it has a tremendous effect on the world (15, p. 828).

When President Kennedy accelerated the lunar program, he was essentially confirming the position of the committee. Accordingly, there was no problem in securing House committee approval of the supplemental appropriation.

Senate hearings were brief. Approximately the same witnesses were heard—NASA and DOD key officials. Both the Senate and House hearings were more noteworthy for who was not there and

what was left unexamined. The Space Science Board report was not discussed. The record does not show any representatives of the PSAC or the scientific community, business, or labor communities. Until the Office of Science and Technology was created (in 1962), the Executive Branch was reluctant to allow the chairman of PSAC to testify on the grounds that his relationship to the President was confidential.

The Senate hearings were held 7, 8, and 12 June. No record of any testimony on 12 June is included. There were 10 Democrats and 5 Republicans on the committee at that time. Three Democrats and two Republicans were present the first day. Among the Senators who did not attend were: Russell (second ranking Democrat, and cited on the floor of the Senate as an authority and vigorous proponent), Magnuson, Dodd, and Holland. On the Republican side, the truants were: Bridges (ranking Republican), Wiley, Smith (now ranking Republican), and Case. The committee report indicates that the only pointed interrogation was on the relatively small request (\$50 million) for communications satellites.

On the floor there was a fairly active debate between Senators Allott and Kerr. The former noted the "stress and strain on the President" and wondered if this "precluded serious consideration of the implications" (16). Predictably, his main concern was cost.

Senator Kerr would not risk selling the program short: "I contemplate this program as one which will enable the American people to meet their destiny . . ." He rejected the propaganda theme and stated that the basic motivations were in addition to the inspiration, the "practical aspects of space including—military spinoff." According to Kerr, the most exciting space spinoff was longevity:

I say to the 183 million Americans of today—that in my judgment, one of the benefits that will come from the program will be an increased average life span of at least 10 years for each one under 50 years of age today. . . . (16, p. 10804).

Conclusions

Gagarin's flight, possibly accentuated by the Bay of Pigs, reversed the policy of two administrations. The Apollo decision of 1961 was ignited by an event interpreted as a loss of international

prestige. It was a commitment to recapture national honor in space. It was made possible by the preparations of men and organizations whose growth was linked with this gigantic R & D program.

Eisenhower's Administration would not commit itself to an ambitious manned space flight program until Mercury, and possibly other projects, demonstrated feasibility. The Wiesner Committee report to President-elect Kennedy favored a less prominent role for manned space flight. As late as 23 March 1961, the Kennedy review of the Eisenhower space budget resulted in greater funding for boosters, but no commitment to an accelerated manned space flight program. This cautious approach drew support from the NSF report of March 1961, which warned against "crash" priorities and called for an orderly space program.

But all the considerations gave way under the impact of the Russian spectacular of 12 April. Soon after the Bay of Pigs, President Kennedy gave instructions, not for a review, but for a method to dramatically outperform the Russians in space as soon as possible.

Congress acted without hearing testimony of compelling military need (17). The Apollo decision was made without reference to any comprehensive and integrated national policy designed to maximize the use of scientific and technological resources for social objectives. Indeed, the record does not indicate whether the available National Academy of Sciences report was introduced. It was a typical Cold War reaction.

If the views of informed and concerned citizens were solicited, the record does not provide evidence of it; if efforts by the scientific community and other groups to record opposition or reservation were made, they were not afforded much weight. Proposals of comparable magnitude, though of lesser cost, required volumes of committee testimony and days of floor debates and a flood of amendments (Peace Corps, Manpower Training, Appalachia, Reciprocal Trade). A subsequent Congress would give greater attention to rat control and rent supplement measures which did not nearly approach the \$1 billion mark.

There were other grounds to justify the action. One of the more interesting reasons, outlined by Dryden, was the need to advance science and technology through a focus on specific goals. But

why Apollo? Crisis usually results in a narrowing of options (18) and the cold war emergency created by the Gagarin flight preempted any opportunity for comprehensive review to choose an optimal program or programs for this purpose.

For example, the national and international need for cheap protein sources and the rich potential of underseas development might have indicated that accelerated oceanographic research would have been a wiser investment of technological resources.

With regard to the economic justification, it is important to recall that the United States was still suffering from an economic slump in 1961. But the unemployed and underemployed were mostly the coal workers and displaced farm workers of Appalachia and elsewhere, and the untrained minority groups of the ghettos—not the engineers and technicians that a re-research and development program demands. If public works were agreed upon as the primary approach to unemployment, most economists would have preferred activity that provided opportunity for the unskilled and semi-skilled.

This article has not delved very deeply into the scientific argument for Apollo. To begin with, the advocates never raised it as a critical justification. If they had, then perhaps the report of the National Academy of Sciences, which gave priority to other space projects and required a more orderly progression for manned space, would have been sufficient to deter the acceleration of Apollo.

