Chapter 4: A Hostile Environment

> An era ended for the National Aeronautics and Space Administration last week when Congress voted a $234-million cut in that agency's budget authorization for Fiscal 1968 . . . . The NASA budget cut is symptomatic of the many currents of basic change that are flowing through the land this summer . . . . If top NASA officials have not interpreted their admittedly long and arduous buffeting on Capitol Hill this spring and summer correctly, then they are facing a much worse time in the years ahead . . . . (Robert Hotz, 1967)[1]

Mariner 4

On 15 July 1965, the Mariner 4 probe snapped 21 blurry pictures of Mars' southern hemisphere as it flew by at a distance of 9,600 kilometers. The flyby, which marked the culmination of a seven-and-a-half-month voyage, was an unprecedented engineering achievement. Mariner 4 had withstood the interplanetary environment for nearly twice as long as Mariner 2 had during its 1962 Venus flyby mission.

Mariner 4 revealed Mars to be a disappointingly Moonlike, cratered world with no obvious signs of water. Scientists had expected to see a world more like Earth, where erosion makes obvious craters the exception rather than the rule. That Mariner 4's images were black and white accentuated the resemblance to Earth's desolate satellite. Canals were conspicuously absent. They are now believed to have been an optical illusion or a product of eyestrain.

Mariner 4's impact on Mars exploration planning is hard to overestimate. First, it showed that Maxime Faget had been right in 1962. Robots could perform Mars flybys—astronauts were not required for this particular exploration mission. It also showed that robot probes could reach Mars in reasonably good condition, undermining the "robot caretaker" justification for piloted Mars flybys.

Mariner 4's radio-occultation experiment revealed Mars' atmosphere to be less than 1 percent as dense as Earth's. Based on these new data and on measurements of the Martian atmosphere made from Earth since the 1940s, planetary scientists calculated that the majority of Mars' atmosphere was carbon dioxide, not nitrogen, as had been widely supposed.[2]

The new Mars atmosphere data relegated to the recycle bin aerodynamic landing systems such as von Braun's delta-winged gliders and Aeronutronic's lifting-body. That meant more rocket propulsion would be required to accomplish a Mars soft landing, which would in turn demand more propellant. This would boost minimum lander weight, which meant more propellant would be needed to transport the lander from Earth to Mars. This in turn would boost Mars spacecraft weight at Earth-orbit departure, which meant, of course, that more expensive rockets would be required to launch the Mars ship into Earth orbit.

Most importantly, Mariner 4 dealt a body blow to hopes for advanced Martian life. Historically, human perceptions of life on Mars have occurred along a continuum. At one end stood the romantic view of nineteenth-century American astronomer Percival Lowell, whose Mars was a dying Earth inhabited by a race of civil engineers who had dug a planet-girdling network of irrigation canals to stave off the encroaching red desert. By the 1930s, Lowell's vision was widely seen as optimistic. Nonetheless, the romance of Lowell's Mars inspired would-be Mars explorers into the 1960s.[3]

The Mariner 4 results eradicated any lingering traces of Lowellian romance, and in fact shifted the prevailing view of life on Mars all the way down the continuum to a pessimism with almost as little basis as Lowell's optimism. The spacecraft had, after all, imaged only 1 percent of Mars at resolution so low that, had it photographed Earth, scientists examining its pictures would likely have missed all signs of terrestrial life.[4] NASA took pains to point out that Mariner 4 had been intended only as a first, preliminary step toward resolving the question of life on Mars, and that it had "blazed the way for later spacecraft to land instruments and, eventually, men on Mars."[5]

On the plus side, Mariner 4 provided the first firm data on conditions astronauts could expect to encounter in interplanetary space during the voyage to Mars. The intrepid robot registered fewer meteoroid impacts than expected, but also detected a higher-than-expected level of cosmic radiation and between 12 and 20 solar flares during what was expected to be a quiet Sun period.[6]

