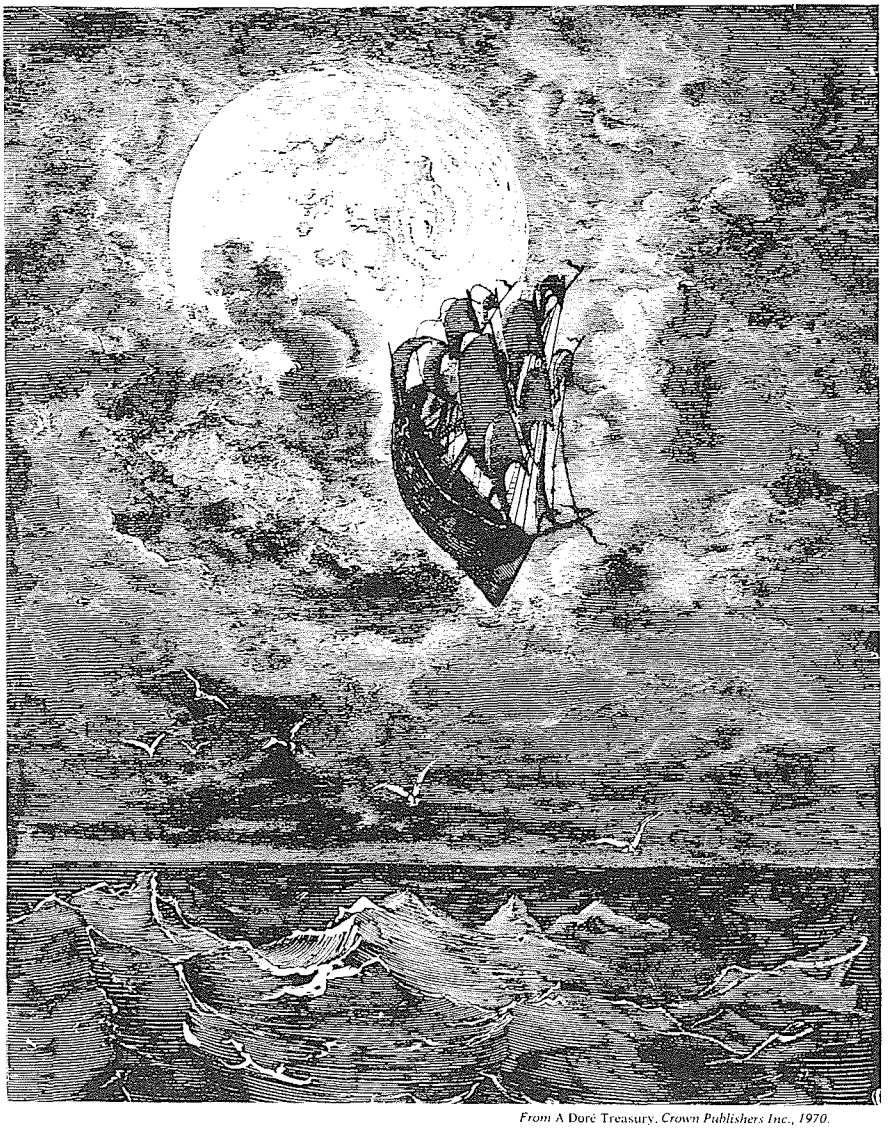

From A Doré Treasury. *Crown Publishers Inc., 1970.*

When two U.S. astronauts stepped on the lunar surface on July 20, 1969, they were, in a sense, the spiritual heirs of Joseph Atterley, an early American science-fiction writer, who imaginatively described A Voyage to the Moon *in 1827. "After various trials," Atterley wrote, "and many successive improvements, in which our desires increased with our successes, we determined to penetrate the aerial void as far as we could." The romantic depiction of a "spacecraft" returning from the moon (above) is by French illustrator Gustave Doré (1833–83).*

The Space Effort

News of U.S. space exploration gradually faded from Page One after Neil Armstrong's "one small step" to the lunar surface 11 years ago, even as other nations began taking small steps of their own. Some, like France and Japan, have made giant leaps. The Soviets, unfazed by defeat in the symbolic moon race, have built up a broad-based program that, in terms of size, is second to none. What of the United States? NASA is a shadow of its former ebullient self—and is taking a back seat to the Pentagon. U.S. hopes center on the troubled space shuttle. Here, journalist John Noble Wilford reviews the history of the space effort; historian Walter McDougall looks at developments abroad; NASA historian Alex Roland weighs the practical "payoffs" of space exploration against the disappointments; and historian Bruce Mazlish ponders the disparity between our achievements in space and the tepid public response.

