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Chapter 22

Apollo Thirtieth Anniversary: Two Views Part 2: Project Apollo in American Memory and Myth^{*}

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This paper presents an historical perspective on the importance of Project Apollo from the perspective of the end of the twentieth century and the millennium. After thirty years, it is only now becoming possible to assess the significance of the lunar landings, accomplished between 1969 and 1972, with any degree of historical perspective. This essay discusses the key elements of the American public's memory about Apollo and why it was important, and is suggestive of the myths that have emerged since the landings and how they have affected the course of American society.

Introduction

The major contours of the American sprint to the Moon during the 1960s have been told and retold many times.¹ With the passage of time, the demise of

^{*} Presented at the Thirty-Third History Symposium of the International Academy of Astronautics, Amsterdam, The Netherlands, 1999. This paper is declared a work of the U.S. Government and is not subject to copyright protection in the United States.

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the Soviet Union, the end of the Cold War, and the subsequent opening of archives on both sides of the space race, however, there are opportunities not present before to reconsider the importance of Project Apollo in American consciousness. This paper will discuss the central themes being investigated in a larger research project presently underway, speaking to the continuing significance of Apollo as a part of the American psyche. There are a whole series of notions that have grown up and became a part of American culture as a result of the Moon landings that hold sway some thirty years after the landing of Apollo 11 in July 1969. The most obvious of these is the now trite saying, "If we can put a man on the Moon, why can't we..." But the legacy of Apollo actually goes much deeper. Modeled on other works in history that are asking central questions about the shaping of national character in response to the myth and memory of past events, this paper will raise seven major areas for consideration. To begin, however, we must discuss briefly the idea of myth and memory in American history.

Project Apollo and American Myth and Memory

Most historians have treated Apollo as the singular achievement of NASA during its early years, and appropriately so, but have not yet moved beyond a straightforward narrative. They have celebrated the public announcement of a lunar landing by the end of the decade, made by President John F. Kennedy in a speech before Congress and the American people on May 25, 1961. They have also commented on the centrality of the decision as a cold war measure to best the Soviet Union.²

For the next eleven years, NASA was consumed with carrying out Project Apollo in response to Kennedy's decision. This effort required significant expenditures, costing \$25.4 billion over the life of the program, to make it a reality. Only the building of the Panama Canal rivaled the Apollo program's size as the largest non-military technological endeavor ever undertaken by the United States; only the Manhattan Project was comparable in a wartime setting.

In addition to Earth-orbital test flights, two circumlunar missions, and the aborted Apollo 13 mission, six Apollo crews set down on the Moon's surface between 1969 and 1972. The first to do so was Apollo 11, which lifted off on July 16, 1969, and, after confirmation that the hardware was working well, began the three-day trip to the Moon. Then, on July 20, 1969, the lunar module—with astronauts Neil Armstrong and Buzz Aldrin aboard—landed on the Moon while Michael Collins orbited overhead in the Apollo Command Module. After check-out, Armstrong set foot on the surface, telling millions who saw and heard him

on Earth that it was “one small step for [a] man-one giant leap for mankind.” Aldrin soon followed him out and the two explored their surroundings, planted an American flag but omitted claiming the land for the U.S. as had been routinely done during European exploration of the Americas, collected soil and rock samples, and set up scientific experiments. The next day they rendezvoused with the Apollo capsule orbiting overhead and began the return trip to Earth, splashing down in the Pacific on July 24th.



Figure 1: Astronaut Neil Armstrong on his way to the Moon and becoming the first man to walk on the Moon (NASA Photo 69-HC-665 [color] and 69-H-1044).