Vietnam and Watts

President Lyndon Johnson supported the lunar program launched by his predecessor, which was not surprising, given that he had played a key role in formulating the Moon goal as Kennedy's Vice President and National Space Council chair. Like many others, however, he was uncertain what NASA's scope and direction should be in the years after it put an astronaut on the Moon. In a letter on 30 January 1964, Johnson asked NASA Administrator James Webb for a list of possible future NASA goals.[7]

As stated in the last chapter, the outline of agency plans submitted to Johnson's Budget Bureau in November 1964 emphasized using Apollo hardware in Earth orbit. An Apollo-based piloted program in the early 1970s was seen as an interim step to an Earth-orbiting space station in the mid- to late-1970s.[8] When the National Academy of Sciences Space Science Board called instead for an emphasis on planetary exploration, NASA officials insisted that the Earth-orbital focus was President Johnson's preference.[9]

This philosophy—that the United States would be best served by using Apollo hardware as an interim step to a future space station—set the tone for much of NASA's post-Apollo planning through the beginning of 1969. NASA's program for reapplying Apollo hardware was the Apollo Applications Program (AAP), an initially ambitious slate of lunar and Earth-orbital missions that eventually shrank to become the Skylab program. As shown in the last chapter, Mars planners in the Future Projects Office at Marshall sought also to apply Apollo technology to Mars exploration.

An event on 25 January 1965 also helped set the tone for NASA's post-Apollo future. On that date, President Johnson sent to Congress a $5.26-billion NASA budget for FY 1966, an increase of only $10 million over the $5.25-billion FY 1965 budget. This was the smallest NASA budget increase since the agency was established in 1958. NASA's eventual FY 1966 appropriation was $5.18 billion, the Agency's first budget drop. Most of the cuts came from AAP and other new starts.

This new frugality in the administration and in Congress with regards to space reflected growing unease across the United States. In August 1964, following a naval incident in the Gulf of Tonkin off North Vietnam, Congress passed the Tonkin Resolution, which empowered President Johnson to take what steps he deemed necessary to thwart further communist aggression in Indochina. In February 1965, Vietcong guerrillas attacked the South Vietnamese military base at Pleiku, killing 8 Americans and wounding 126. In response, Johnson ordered the bombing of North Vietnam's base at Dong Hoi. On 8 March, the first U.S. combat troops—two battalions of marines—joined the 23,000 American advisors already in South Vietnam.

As Mariner 4 approached Mars in July, President Johnson announced that he would increase the number of soldiers in South Vietnam from 75,000 to 125,000. On 4 August, while Mariner 4's images were trickling back to Earth, Johnson asked Congress for an additional $1.7 billion to support the expanding war.

On 11 August, as Mars planners attempted to reconcile the thin atmosphere and craters revealed by Mariner 4 with their old plans for Mars, racial violence flared in the Watts ghetto of Los Angeles, California. Five nights of anarchy left 34 dead and caused $40 million in damage.

Planetary JAG

Against this backdrop of war, social unrest, and Mariner 4 results, NASA launched a two-prong assault on Mars. The first, the Voyager program, aimed at planetary exploration using automated orbiters and landers. The second was an internal piloted Mars flyby study involving several NASA centers.

As already indicated, planetary scientists had rejected the AAP space station emphasis in favor of planetary exploration, which, they felt, was being neglected in NASA's headlong rush to reach the Moon. In its report Space Research: Directions for the Future, released in January 1966, the National Academy of Sciences Space Science Board designated "the exploration of the near planets as the most rewarding goal on which to focus national attention for the 10 to 15 years following manned lunar landing."[10] In May 1966, the American Astronomical Society Symposium "The Search for Extraterrestrial Life" re-emphasized the importance of seeking life on Mars despite the Mariner 4 results.[11] These inputs helped build both Voyager and piloted flyby mission rationales.

Voyager, first proposed in 1960 at the Jet Propulsion Laboratory (JPL) in Pasadena, California, was envisioned as a follow-on program to the Mariner flyby series. The 1960s Voyager should not be confused with the twin Voyager flyby probes launched to the outer planets in 1977 and 1978. In the FY 1967 budget cycle, NASA had postponed proposing Voyager as a new start following assurances that it could get off to an aggressive start in FY 1968. The delay was partly a result of the Mariner 4 findings. New atmosphere data forced a re-design that drove the program's estimated cost beyond $2 billion.[12] Voyager was initially targeted for first launch in 1971, with a second mission in 1973, and other missions to follow.