RIDING HIGH

by John Noble Wilford

On July 20, 1969, two American astronauts planted human bootprints on the gray regolith of the moon. It was one of the most impressive achievements in the history of Man, and it was recognized as such at the time. Yet, almost immediately, Congress and the White House took an ax to the budget of the National Aeronautics and Space Administration (NASA). There was no public outcry. While NASA, during the 1970s, sponsored a series of unmanned missions to Mercury, Venus, Mars, Jupiter, and Saturn, all of these explorations were fruits of initiatives begun during the '60s. Future space spectaculars, conceived during the '70s for implementation during the '80s and beyond, have, by and large, remained on the drawing boards.

The American space effort is not *entirely* dormant. Sometime in 1981, if no more technical problems intrude, a revolutionary flying machine, part spacecraft, part airplane, will blast off from the Kennedy Space Center in Florida. This vehicle, the space shuttle Columbia, will carry American astronauts into earth orbit for the first time in six years. More importantly, it should usher in a new era in the space age, an era of routine orbital comings and goings.

But even the space shuttle illustrates how times have changed. Its purpose—hauling freight into orbit—is more mundane than shooting for the moon. It has been built on a shoestring budget, not with the lavish transfusions of cash that sustained Apollo. And the American Republic is not waiting breathlessly for the shuttle's success.

Sputnik vs. "Stayputnik"

By contrast, at the beginning of the space age almost a quarter century ago, nothing seemed more important to many Americans than getting something—anything—up into the sky. Do it, then count the cost and consider the possible substantive benefits. That was the attitude soon after the Soviet Union launched the satellite Sputnik 1 on October 4, 1957.

At the time of Sputnik, the United States had already embarked on a modest space program. In July 1955, President Dwight D. Eisenhower launched the Vanguard project, under the auspices of the Navy, as part of U.S. participation in the 1957–58 International Geophysical Year. (Vanguard's mission was to put small, unmanned satellites into earth orbit.) Soon thereafter, the Soviets made a similar public commitment. Initially, neither program received much public attention.

Sputnik caught the Eisenhower administration by surprise. Its spokesmen sought at first to dismiss Sputnik as a "neat technical trick" and "silly bauble." But Soviet Premier Nikita Khrushchev, more full of himself than ever, boasted that Sputnik demonstrated the superiority of communism over capitalism. In a Cold War atmosphere, such a bald challenge

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"Fill 'er up—I'm in a race" was the caption of this 1961 Herblock cartoon. The impetus for U.S. space exploration was linked not to any compelling scientific rationale but to the political exigencies of the Cold War.

© *1961 by Herblock in the* Washington Post.

had a riveting effect. Dr. James R. Killian, Jr., the MIT president who became White House science adviser in 1957, later recalled that Sputnik "created a crisis of confidence that swept the country like a windblown forest fire." The fire was only fanned when, in December 1957, the Navy's first Vanguard rocket blew up on the launching pad. Headline writers around the world dubbed Vanguard the "Stayputnik."

Increasingly, Congress and the public demanded reassurance—and action.

After the Vanguard embarrassment, Eisenhower unleashed the Army rocket crew in Huntsville, Alabama, led by Dr. Wernher von Braun, developer of the Third Reich's lethal V-2. Von Braun had been ready to launch a satellite for two years, but his proposals were repeatedly rejected out of deference to Vanguard. On January 31, 1958, Von Braun's Jupiter-C rocket fired the 14-kg. Explorer 1 satellite into orbit.* Encouraged by success, Washington now made plans for an even more ambitious program. The space race was on.