Until this point in time, few have looked at Apollo as a mythical event, but in reality it was one of the most important in American history. In a certain sense, our memory of Apollo is a myth, although before anyone gets excited about my use of this term let me explain that myth is not so much falsehood—as many

people seem to believe—as it is a story about our past that points up the highest ideals of the society. As James Oliver Robertson observes in *American Myth, American Reality*, “Myths are the patterns of behavior, or belief, and/or perception—which people have in common. Myths are not deliberately, or necessarily consciously, fictitious.”³

This myth is not so much a fable or falsehood, as it is a story, a kind of poetry, about events and situations that have great significance both for those involved and those that follow. Myths are, in fact, essential truths for the members of a cultural group who hold them, enact them, or perceive them. They are sometimes expressed in diffuse ideologies, but in literate societies like the United States they are also embedded in historical narratives. Robertson’s book is one of many studies that focus on American myths—such as the myth of the chosen people, the myth of a God-given destiny, and the myth of a New World innocence or inherent virtue.⁴ As scholars of aerospace history are now beginning to recognize versions of these myths have also been held by those who recollect the history of flight; they in turn relate them to a range of experiences relating to the subject.⁵

Memory, myth, and history are closely akin to each other; essentially they are stories that explain how things got to be the way they are. But common parlance suggests that memory is often faulty, myth is fiction, and only history is, or at least aspires to be, true. History to me, however, is an attempt to recount, model, or reconstruct the memory of the past for the purposes of the present. For a variety of reasons, such attempts are never completely successful. Thus, although few historians overtly do so, it is important to distinguish between history—the recounting of past events—and the past that is truly lost forever. History never fully or completely or accurately describes the past, but attempts to develop approximate mental models or reconstructions of events. Different cultures at different times formulated and presented their reconstruction’s of the past in strikingly different ways. Thus, it is highly dangerous to attempt to evaluate the relationship between another culture’s concept of “history,” our own concept of “history,” and the lost reality of the past. All themes overlap in some way, but none is a precise mirror image of the other. Many people confuse history with the unrecoverable past, and confuse myth and memory with fiction.⁶

This must, of necessity, raise the specter of the inexact character of historical “truth,” and of its relationship to myth and memory and the reality of the dim and unrecoverable past. It has reinforced, however, that what particular groups have understood and acted upon as truth, even if quite absurd to outsiders, have changed throughout time, circumstances, and other mediations in the social fabric. Indeed, these truths have differed from time to time and place to place with

reckless abandon and enormous variety. Religious, social, ethnic, national, language, and other types of groups over time have held a remarkably diverse set of truths, all internally consistent and rational, that have ruled their cultures. Choice between them is present everywhere both in the past and the present; my truth dissolves into your myth and your truth into my myth almost as soon as it is articulated. We see this reinforced everywhere about us today, and mostly we shake our heads and misunderstand the versions of truth espoused by various groups about themselves and about those excluded from their fellowship. Perhaps Pontius Pilate framed the dilemma best two millennia ago when he asked Jesus, "What is truth?"⁷ We tend to call those versions of truth that we do not accept "myths," as Pilate obviously thought about the truth espoused by Jesus, but they nonetheless cement relationships and provide rationale for actions. They have given and continue to give meaning and value to individual human lives and to create a focal point for explaining the sufferings and triumphs of the group.

It is now time to begin the systematic exploration of the nature of memory and myth in aerospace history, and Apollo is the quintessential starting point for such an investigation. No space flight program has been more celebrated and scrutinized and, indeed, mythologized. I propose to explore, in a very tentative manner, seven major areas that offer meaningful avenues of further research and writing.

Visions of Reality

The first of these relates to the quest for the Moon in history and how perceptions about it have changed as a result of the reality of Apollo. The Moon was an early attractive target for both the United States and the Soviet Union because it was comparatively close; in the context of cosmic distances it is the neighbor in the next apartment whose stereo can be heard through thin walls. There were also numerous opportunities every month for a launch from the Earth to the Moon, and it held great potential as a public relations coup in the international community for the nation reaching it first.