The NASA Headquarters Office of Manned Space Flight (OMSF) under George E. Mueller, Associate Administrator for Manned Space Flight, managed the piloted flyby study. Mueller had taken charge of the OMSF in September 1963 and had set up the Advanced Manned Missions Office under Edward Gray in November 1963 to direct NASA's piloted planetary mission planning activities. At a meeting on 15 April 1965, Mueller had received authority from NASA Deputy Administrator Robert Seamans to put together a NASA-wide group to plan piloted planetary missions. A preliminary meeting of the group occurred on 23 April 1965. This prepared the ground for development of the Planetary Joint Action Group (JAG), which was formally established later in the year. The Planetary JAG was headed by Gray and drew members from NASA Headquarters, Marshall, MSC, and Kennedy Space Center (KSC), as well as from the Apollo planning contractor, Bellcomm.[13]

Initially the Planetary JAG's focus was on piloted Mars missions using nuclear rockets. In April 1966, however, Mueller launched a piloted Mars flyby study within the Planetary JAG at the request of Nobel Laureate Charles Townes, chair of the NASA Science and Technology Advisory Committee. Townes had asked Mueller in January 1966 to carry out a study comparing the unpiloted Voyager project with a piloted flyby with robot probes (what he called a "manned Voyager").[14] In the second half of 1966, NASA spent $2.32 million on 12 piloted plan-