But what team would the United States field? The Army, Navy, and Air Force all vied for the assignment. So did the Pentagon's Advanced Research Projects Agency. So did the Atomic Energy Commission.

And then there was the National Advisory Committee for Aeronautics (NACA), an obscure group of part-time scientific

*1 kilogram is approximately 2.2 pounds.

consultants who oversaw the operation of a handful of federal flight-technology laboratories. Science adviser James Killian was impressed by the "special charm" of the sleepy little agency. It had some of the best engineering talent in the country, was under civilian control (which Eisenhower preferred), was too little known to have been caught up in partisan politics, and was a stranger to the red tape of government bureaucracy. NACA got the job.

Reconstituted as the National Aeronautics and Space Administration in October 1958, the agency drew under its umbrella NACA's five labs and 8,000 technicians; the California Institute of Technology's Jet Propulsion Laboratory; the Navy's Vanguard project; and the Army's 4,000-man Von Braun rocket team. At the insistence of Congress, however, the Pentagon was allowed to maintain a separate space effort.

NASA started out with a budget of $330 million. It was simply assumed that America's expanded space program, like the USSR's, would include a *manned* space effort, and NASA acted on that assumption. With a sheaf of engineering designs from the old NACA files, the agency immediately called for bids to build a manned spacecraft. By December, 1958, NASA announced that it would begin recruiting astronauts from the ranks of test pilots. (Seven were eventually chosen.) Within a year after Sputnik, Project Mercury was under way.

Not everyone was comfortable with this swift turn of events. In a 1960 speech, shortly after he left the White House, Killian reflected the concerns of many scientists:

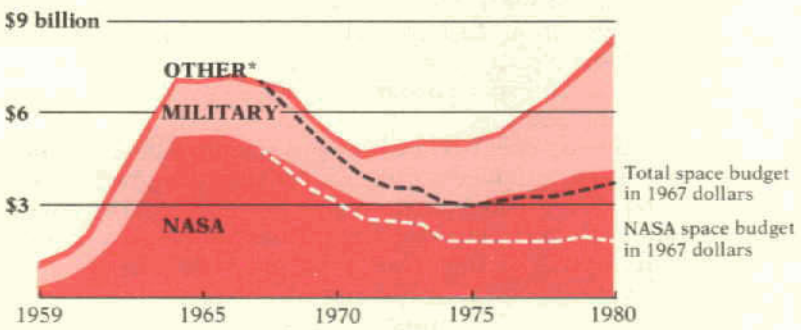
> It may be argued that our man-in-space program is trying to proceed too fast and that it is on the way to becoming excessively extravagant and will be justified only as a competitor for world prestige with the Soviet man-in-space program. Many thoughtful citizens are convinced that the really exciting discoveries in space can be realized better by instruments than by man.

But competition for world prestige was not a trivial matter during the Cold War — if it ever is for a world power — and the manned flight planners were not to be denied.

Emerging from these formative months of the space program were several trends and conflicts that persist. They were:

¶ Two national space efforts. One is open, highly visible, and civilian-controlled — the NASA program of manned flight, scientific and commercial "applications" satellites, and the unmanned exploration of the planets. The other is military and conducted mostly in secret — the Pentagon program of picture-

THE U.S. SPACE BUDGET, 1959–80



*Includes the U.S. Departments of Energy, Commerce, Interior, and Agriculture, and the National Science Foundation.

Source: Office of Management and Budget.

The U.S. *civilian* space budget, represented almost entirely by NASA, began declining in 1966; during the 1970s, high inflation further eroded NASA's buying power. Yet, the total U.S. space budget has actually picked up in recent years following a decade-long slump. The reason: a new emphasis on the military uses of outer space.

Details of the military program are unpublicized. The Pentagon launches about a dozen satellites every year, their purpose invariably described as "development of spaceflight techniques and technology." All branches of the armed services use satellites—for navigation of missiles, ships, aircraft, and submarines; early warning of nuclear attack; weather forecasting; arms-control verification; photographic and electronic reconnaissance; and communications.