At the same time, there was a long history of expectations about the Moon. Almost with the Copernican revolution of the seventeenth century, and its attendant acceptance of other planetary bodies as real places, human beings began speculating about the possibility of life elsewhere.⁸ The Moon, as the closest place, received a full measure of consideration. The famed astronomer Sir William Herschel, for instance, wrote to a friend in 1780 that it was "beyond doubt, that there must be inhabitants on the Moon of some kind or another."⁹ In 1835,

the *New York Sun* ran a series of stories that supposedly described life on the Moon viewed through a telescope, what later became known as the “Great Moon Hoax,” but hopes of finding life still held sway for many years thereafter.¹⁰

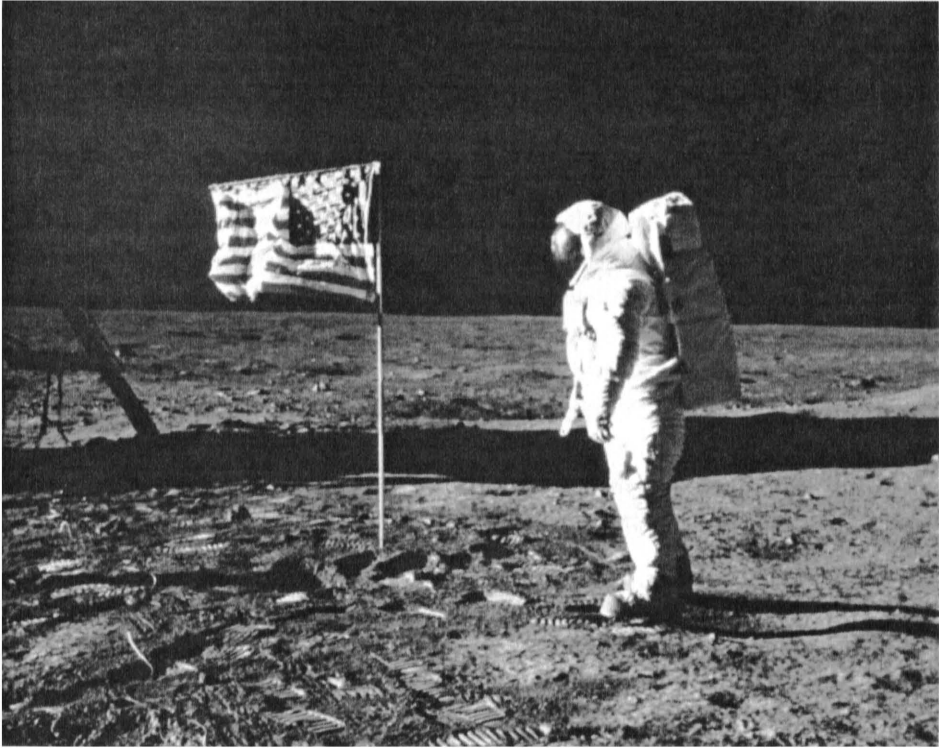


Figure 2: Astronaut Buzz Aldrin posing for a photo, taken by Armstrong, beside the deployed flag of the United States during the Apollo 11 EVA (Extra-Vehicular Activity). The Lunar Module is on the left (NASA Photo 69-H-1253).

By the time of the lunar landings those dreams of finding life had been dashed by the reality of the expeditions, but we learned a great deal more about the Moon and its origins than had been known before.¹¹ For instance, the top ten list of scientific findings include:

1. The Moon is not a primordial object; it is an evolved terrestrial planet with internal zoning similar to that of Earth.
2. The Moon is ancient and still preserves an early history (the first billion years) that must be common to all terrestrial planets.