A far more important question of principle is involved. Modern science is often inextricably linked with modern technological development. Both call for huge investments of men and money. This necessarily involves questions of priority: Which other proposals for R & D must be refused, and which other social objectives must be deferred? These are primarily political questions to be decided upon by political and administrative representatives with the full and knowledgeable participation of the entire concerned community—natural scientists, social scientists, and citizens' groups.

Too often, it is impossible for concerned citizens to appraise and comment upon an incipient program. This is sometimes attributed to the esoteric knowledge required to understand what is proposed. But tax and trade bills are

complicated too. The more serious obstacles to mature consideration are the crisis atmosphere (often artificial), the fragmented machinery (discussed below), and the momentum of technological impulse.

The April 1961 response to the Russians was the spark that set off Apollo—but it probably would have been launched anyway. With the approval of the concept of Saturn, it was plain that the men, desire, and organization were welded together behind the idea of manned space exploration of the moon. These factors add up to a considerable social force that I have termed "technological impulse."

Only an alert and vigorous set of sociopolitical mechanisms, equipped with a well-designed policy, could confine this promotional force to its proper place in a democratic society. The American of the late 19th-century economy was substantially the manifestation of the planning and activity of the great industrial captains. This economy is now permeated by a network of social controls. It is no less vital; many argue that its growth is due in large part to the regulatory system.

Perhaps it was too much to expect both a rationalized science policy and a sophisticated system of R & D decision-making less than 4 years after Sputnik and before any experience with the Russians in limiting the technological terrors of the Cold War. But now it is 12 years since Sputnik. We know more about poverty, and other social problems both here and abroad. There is increased awareness of the potential of technological approaches to social questions of inadequate housing, food production, environmental pollution, and crime prevention and control (19).

Nevertheless, recent decisions such as approval of the supersonic transport program, and the Air Force manned orbiting laboratory provide substantial evidence that without an integrated federal R & D policy and decision-making system, technological impulse, supported by vague claims of international prestige and increased security, will prevail.

Any well-integrated policy would recognize that scientific and engineering manpower, including systems analysis capability, are required for basic social objectives before surplus resources may be allocated to prestigious or otherwise marginal projects. The latter would be entitled to more serious con-

sideration if the cost were minimized by international cooperation, minimal duplication, and adequate research experience prior to heavy development outlays.

Such a policy is impossible within the fragmented framework of federal R & D decision-making which has not substantially changed since 1961. Executive and congressional committees and panels are certainly more informed than they were 7 years ago. But both systems are designed for specialization. The PSAC uses panels of experts to judge the validity of increasingly esoteric proposals. Nuclear, space, and military problems are assigned to separate and powerful congressional committees. It is a system ideally suited for the effective lobbyist, whether he represents industry, government agencies, or institutional education.

A generation has passed since the nuclear age was introduced and the space age heralded. Within this period, imposing numbers of articles and books by respected authorities have debunked reform ideas such as instituting a Department of Science. Now that the federal budget for research and development items is being given most critical review, it is time for well-informed people in the social and natural sciences to step forward with meaningful ideas on policy formation and machinery, so that these limited resources will be employed at maximum advantage.

References and Notes

1. At different stages different estimates were given. Originally, the Administration talked of the \$20- to \$40-billion range. More recently, NASA tried to establish that only a few billion will be used for items designed solely for Apollo. Other outlays, however (launch facilities, booster technology, Gemini, and others), are deemed necessary for an overall space program. Recently T. Wicker (*New York Times*, 29 Dec. 1968, p. 12E) cited a \$24-billion estimate.
2. For a summary of pioneering in this field, see J. Holmes, *America on the Moon: The Enterprise of the Sixties* (Lippincott, Philadelphia, 1962), sec II.
3. President's Science Advisory Committee, *Introduction to Outer Space*, The White House (Government Printing Office, Washington, D.C., 26 Mar. 1958).
4. *Saturn Illustrated Chronology* (George C. Marshall Space Flight Center, Huntsville, Ala., 10 Aug. 1964), p. 1.
5. Democrats enjoyed a 15 to 9 majority of this committee at that time.
6. J. Doherty, "Space in the 1960 Campaign," NASA Historical Archives, Washington, D.C. (unpublished).
7. E. Emme, "Historical Perspective on Apollo," NASA Historical Note No. 75, Washington, D.C., 24 Oct. 1967, p. 26.
8. U.S. President's Commission on National Goals, *Goals for Americans* (Prentice-Hall, Englewood Cliffs, N.J., 1960), p. 114.
9. My interview with Robert C. Seamans, Jr., NASA Associate Administrator, 27 May 1964 (John F. Kennedy Library, Cambridge, Mass.), p. 1.