Early-warning satellites can detect exhaust emissions from missiles as soon as they are launched. The multipurpose satellites of the "Big Bird" series can photograph items as small as one foot in diameter from an altitude of 100 miles; the film is processed on board, scanned by a laser, and converted into electronic signals that are transmitted back to Earth and "enhanced" by computers. Electronic intelligence (or "Elint") satellites, also known as "ferrets," can intercept satellite and ground communications. The U.S. Air Force is proceeding with its 24-satellite NavStar system, which should be operational by the mid-1980s, and which will be capable of handling almost all of the military's navigation needs.

In the nuclear age, a military establishment is only as good as its electronic "eyes." For that reason, the United States, like the Soviet Union, has been developing satellite-borne laser and particle-beam weapons to "blind" hostile spacecraft. The Pentagon will spend nearly $280 million on laser and particle-beam R&D next year.

taking "spy" satellites and of orbital vehicles for military communications and navigation.

¶ A split between the advocates of manned and unmanned space exploration. Eisenhower and Killian had favored the latter, but post-Sputnik momentum gave more life to the former. The manned space program in NASA eventually became the tail wagging the dog.

¶ An uneasy coexistence between scientists and engineers within NASA. The engineers built the rockets, designed the electronics, and developed all the other systems without which there could have been no space flight. Inevitably, they assumed operational control of the space program. The engineers generally pushed manned flight because it represented the greatest engineering challenge. Scientists chafed at their secondary role. They feared, too, that the expense of manned space flight would drain money away from non-space research.

Promising the Moon

On a pledge to "get this country moving again," John F. Kennedy was elected President in 1960. The economy was sluggish, there was concern about a "missile gap," and, for all its efforts, the United States still lagged behind the Soviet Union in space. On April 12, 1961, less than four months after Kennedy's inauguration, the Russians jumped further ahead by putting the first man into orbit, Yuri A. Gagarin.

Kennedy called a meeting two nights later with James E. Webb, a North Carolina lawyer-businessman and the new head of NASA. "Can we go around the moon before them? Can we put a man on the moon before them?" Kennedy asked, according to Hugh Sidey, a *Time* correspondent who happened to be at the White House that night. Kennedy listened to a recitation of problems and costs. "If somebody can just tell me how to catch up," he said finally, "there's nothing more important."

The Bay of Pigs fiasco came three days later. Kennedy was now more concerned than ever that something be done to enhance the American image abroad—and, not incidentally, his own political prospects at home. He asked Vice President Lyndon Johnson, a space enthusiast, to explore in detail the possibility of a moon landing to "leapfrog" the Soviets. As the nation cheered Alan B. Shepard's first Mercury flight (a 15-minute suborbital hop on May 5, 1961, hardly in the Gagarin orbital class), NASA and Pentagon officials hammered out the final version of the moon-landing plan for Johnson. On May 25, President Kennedy announced his decision to the world:

> 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. 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.

It was a typically American response, optimistic and expansive. Congress went along, after little debate, and mobilization for the Apollo Project got under way. The building of the necessary rockets, spacecraft, and ground-support facilities would require the concerted efforts of scores of university laboratories, some 20,000 industrial contractors, and more than 400,000 technicians and skilled workers—at a total cost of about $24 billion. It was a massive enterprise.

It was also well managed. One of the agency's first decisions was to reject the "arsenal" model: creating manufacturing facilities owned and operated by the government. While this was the Army's approach, NASA instead followed the Air Force's lead and farmed out most of its work to private companies like McDonnell and Rockwell International. It thus could draw on the full range of American know-how—and remain unencumbered by a large, permanent bureaucracy. (At the peak of the Apollo program, NASA had only 36,000 employees.)

The concept also had the political advantage of spreading the Apollo wealth to every state of the Union. When Washington Congressman Thomas Pelly, a sometime critic of the Apollo program, toured Cape Canaveral in 1963, a NASA official was there to make sure he saw the manufacturer's name on a huge crane: Colby Crane Corp., a Seattle company. The roots of Apollo spread deep into the U.S. economy. It was pork-barrel politics, but it ensured that NASA would not be a victim of neglect.