3. The youngest Moon rocks are virtually as old as the oldest Earth rocks. The earliest processes and events that probably affected both planetary bodies can now only be found on the Moon.
4. The Moon and Earth are genetically related and formed from different proportions of a common reservoir of materials.
5. The Moon is lifeless; it contains no living organisms, fossils, or native organic compounds.
6. All Moon rocks originated through high temperature processes with little or no involvement with water. They are roughly divisible into three types: basalts, anorthosites, and breccias.
7. Early in its history, the Moon was melted to great depths to form a “magma ocean.”
8. The lunar magma ocean was followed by a series of huge asteroid impacts that created basins, which were later filled by lava flows.
9. The Moon is slightly asymmetrical in bulk form, possibly as a consequence of its evolution under Earth’s gravitational influence.
10. The surface of the Moon is covered by a rubble pile of rock fragments and dust, called the lunar regolith, that contains a unique radiation history of the Sun which is of importance to understanding climate changes on Earth.¹²

While the scientific return of Apollo was significant—even though the project was not undertaken to advance scientific understanding so much as to resolve cold war rivalries—the reality of learning little more than geological details about the Moon fundamentally has stunted our interest in the Moon. Only in 1994 did the United States return to the Moon since Apollo. Clementine was a joint technology demonstration project of the Department of Defense’s (DOD) Strategic Defense Initiative Organization and NASA, but its scientific return was astounding. It imaged the Moon at various wavelengths including ultraviolet and infrared, and detected ice from an asteroid crash on the Moon’s south pole. This has re-energized lunar science, prompting the launch of Lunar Prospector in 1998 and it appears that additional missions will be approved to explore this area further.

This is only because the presence of water ice offers the possibility of some type of life. What if this had been detected in 1969? Probably the entire history since, and certainly the legacy of Apollo would have been fundamentally different. One of the humorous stories that has circulated is that one of Neil Arm-

strong's astronaut colleagues recommended that his first words spoken on the lunar surface should be, "oh my goodness, what was that that just ran behind that rock." He, of course, refused, but the point is well taken. Had we found something of interest on the Moon, instead of an aborted space exploration program, Apollo would have been the vanguard of an armada of spacecraft from Earth. As it was, the belief of most Americans became "been there, done that," and they pushed for decreased funding for NASA and emphases on other projects. The hope of a lunar base was trashed in the perceptions of Apollo as being something only mildly worthwhile for narrow scientific purposes.

A Moment in Time

The decision of President John F. Kennedy in 1961 to go to the Moon has also left an indelible mark on public perceptions of space flight and American culture. While it was an enormous achievement, Apollo left a divided legacy for NASA and the aerospace community. The perceived "golden age" of Apollo created for the agency an expectation that the direction of any major space goal from the President would always bring NASA a broad consensus of support and provide it with the resources and license to dispense them as it saw fit.¹³

Something most NASA officials did not understand at the time of the Moon landing in 1969, or for many years thereafter, was that Apollo had not been a normal situation and would not be repeated. The Apollo decision was, in reality, an anomaly in the national decision-making process. This proved to be true in part because of its reliance on presidential prerogative, made possible only because of its national defense implications. Space exploration enthusiasts, however, greeted Ronald Reagan's 1984 space station directive as a political mandate to take the "next logical step" in space. NASA established a schedule to produce a space station, as Reagan had directed, by 1994.¹⁴ But nothing happened. Eight years after Kennedy offered his challenge, Americans stood on the Moon. Ten years after President Reagan issued his directive, NASA and its political overseers were debating space station design.

Not until the inevitable confrontation with reality for exploration advocates during the debate over the Space Exploration Initiative (SEI) in 1989 did those associated with NASA fully learn that the myth of presidential leadership in dictating the Apollo decision was not the norm. The demise of SEI, concurrent with continuing troubles for the Earth-orbiting space station, at last forced space exploration champions to question long-held assumptions about presidential omnipotence. Faith in the ability of presidential commitments to free space policy

from the constraints of Washington politics finally declined. As Leonard David pointed out in a popular article, expensive space efforts such as SEI were extremely tough sells.¹⁵ Space had ceased to be special by the time the first Americans reached the Moon. But Kennedy's decision had excited the expectation that presidential leadership could carry space policy above politics.

The symbolism of Kennedy's Apollo commitment held special appeal for the true believers of space exploration. To them, the lunar decision suggested that space exploration deserved special treatment within the American political system. The decision to go to the Moon implied that a president could overcome partisan divisions and lead the nation to great accomplishments, if only the objective was properly framed. Many argued that the subsequent ills of the space program could be traced to the unwillingness of later presidents to make "Apollo-like" public commitments.¹⁶ Unfortunately, while this was an illusion, the myth held sway for more than a generation.