10. Report to the President-elect of the ad hoc Committee on Space, released 12 Jan. 1961, particularly p. 14.
11. My interview with Dryden in Washington, D.C., 23 Mar. 1963.
12. *Man's Role in the National Space Program* (National Academy of Sciences Space Sciences Board, Washington, D.C., 31 Mar. 1961).
13. *Hearings before the U.S. House Committee on Sciences and Astronautics*, 87th Congress, 1st Session, regarding H.R. 6874, p. 375.
14. My interview with Welsh in Washington, D.C., 14 Apr. 1964.
15. *Report of Committee on Science and Astronautics*, No. 391 to accompany H.R. 6874, 87th Congress, 1st Session (Government Printing Office, Washington, D.C.), p. 89.
16. *Congressional Record*, 28 June 1961, p. 10803.
17. While military experts saw some potential benefit from manned space flight capability (for inspection and repair of satellites, and so forth), most saw no military application for extended space flight to the moon and planets.
18. R. C. Snyder, in *Approaches to the Study of Politics*, R. Young, Ed. (Northwestern Univ. Press, Evanston, Ill., 1958).
19. A. Weinberg, "Scientific choice, basic science and applied missions" in *Basic Research and National Goals, 1967, A Report to the Committee on Science and Astronautics of the U.S. House of Representatives by the National Academy of Sciences* (Washington, D.C., March 1965), p. 279.

NEWS AND COMMENT

Senate: New Leaders For Health and Education

Personalities shape political action and the work of two Democratic senators—Lister Hill of Alabama and Wayne Morse of Oregon—was important in increasing federal support for health and education during recent years.

When Hill and Morse left the Senate last month—Hill through retirement, Morse because of defeat at the polls—people in the fields of health, education, and science understandably wondered what their successors would be like. Hill exerted his influence in these areas primarily through his chairmanship of a major Senate committee. Although

this group is called the Senate Labor and Public Welfare Committee, much of its work lies in supervising health, education, and, now, the National Science Foundation. Hill took a special interest in health matters and was regarded as the "patron saint" of the nation's medical research. Morse served as a member of the committee and as chairman of one of its important constituent parts—the education subcommittee.

Hill's successor as committee chairman is a fighting 65-year-old Texas liberal, Ralph Yarborough. Morse's successor as chairman of the education

subcommittee is Rhode Island's Claiborne Pell, 50, a Newport patrician with a liberal voting history. Those who favor generous federal support to health, education, and science were relieved that men with the views and records of Yarborough and Pell assumed these important posts. It remains to be seen, however, whether Yarborough and Pell have all the personal qualities that made Hill and Morse so effective.

Yarborough, who has been in the Senate for 12 years, assumed his first Senate committee chairmanship when he took over Labor and Public Welfare last month. Comparisons with Hill are inevitable. One long-term committee observer describes chairman Hill as "a foxy old grampa, the smoothest ever." Another observer termed Hill "a fine old Southern gentleman, who was not excitable and did not rattle around; Yarborough on the other hand is a different kind of guy, a partisan who gets into tiffs with his colleagues." (Senate veterans still remember Yarborough's not-so-friendly wrestling match a few years ago with Senator Strom Thurmond of South Carolina.)

Most of those who have watched Yarborough point out the difficulty of being a successful liberal politician representing Texas. "If you're a Texas liberal, you've got to be a little paranoid," one observer comments; "you expect a knife in your back at any moment and have a tendency to look for machinations when there are none."

Yarborough does, nonetheless, have many positive qualities. He is likeable, articulate, quick, and a diligent, though sometimes unfocused, worker. Perhaps what is most striking about him is his ability to speak with a moral passion which is rare among politicians. When this reporter interviewed Yarborough recently, the Senator was looking through an article in *Science* which mentioned the cutbacks in federal funds available to poor college students. "Folly!" Yarborough exploded. "This cutting back on education, this tokenism on education is an economic folly! This

Senate Labor and Public Welfare Committee Members

The members are listed in order of seniority on the committee. Seniority determines access to the coveted subcommittee and committee chairmanships. Committee members on the health subcommittee are indicated by (H); those on the education subcommittee by (E). Senators who entered the Senate and the Labor and Public Welfare Committee this year are indicated by an asterisk.

Democrats

Ralph Yarborough, Texas (H, E)
Jennings Randolph, W.Va. (E)
Harrison A. Williams, Jr., N.J. (H, E)
Claiborne Pell, R.I. (E)
Edward M. Kennedy, Mass. (H, E)
Gaylord Nelson, Wis. (H)
Walter F. Mondale, Minn. (E)
*Thomas F. Eagleton, Mo. (E)
*Alan Cranston, Calif. (H)
*Harold E. Hughes, Iowa (H)

Republicans

Jacob K. Javits, N.Y. (H, E)
Winston L. Prouty, Vt. (H, E)
Peter H. Dominick, Colo. (H, E)
George Murphy, Calif. (H, E)
*Richard S. Schweiker, Pa. (E)
*Henry Bellmon, Okla.
*William B. Saxbe, Ohio (H)