NASA also adopted something called PERT—for Program Evaluation and Review Technique—which had been developed by the Navy for the Polaris missile project. Under PERT, each project manager sorted out all the tasks that had to be done, established when they had to be done and in what sequence, and determined how long each should take. The result was a row of parallel paths charted from the beginning of the project, running past critical points, and converging toward the end in a finished product. Without PERT, there might have been chaos.

But the Apollo program did not go uncriticized, even at the outset. Former President Eisenhower, during a 1963 breakfast with Republican Congressmen, called the venture "nuts," and Philip Abelson, editor of the influential journal *Science*, told

Congress that same year 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.

Opinion polls conducted during the 1960s are revealing. Public approval of the U.S. space program generally jumped after a successful Russian effort; the approval rating was almost unaffected by American achievements. Further, when respondents were given a list of certain government activities and asked which ought first to be cut out of the budget in the event of a financial crisis, the space program usually appeared on top. Even after the Vietnamese communists' 1968 Tet offensive demoralized Washington, people were *most* willing to cut off funding for Apollo, *least* willing to trim spending for the Vietnam War.*

Tragedy and Triumph

But support for the space effort remained strong in Congress, where it mattered. No NASA administrator before or since knew how to play Washington's political game better than James Webb, who skillfully cultivated his benefactors on Capitol Hill. He was particularly fortunate to have as an ally Olin Teague, the abrasive but powerful Texas Democrat who headed the House subcommittee on manned space flight. "Tiger" Teague was known as a fiscal conservative, not one to back foolish schemes. When he stressed the military potential of space, the danger of yielding mastery of the high frontier to the Soviets, and the "whole spectrum of scientific and technological accomplishment" that would flow from Apollo to every congressional district, his Hill colleagues listened.

By the time of John F. Kennedy's assassination on November 22, 1963, the six manned Mercury flights were over, and the interim two-man Gemini Project was under way. The Gemini flights in 1965–66 clearly advanced the United States beyond known Soviet capabilities. The lunar-landing goal now seemed within easy reach.

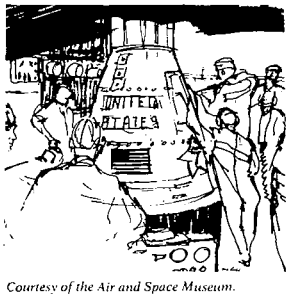
Then tragedy struck. On the afternoon of January 27, 1967, fire erupted in the first Apollo spacecraft during a launch-pad test, killing astronauts Virgil "Gus" Grissom, Edward White, and Roger Chaffee. When NASA and congressional investigators uncovered evidence of poor workmanship and lax quality control, the Apollo spacecraft had to be redesigned, causing an 18-month delay — and a new round of embarrassing questions

* See John V. Moeser, *The Space Program and the Urban Problem*, Washington: George Washington University, 1969.

"NOTHING NEW"

On May 5, 1961, astronaut Alan B. Shepard, Jr. became the first American to be launched into space. For all the excitement on the ground, Shepard himself simply sat in his capsule, like the chimpanzee that had made a similar flight three months before. As Tom Wolfe observes in The Right Stuff, *Shepard found the experience to be anticlimactic:*

The gauges told him he was weightless. After reaching this point so many times on the procedures trainer, he knew he must be weightless. But he felt nothing. He was so tightly strapped and stuffed into this little human holster there was no way he could float as he had in the cargo bays of the big C-131s [Samaritans]. He didn't even experience the tumbling sensation he felt when riding backseat in the F-100s [Supersabres] at Edwards. *It was all milder!—easier!* No doubt he should say something to the ground about the sensation of weightlessness. It was the great unknown in space flight. *But he didn't feel anything at all!* He noticed a washer floating in front of his eye. . . . It was just floating there in front of his left eye. That was the only evidence his five senses had to show that he was weightless. . . . He had no sensation of speed at all, even though he knew he was going Mach 7, or about 5,180 miles an hour. There was nothing to judge speed by. There were no vibrations at all in the capsule. . . . It was as if he were standing still, parked in the sky. The sounds of the interior of the capsule, the rising and falling and whirring and moaning of the inverters and the gyros . . . the cameras, the fans . . . the busy little kitchen—they were exactly the same sounds he had heard over and over in the simulations inside the capsule on the ground at the Cape. . . . There was nothing new going on! . . . He knew he was in space, but there was no way to tell it! . . . He looked out the periscope, the only way he had of looking at the Earth. *The goddamned gray filter!* He couldn't see any colors at all! He had never changed the filter! The first American to ever fly this high above the Earth—and it was a black-and-white movie. Nevertheless, they'll want to know about it—"What a beautiful view!" he said.