The Culture of Confidence

NASA's rise as a "can do" agency can be traced directly to the experience of Apollo and its legacy of success. If we have heard the quote once we have heard it a million times: "If we can send a man to the moon, why can't we clean up Chesapeake Bay?"¹⁷ Or choose the task of your choice.

Indeed, if there is one hallmark of the American people, it is their enthusiasm for technology and what it can help them to accomplish. Historian Perry Miller wrote of the Puritans of New England that they "flung themselves in the technological torrent, how they shouted with glee in the midst of the cataract, and cried to each other as they went headlong down the chute that here was their destiny" as they used technology to transform a wilderness into their "City upon a hill."¹⁸ Since that time, the U.S. has been known as a nation of technological system builders who could use this ability to create great machines, and the components of their operation, of wonder.

Perceptive foreigners might be enamored with American political and social developments, with democracy and pluralism, but they are more taken with U.S. technology. The United States is not just the nation of George Washington, Thomas Jefferson, Abraham Lincoln, Frederick Douglass, and Elizabeth Cady Stanton, but also of Thomas Edison, Henry Ford, the Tennessee Valley Authority, and the Manhattan Project. These reinforced the belief throughout the world that America was *the* technological giant of the world. Until the loss of *Challenger* and a few other embarrassing missteps, NASA and its accomplishments

symbolized more than any other institution America's technological creativity. That symbolism, misplaced, as it might have been all along, accounts more than any other for the difficulties the agency has felt in the recent past. Every NASA failure raises the question of American technological virtuosity in the world, and questioning of much American capability in so many other areas is already underway that setbacks in this one are all the more damaging to the American persona. American doubts increased with every perceived failure in the space program.¹⁹

This is largely because Apollo created a culture of confidence in science and technology. Every project was supposed to succeed. No exceptions. Such a mythology has ensured that NASA cannot fail in its efforts, and if it does it invariably conjures up recollection of the agency that put an American on the Moon in 1969, a feat of admittedly astounding technological virtuosity, and compares it with current failures to meet challenges.

This, in reality, is so much nostalgia. As the whole record of human and instrumented flight reveals, NASA did not operate a failure-free space program during that time. But its image was carefully crafted so as to avoid pejorative aspects of governmental activity. Politicians and pundits also presented the Apollo program as something that was difficult to accomplish. Part of its worthiness was contained in the difficulty that it possessed. Human flights to the Moon and robotic probes to the planets seemed incredibly perplexing to a public barely accustomed to rocketry. They even appeared difficult to NASA engineers.²⁰

The Space Race thus provided a national self-examination, a trial of the ability of Americans and their government to overcome great obstacles, just as the mobilization for World War II had tested the American system two decades earlier. As the decade progressed, and the Apollo flights began, a government whose space program had begun with exploding rockets put its reputation on the line and carried out one successful mission after another, each a more complex or daring task. Ever increasing through the early 1960s, a culture of confidence grew up around the U.S. civil space program.

In the process, we forgot that failures had always been a part of the effort. We were reminded of that in January 1967 when the Apollo 1 crew was lost during a ground test, but NASA weathered that tragedy and moved forward. Even it was viewed in retrospect as a triumph of sorts, as observers pointed to the recovery from the fire as necessary in successfully completing the landings. Finally, even such a public failure as Apollo 13 has been interpreted as a success story. Flight Director Eugene Kranz has been credited, erroneously as it turned out, with the saying uttered during the desperate hours in Houston as NASA engineers worked to bring the crew home alive, that "failure is not an option." While

one must give Kranz high marks for never giving up on the possibility of successfully recovering the crew, it is ironic that neither Kranz nor too many others had realized that the mission has already failed, and failed catastrophically.²¹