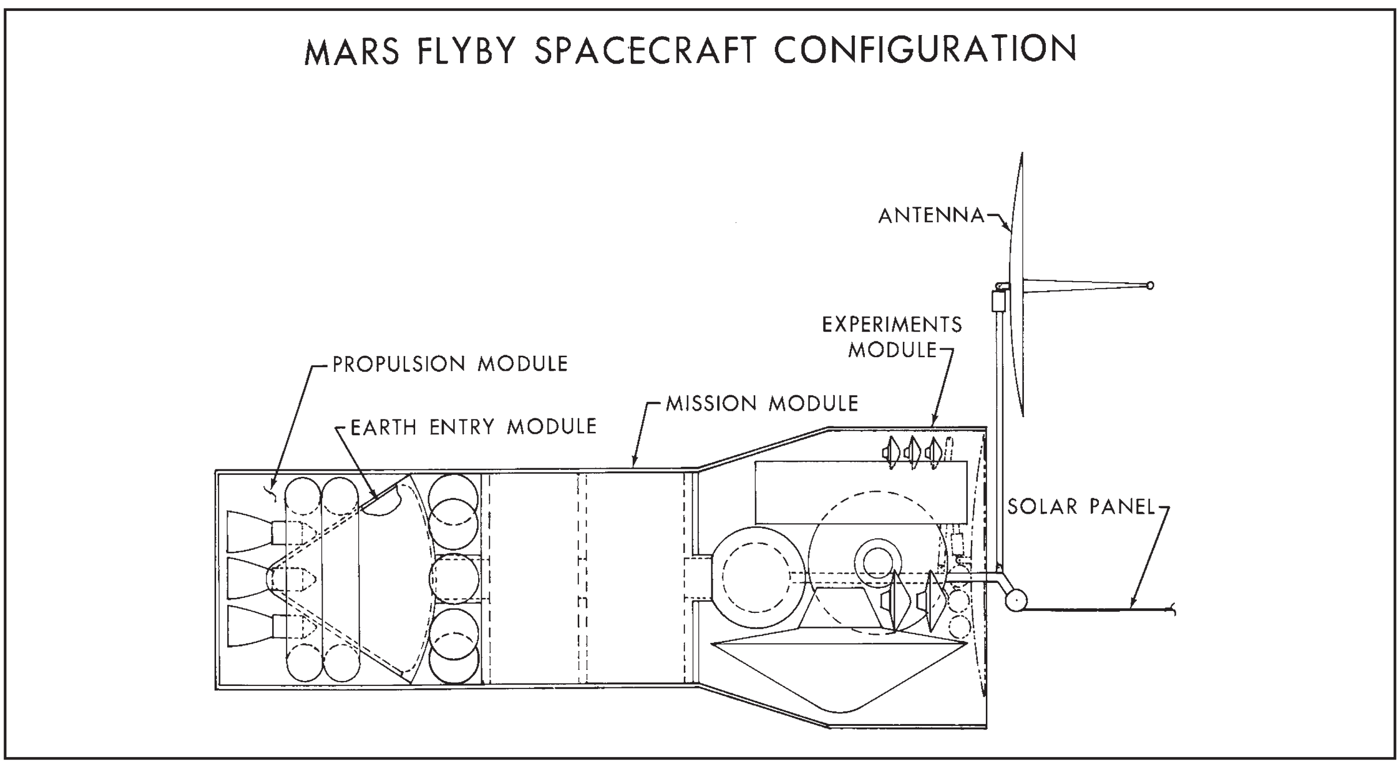

Figure 7—The 1966 Planetary Joint Action Group study used existing and near-term technology for its piloted Mars flyby spacecraft design. Note the Earth Entry Module (left) based on the Apollo Command Module. (NASA Photo S-66-11230)

etary mission studies supporting the Planetary JAG.[15]

Later that year, Mueller testified to the House Space Committee on the benefits of a piloted flyby. He explained that it afforded

> the best opportunity for performing manned planetary exploration with minimal cost and at an early date . . . . The attractiveness of this type of mission . . . stems from the relatively light burden which it imposes on the propulsion system, although the short interval of direct contact with the target planet detracts from its desirability. The usefulness of the flyby mission becomes clearly established when viewed as an in-situ test-bed for evaluating the performance of various subsystems such as navigation, life support, and communications to be used in later landing missions; [and] when also viewed as a platform for launching instrumented probes toward the target planet during the close passage.[16]

On 3 October 1966, the Planetary JAG published its Phase 1 report, Planetary Exploration Utilizing a Manned Flight System.[17] The report placed piloted flybys within an evolutionary "integrated program" of new and Apollo-based technology with "balanced" use of humans and robots, the objective of which was "maximum return at minimum cost, assuming intensive investigation of the planets is a goal." By this time the integrated program concept had been discussed for more than a year outside NASA.[18] The Planetary JAG's integrated program proceeded through the following steps:

- Apollo Applications Program (1968-73): Astronauts would remain aloft in space stations based on Apollo hardware for progressively longer periods to collect data on human reactions to weightlessness. Some would live in Earth orbit for more than a year approximately the duration of a piloted Mars flyby mission.

- Mariner (1969-73) and Voyager (1973): The Planetary JAG report cast Mariner and Voyager as lead-ins to piloted expeditions by stating that data they collected would aid engineers designing piloted flyby hardware. A Mariner probe would fly by Mars in 1969; in 1971 another Mariner would drop a probe into Mars' atmosphere. The first Voyager probe would land on Mars in 1973 bearing a suite of life-detection experiments.

- Piloted Mars/Venus Flybys (1975-80): The first piloted Mars flyby mission would leave Earth-orbit in September 1975. Mars flyby launch opportunities would also occur in October 1977 and November 1979. Multiple flyby missions were possible—a Venus/Mars mission could start in December 1978, and a Venus/Mars/Venus mission could launch in February 1977. These would dispense automated probes based on Mariner and Voyager technology.

- Piloted Mars Landing and piloted Venus Capture (orbiter) missions (post-1980) would see introduction of AEC-NASA nuclear-thermal rockets. The Planetary JAG deemed nuclear propulsion "essential for a flexible Mars landing program" capable of reaching Mars in any launch opportunity regardless of the energy required. (The nuclear rocket program is described in more detail in Chapter 5.)

The Planetary JAG's piloted Mars flyby spacecraft would reach Earth orbit on an Improved Saturn V rocket with a modified S-IVB (MS-IVB) third stage. The MS-IVB would feature stretched tanks to increase propellant capacity and internal foam insulation to permit a 60-hour wait in Earth orbit before solar heating caused its liquid hydrogen fuel to turn to gas and escape.