"Securing the Hatch" by Robert McCall.

Courtesy of the Air and Space Museum.

MANAGING INFINITY

How much freedom should nations have to explore space? What kinds of military activities should be barred? How much "space law" do we need?

As the space age began in 1958, an enthusiastic United Nations deemed space law to be within its purview and set up the Committee on the Peaceful Uses of Outer Space (COPUOS). COPUOS has since midwived most of what little space law there is, including the 1967 Outer Space Treaty (which prohibited claims of national sovereignty in space and extended the UN charter to the heavens) and several "conventions" governing astronaut rescue (1968), damage liability (1973), and spacecraft registration (1976). Other agreements, including the controversial Draft Treaty on the Moon, are pending.

"Space for peace" advocates criticize the vagueness of space law and the lack of strict international controls. Where "air space" leaves off and "outer space" begins, for example, has never been defined. Nor has the distinction between "aggressive" and "military" use of space. There is no legal formula to ensure that space exploration is actually carried out "for the benefit of all mankind."

In the early years, many critics felt that subsuming all national space programs under some new UN agency was the only answer. That approach still has obvious drawbacks. First, the United States and Soviet Union will not accept it. Second, historically, technology has developed most efficiently in the hands of an integrated *national* team. Third, too much international regulation would stifle competition. It is significant that nations advocating detailed regulation are those without space programs.

Some observers, like Herbert Reis, counsel to the U.S. Mission to the United Nations, defend the current reliance on "vague principles" as the only practical means of guiding man's future in space. Technology moves too fast—and legal committees move too slowly—for close regulation. Better, then, to rely on the "spirit" of the law. The spirit may be unenforceable, but so is all international law, no matter how carefully crafted.

As for the militarization of space, the issue is not clear-cut. Certain prospects—orbiting A-bombs and testing nuclear weapons in outer space—are, of course, horrifying, but both have been outlawed. (Space-based atomic weapons proved to be impractical anyway, as both Washington and Moscow discovered.) Other military uses of space are, perhaps, laudable. Spy satellites, for example, deter surprise attacks and help verify arms control agreements. Futuristic space weapons such as lasers—designed to neutralize satellites and missiles—could one day render obsolete the megaton monsters of the current "primitive" nuclear missile age.

—Walter A. McDougall

about the whole effort. By this time, NASA was relying more on sheer momentum than popular good will to see Apollo through.

Finally, on July 16, 1969, Apollo 11 was launched into the history books. Four days later, astronaut Neil A. Armstrong made his "giant leap for mankind" as he stepped down to the dead lunar surface. President Kennedy's goal had been achieved, within the decade, even as manned Soviet spacecraft were still confined to low earth orbit.

Now the question became: What next?