The Astronaut as Icon

Something that certainly surprised NASA leaders was the public embracing of the astronauts. The astronaut as a celebrity and what that has meant in American life never dawned on them beforehand. To the surprise and ultimately consternation of some NASA leaders, they immediately became national celebrities and the leading symbols of the fledgling space program.²² Even so, both NASA and the press contrived to present the seven astronauts as embodiments of the leading virtues of American culture in the 1950s. Their public images were as carefully molded and controlled as those of movie idols or rock music stars.²³

The press was fascinated by the apparent willingness to risk their lives for the good of a national cause. Tom Wolfe captured the method of this imagery some twenty years later in *The Right Stuff*. The astronauts were not brave in a stupid, unknowing way. Any fool could throw his or her life away. “No, the idea here...” wrote Wolfe, “seemed to be that a man should have the ability to go up in a hurling piece of machinery and put his hide on the line and then have the moxie, the reflexes, the experience, the coolness, to pull it back in the last yawning moment—and then to go up again *the next day*.”²⁴

Describing that first press conference, Wolfe cut to the essential question that the reporters kept circling around. Were the astronauts afraid they were going to die?

The bravery of the astronauts touched emotions deeply seated in the American experience of the twentieth century. Each astronaut would sit alone in the single-seat Mercury capsule, like the “lone eagle” Charles Lindbergh crossing the Atlantic Ocean thirty-two years earlier. Facing personal danger, they fit the myth of frontier law enforcers, whose grit had filled the substance of Hollywood matinees and feature films.²⁵ As military test pilots, they recalled the sacrifices required to produce the Allies’ victory in World War II, at a time when military service was still held in high regard. Their personal exploits even recalled the substance of one of America’s most popular sporting events.²⁶

Test pilots and race car drivers were thought to be a hard-living, hard-drinking lot.²⁷ The astronauts, about whom the public clamored for personal details, were cast by the press in the image of clean-cut “all American” boys whose mythical lives popularized family-oriented television programs during the 1950s

and 1960s. The astronauts were portrayed as brave, God-fearing, patriotic individuals with loving wives and children. Addressing a joint session of Congress after his orbits around the world, astronaut John Glenn announced to the wildly cheering crowd that “I still get a real hard-to-define feeling down inside when the flag goes by” and got away with it.²⁸

The astronauts, of course, were the “main architects” of their image.²⁹ But they appeared at a time when NASA desperately needed to inspire public trust in its ability to carry out the nation’s goals in space. Rockets might explode, but the astronauts shined. The astronauts seemed to embody the personal qualities in which Americans of that era wanted to believe: bravery, honesty, love of God and country, and family devotion. How could anyone distrust a government agency epitomized by such people? The trust that the public placed in the astronauts spread through NASA and to the government as a whole. As one of the *Life* reporters summarized:

“*Life* treated the men and their families with kid gloves. So did most of the rest of the press. These guys were heroes, most of them were very smooth, canny operators with all of the press. They felt that they had to live up to a public image of good clean all-American guys, and NASA knocked itself out to preserve that image.”³⁰

They have remained so to the present, and represent one of the truly great examples of myth making in modern American history. All astronauts are viewed as virtuous and heroic, cool under pressure and technologically dexterous. They are sought after like only a few other celebrities. Two recent anecdotes demonstrate this level of iconography.

First, in early June 1999, I attended a formal dinner at the annual National Space Forum. Seated at the table with me were nine other people, one of whom was Frederick Hauck, an astronaut on three Space Shuttle missions but now working in the private sector. Hauck’s name, like so many of the astronauts of the Shuttle era, is unknown to most people and no one at the table except for me was aware of his status. As we talked, however, he casually mentioned one of his Shuttle flights; thereupon those at the table began fawning over him and asking for his autograph. Hauck and I discussed this afterward and thought it was the height of myth-making that one might be transformed in the twinkling of an eye into a hero merely by being identified as an astronaut.