The four-person flyby crew would ride into Earth orbit on a two-stage Improved Saturn V in an Apollo CSM stacked on top of the flyby craft. Upon reaching orbit, the CSM/flyby craft combination would detach from the spent Saturn V S-II second stage; then the astronauts would detach the CSM, turn it around, and dock with a temporary docking structure on the flyby craft's forward end.

The Planetary JAG's flyby spacecraft would consist of the Mid-Course Propulsion Module with four main engines; the Earth Entry Module, a modified Apollo CM for Earth atmosphere reentry at mission's end; and the Mission Module, the crew's living and working

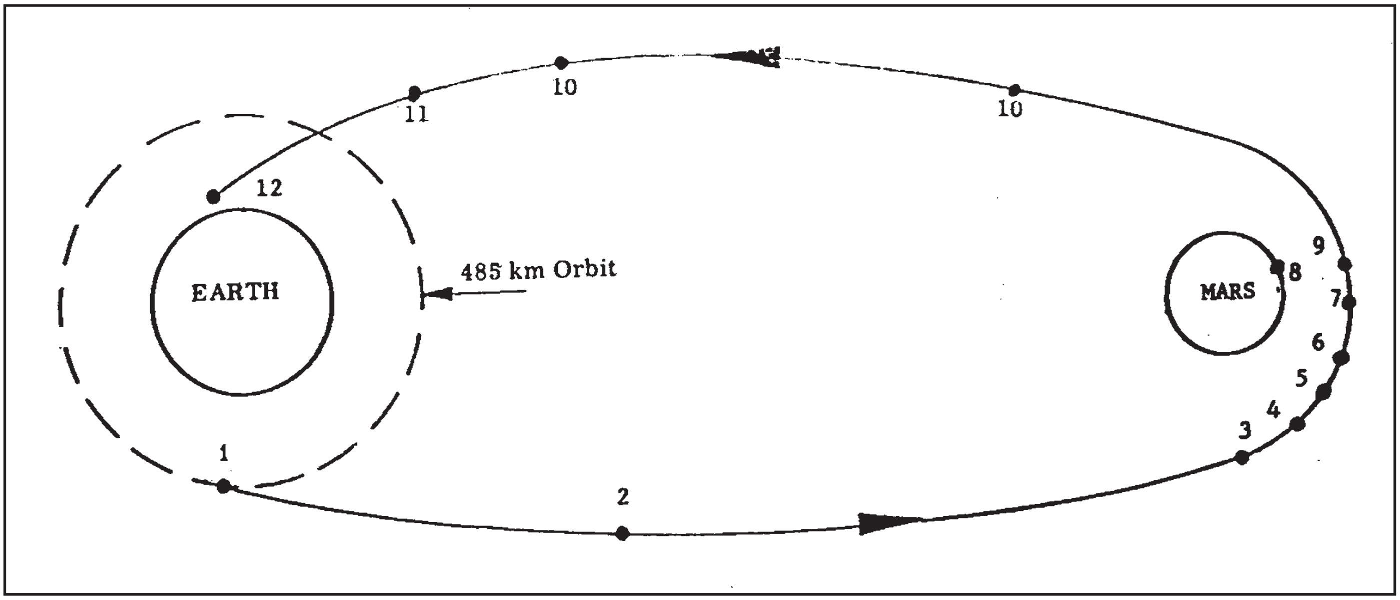

Figure 8—Typical piloted Mars flyby mission. 1—depart Earth orbit. 2, 4, 10—course corrections. 3, 5, 6, 7—eject automated Mars probes. 8—automated probe collects Mars surface sample and launches it off the planet. 9—piloted flyby craft retrieves Mars surface sample. 11—crew leaves Mars flyby craft in Earth return capsule. The abandoned flyby spacecraft sails past Earth into solar orbit. 12—Earth atmosphere reentry and landing. (Planetary Exploration Utilizing a Manned Flight System, Office of Manned Space Flight, NASA Headquarters, Washington, DC, October 3, 1966, p. 16.)

space. The Earth Entry Module would serve double duty as a radiation shelter during solar flares. Mid-Course Propulsion Module propellant tanks would be clustered around it to provide additional radiation shielding. The Mission Module's forward level (for "rest and privacy") would be lined with lockers containing freeze-dried foods; the aft level would contain the flyby craft's control console, science equipment, and wardroom table. The Planetary JAG report proposed that the Mission Module structure and subsystems, such as life support, be based on Earth-orbital space station module designs.