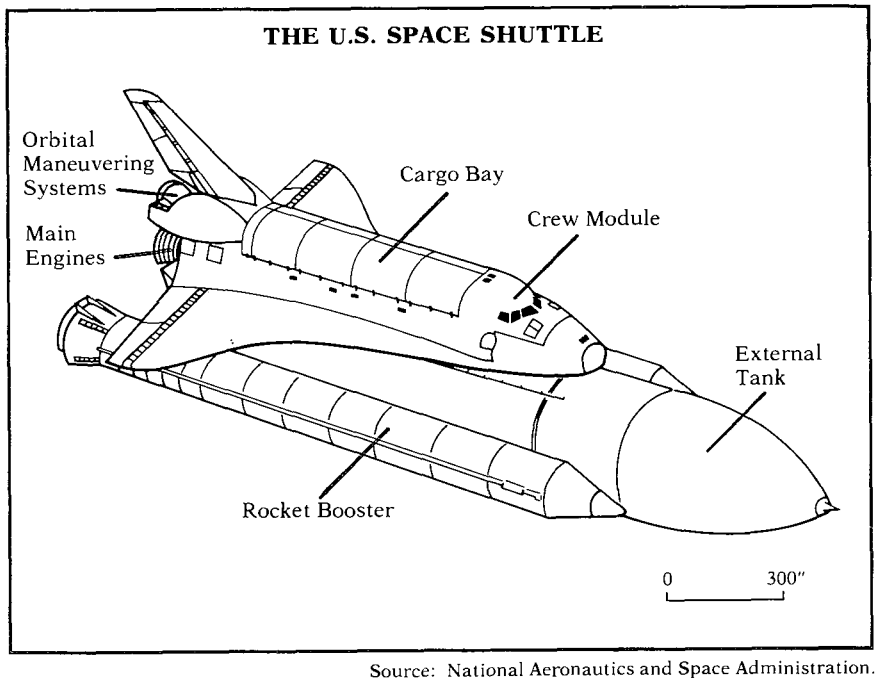
Banished from Eden

With the end of the "beat-the-Russians" era came a long, troubled period of adjustment for NASA that has not yet ended. NASA should not have been surprised. From a peak budget of nearly $6 billion in 1965, at the height of Apollo development, NASA's fortunes had been declining every year. Several "follow-on" proposals had either been rejected, postponed, or scaled down. NASA, nonetheless, counted on a tide of Apollo 11 enthusiasm to float its bold plans for the future. To a presidential panel reviewing space policy for the post-Apollo period, NASA's Thomas O. Paine proposed as "the next natural step" permanent space stations in earth orbit, bases on the moon, manned flights to Mars by the mid-1980s (or at least by the end of the century), and a fleet of reusable "spaceplanes" for shuttling to and from space.

But NASA had misread the national mood. While President Richard M. Nixon declared Apollo 11 to be the greatest event since the Creation, his administration now seemed to feel that expulsion from the Garden of Eden was the next logical step. Political support for space had never been weaker. The racial and campus turmoil of the late 1960s had prompted much of the press and some politicians to view the space effort as the paramount symbol of "misplaced national priorities." With detente, the Soviet threat no longer seemed so ominous. New antitechnology tremors were felt throughout the land—against nuclear power, atomic weapons, even automobiles.

NASA was told to scrap its plans for large space stations and manned missions to Mars. Three lunar landings were cancelled. A "grand tour" of the outer planets by robot spacecraft was abandoned. Prepare to make do with budgets well below $4 billion, NASA was informed, and inflation be damned. The only major proposal to survive was the spaceplane—the shuttle.

As originally conceived, the space shuttle featured two components, both reusable. One would be a big rocket booster



Source: National Aeronautics and Space Administration.

the size of a Boeing 747 airliner that would provide the initial thrust, then be piloted back to runway landings and used again. The second stage would be an "orbiter" the size of a Boeing 707 airliner, which would ride atop the booster and, after separation, propel itself into orbit. When its mission was accomplished, it too would be flown back for a runway landing, and likewise reused. By eliminating throwaway rockets and one-flight spacecraft, NASA believed that a fleet of shuttles would, in time, dramatically reduce the cost of space flight.

Staggered by the $10 billion price tag, President Nixon's Office of Management and Budget sent the proposal back to the drawing board. NASA designed a less expensive ($6 billion), partly reusable shuttle. The orbiter (smaller, about the size of a DC-9) would still be piloted and capable of return and reuse. But its fuel tank would be jettisoned and destroyed, and its unmanned rocket boosters would drop by parachute into the ocean and have to be recovered and extensively refurbished before reuse. Dr. James C. Fletcher, the NASA Administrator at the time, persuaded President Nixon to buy a fleet of five low-budget shuttles. The project was officially announced in Janaury 1972.