Figure 3: Apollo 11 astronauts in their glory, in a typical motorcade parade, in Bogotá, Columbia, following their mission. They visited 24 countries and 27 cities in 45 days (NASA Photo 70-H-1554).

Second, on July 20, 1999, NASA celebrated the thirtieth anniversary of the first lunar landing, and the crew of Apollo 11 was in Washington for the festivities. Aside from the rather tiresome autograph seekers, none other than Congressman David Rogin demanded of the NASA Administrator that he be allowed to bring his twin daughters to meet the crew and have their pictures taken with them, and that they obtain their autographs. We put Rogin off repeatedly, but he showed up at one of the events anyway, without his daughters whom he said were sick that day, and demanded to be photographed with them and to have their autographs. The crew, confronted with an aggressive member of Congress, agreed to the photograph but not autographs.

Neil Armstrong, Buzz Aldrin, and Michael Collins are genuine heroes, but it is curious that a respected leader of the nation would blatantly use his power for such a thing. The only answer is the overpowering perception of the astronaut as icon.

Technological Virtuosity

Project Apollo was a triumph of management in meeting the enormously difficult systems engineering and technological integration requirements, and the ability of NASA to rise to that challenge has forever colored perceptions of the agency. James E. Webb, the NASA Administrator at the height of the program between 1961 and 1968, always contended that Apollo was much more a management exercise than anything else, and that the technological challenge, while sophisticated and impressive, was also within grasp. More difficult was ensuring that those technological skills were properly managed and used. Webb's contention was confirmed in abundance by the success of Apollo.

More to the point, NASA personnel employed a "program management" concept that centralized authority over design, engineering, procurement, testing, construction, manufacturing, spare parts, logistics, training, and operations. The management of the program was recognized as critical to Apollo's success in November 1968, when *Science* magazine, the publication of the American Association for the Advancement of Science, observed:

"In terms of numbers of dollars or of men, NASA has not been our largest national undertaking, but in terms of complexity, rate of growth, and technological sophistication it has been unique.... It may turn out that [the space program's] most valuable spin-off of all will be human rather than technological: better knowledge of how to plan, coordinate, and monitor the multitudinous and varied activities of the organizations required to accomplish great social undertakings."³¹

Understanding the management of complex structures for the successful completion of a multifarious task was a critical outgrowth of the Apollo effort. The memory of a successful organization, one that can accomplish any task, has been with us ever since.

Environmental Revelations

By sheer serendipity, Apollo taught humanity about itself, and in the process altered our perception of the world on which we live. Apollo 8 was critical to this fundamental change, as it treated the world to the first pictures of the Earth from afar. Writer Archibald MacLeish summed up the feelings of many people when he wrote at the time of Apollo, that: "To see the Earth as it truly is, small,

and blue and beautiful in that eternal silence where it floats, is to see ourselves as riders on the Earth together, brothers on that bright loveliness in the eternal cold—brothers who know now that they are truly brothers...³² The modern environmental movement was galvanized in part by this new perception of the planet and the need to protect it and the life that it supports.³³

Conclusion

These comments offer the beginning of an exploration of the meaning of Apollo for the American people. There is an important memory of the project held by many of us. In the future I plan to explore these and other themes in greater depth. I would invite your thoughts on these exploratory comments.

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⁷ *The Holy Scriptures* (Independence, MO: Herald Publishing House, 1944 ed.), John 18:38.

⁸ Steven J. Dick, *Plurality of Worlds: The Origins of the Extraterrestrial Life Debate from Democritus to Kant* (New York: Cambridge University Press, 1982), contains a superb discussion of the possibility of life beyond Earth before an era in which anything approaching definitive research could be undertaken to discover the truth.

⁹ Quoted in Patrick Moore, *New Guide to the Moon* (New York: W.W. Norton and Co., 1976), p. 128.