The automated probes would be housed in the Experiment Module forming the aft end of the flyby spacecraft, along with a probe deployment manipulator arm, a biology laboratory, a 40-inch telescope, and an airlock for spacewalks with an Apollo-type docking unit. A 19-foot-diameter radio dish antenna for high-data-rate communications with Earth unfolded from the back of the Experiment Module, as did a 2,000-square-foot solar array capable of generating 22 kilowatts of electricity at Earth, 8.5 kilowatts at Mars, and 4.5 kilowatts in the Asteroid Belt.

With the crew and flyby craft in Earth orbit, three Improved Saturn V rockets would launch 12 hours apart to place the three MS-IVB rocket stages in orbit.

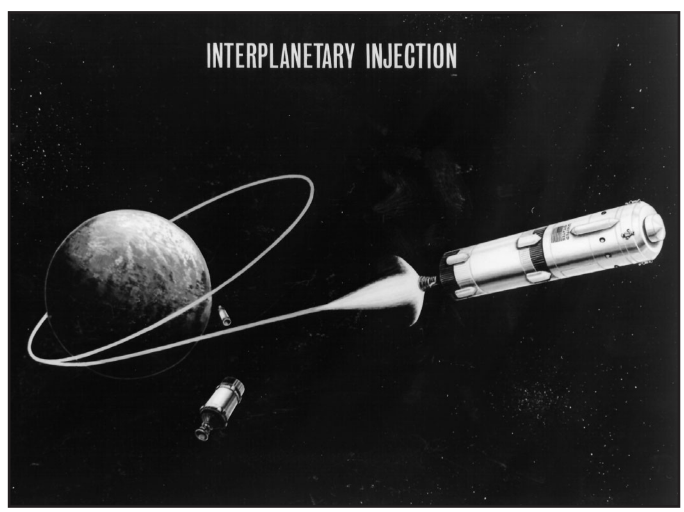

Figure 9—Three modified Apollo S-IVB stages burn one after the other to launch the 1967 Planetary Joint Action Group Mars flyby spacecraft out of Earth orbit. (NASA Photo S-67-5998)

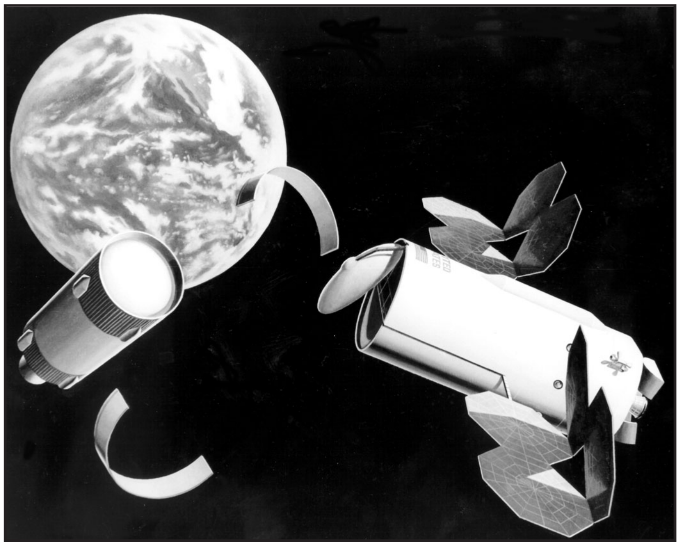

Figure 10—Following final S-IVB stage separation, the 1967 Planetary Joint Action Group's Mars flyby spacecraft deploys solar arrays and a dish-shaped radio antenna. (NASA Photo S-67-5991)