Seven years later, when the planned 1979 launching date

came and went and the shuttle Columbia was still on the ground, plagued by engine failures and a suspect heat-protection coating, the administration of Jimmy Carter grew concerned. Its appointed "blue-ribbon" consultants discovered that, while the shuttle's basic technology was sound, the program had suffered from years of economic malnutrition. Rather than asking for more money—and risking possible cancellation—NASA had taken engineering shortcuts and stretched out procurements, a practice that deferred (but increased) costs. A "routine" fire in 1979 caused a four-month hiatus in the engine test program; in Apollo, there would have been spares enough to allow testing to resume in days. "We tried to poorboy it and got caught," one NASA official remarked.

Once such problems were understood, the Carter administration agreed to back substantial increases in shuttle expenditures for 1980 and 1981, and Congress reluctantly went along. Yet the forces influencing the positive decision had changed since Project Mercury days.

A New Beginning?

The most important factor now was the Pentagon. Since 1958, the United States has spent some $120 billion on space, of which about $50 billion has gone to military-related activities. While the civilian program used to get the heftier share by far, the Defense Department now takes one-half of the annual space pie. Concern over Soviet "killer" satellites and laser and particle-beam weapons virtually guarantees that the Pentagon's stake in space will continue to increase. The Defense Department has been counting on the shuttle (which will have at least two vehicles in service at all times) to deliver its communications and reconnaissance satellites. Without military backing, in my opinion, the space shuttle would now be dead.

A secondary pressure was commercial. After 4 test flights, according to NASA, 2 shuttle flights booked by paying customers—for communications satellites, primarily—are planned for 1982, 9 for 1983, 17 for 1984, 20 for 1985, and 22 for the first half of 1986. As the shuttle's prospects lapsed into uncertainty, these customers were nervously pressing Washington for reassurance, even threatening to take some of their business to the European Space Agency's Ariane rocket, which is now being tested.

A third factor was scientific. Only a few major scientific missions are planned for the 1980s, but all of them—Galileo to orbit Jupiter and probe its atmosphere; an American-European mission to orbit the poles of the sun; the Space Telescope for

viewing distant reaches of the universe—depend on the shuttle.

As the focus of interest has shifted, so has the locus of bureaucratic power. Aware of its leverage, the Defense Department is pushing for an independent manned space program. The National Oceanic and Atmospheric Administration has assumed ad hoc responsibility for earth-resources satellites, prior to establishment of some new agency to take over the burden. Communications satellites are now within the domain of Comsat, of private corporations, and of the military.

Where will that leave NASA once the shuttle is operational?

There have been several proposals. One is to merge the NASA and Pentagon space programs. To my mind, that would put an end to one of the most appealing aspects of the American venture into space: its openness, in failure and success. Another idea is to reduce the agency to a "service" organization responsible for supervising orbital traffic (as a kind of Federal Aviation Administration) and for conducting R & D in the basic technologies of space flight (à la NACA). That would be a comedown from the glory days, but these are still important functions.

The real issue facing the U.S. space program is not that of institutional rivalries but that of rationale. There are good arguments for going into space—for national defense, for the benefits that communications and applications satellites will continue to provide, for solar energy, for manufacturing, even for sheer curiosity. These are solid reasons. They were, in my view, undersold from the start.

Instead, Washington played on America's emotions, producing a one-shot burst of adrenalin that has by now all but petered out. In effect we tricked ourselves into doing what could have been justified with calm logic. The result today is lack of public interest, lack of will, and lack of purpose.

Man is going to make himself at home in space, just as he will come to rely on the sun and the atom for energy. I find it inconceivable that, 100 years from now, we will not be plying the heavens with skill—and at a profit. Will we try to postpone the inevitable? Or will we draw up a comprehensive new blueprint for space exploration, spell out the rationale, and then stick to it?

EDITOR'S NOTE: *Next February, NASA will sponsor a two-day scholarly conference at Yale University on the history of the global space effort, the first major gathering of its kind. The participants will include WQ contributors John Noble Wilford, Walter McDougall, and Bruce Mazlish.*