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¹¹ See W. David Compton, *Where No Man Has Gone Before: A History of Apollo Lunar Exploration Missions* (Washington, D.C.: NASA SP-4214, 1989); David M. Harland, *Exploring the Moon: The Apollo Expeditions* (Chichester, UK: Springer Praxis, 1999); Don E. Wilhelms, *To a Rocky Moon: A Geologist's History of Lunar Exploration* (Tucson: University of Arizona Press, 1993); and Paul D. Spudis, *The Once and Future Moon* (Washington, D.C.: Smithsonian Institution Press, 1996).

¹² Curator for Planetary Materials, Johnson Space Center, "Top Ten Scientific Discoveries Made During Apollo Exploration of the Moon," October 28, 1996, NASA Historical Reference Collection, NASA History Division, Washington, D.C.

¹³ This has been demonstrated too many times to be seriously questioned. See Walter A. McDougall, *... the Heavens and the Earth*, pp. 141-235; Logsdon, *Decision to Go to the Moon*; Harvey Brooks, "Motivations for the Space Program: Past and Future," in Allan A. Needell, ed., *The First 25 Years in Space: A Symposium* (Washington, DC: Smithsonian Institution Press, 1983), pp. 3-26; Rip Bulkeley, *The Sputniks Crisis and Early United States Space Policy* (Bloomington: Indiana University Press, 1991).

¹⁴ NASA Office of Space Station, *The Space Station: A Description of the Configuration Established at the Systems Requirements Review (SSR)* (Washington, DC: Technical and Administrative Services Corporation, June 1986).

¹⁵ Leonard David, "Space Report: Planning Missions to the Moon and Mars," *Ad Astra*, December 1990, pp. 16-20. See also John M. Logsdon, "Looking for Leadership," *Ad Astra*, July/August 1990, pp. 10-14.

¹⁶ See, for example, George M. Low, Team Leader, to Mr. Richard Fairbanks, Director, Transition Resources and Development Group, "Report of the NASA Transition Team," December 19, 1980, NASA Historical Reference Collection.

¹⁷ Tom Horton, "On Environment: If America Could Send a Man to the Moon, Why Can't We . . .?" *Baltimore Sun*, July 22, 1984.

- ¹⁸ Perry Miller, "The Responsibility of a Mind in a Civilization of Machines," *The American Scholar*, 31 (Winter 1961-1962), pp. 51-69.
- ¹⁹ Thomas Park Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970* (New York: Viking, 1989), p. 2.
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- ²¹ Jim Lovell and Jeffrey Kluger, *Lost Moon: The Perilous Voyage of Apollo 13* (Boston: Houghton Mifflin Co., 1994).
- ²² T. Keith Glennan, *The Birth of NASA: The Diary of T. Keith Glennan*, J.D. Hunley, ed. (Washington, D.C.: NASA SP-4105, 1993), pp. 20-21.
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- ²⁴ Wolfe, *The Right Stuff* (New York: Farrar, Straus, and Giroux, 1979), p. 24.
- ²⁵ Richard Slotkin, *Gunfighter Nation* (New York: Atheneum, 1992).
- ²⁶ Tom Wolfe, "The Last American Hero," in Wolfe, *The Kandy-Kolored Tangerine-Flake Streamline Baby* (New York: Farrar, Straus, and Giroux, 1965).
- ²⁷ Chuck Yeager and Leo Janos, *Yeager: An Autobiography* (New York: Bantam Books, 1985).
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- ²⁹ Don A. Schanche to P. Michael Whye, December 28, 1976, NASA Historical Reference Collection.
- ³⁰ Dora Jane Hamblin to P. Michael Whye, January 18, 1977, NASA Historical Reference Collection.
- ³¹ Dael Wolfe, Executive Officer, American Association for the Advancement of Science, editorial for *Science*, November 15, 1968.
- ³² Quoted in Oran Nicks, ed., *This Island Earth* (Washington, D.C.: NASA SP-250, 1970), p. 3.
- ³³ R. Cargill Hall, "Project Apollo in Retrospect," June 20, 1990, pp. 25-26, in "R. Cargill Hall" Biographical File, NASA Historical Reference Collection.