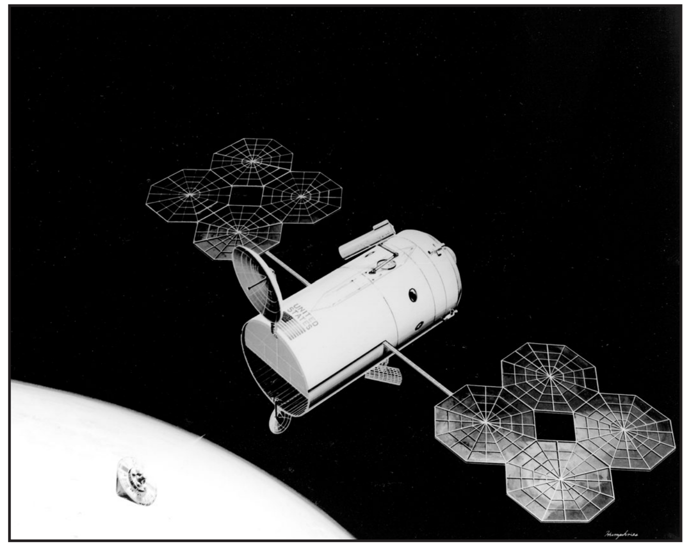

Figure 11—The 1967 Planetary Joint Action Group's Mars flyby spacecraft releases automated probes and deploys instruments. Close Mars flyby would last mere hours, but the astronauts would study themselves throughout the mission, helping to pave the way for future Mars landing expeditions. (NASA Photo S-67-5999)

This rapid launch rate, a veritable salvo of 3,000-ton rockets, each nearly 400 feet tall, would demand construction of a third Saturn V launch pad at KSC. The Planetary JAG determined, however, that Pad 39C would be the only major new ground facility needed to accomplish its flyby program.

Using the CSM's propulsion system, the astronauts would perform a series of rendezvous and docking maneuvers to bring together the flyby craft and three MS-IVBs. The flyby crew would then undock the CSM from the temporary docking structure, re-dock it to the airlock docking unit on the flyby craft's side, and enter the flyby craft for the first time. They would discard the CSM and eject the temporary docking structure.

Launch from Earth orbit would occur between 5 September and 3 October 1975. The MS-IVB stages would in turn ignite, deplete their propellants, and be discarded. As Earth and Moon shrank in the distance, the crew would deploy the radio antenna and rectangular solar array.

The astronauts would perform a wide range of scientific experiments during the 130-day flight to Mars. These included solar studies, monitoring themselves to collect data on the physiological effects of weightlessness, planetary and stellar observations, and radio astronomy far from terrestrial radio interference.

Mars flyby would occur between 23 January and 4 February 1976, the precise date being dependent on the date of Earth departure. Beginning several weeks before flyby, the crew would turn the craft's telescope toward Mars and its moons. The pace would quicken 10 days before flyby, when the flyby craft was 2 million kilometers from Mars. At that time the astronauts would use the probe deployment arm to unstow and release the automated probes. At closest approach, the flyby spacecraft would fly within 200 kilometers of the Martian dawn terminator (the line between day and night).

For the 1975 mission, the flyby craft would carry in its Experiment Module three 100-pound Mars impactors, one five-ton Mars polar orbiter, one 1,290-pound Mars lander, and one six-ton Mars Surface Sample Return (MSSR) lander. The MSSR was designed to leave the flyby craft, land on Mars, gather a two-pound sample of dirt and rock, and then blast it back to the passing flyby craft using a three-stage liquid-fueled ascent vehicle.

This last concept, an effort to improve the piloted flyby mission's scientific productivity, was proposed by

Bellcomm at the Planetary JAG's meeting at KSC on 29-30 June 1966.[19] The concept originated in a paper by R. R. Titus presented in January 1966.[20] Titus, a United Aircraft Research Laboratories engineer with a talent for unfortunate acronyms, dubbed his concept FLEM, for "Flyby-Landing Excursion Mode." He had been part of the Lockheed EMPIRE team.

Titus' mission plan had a piloted MEM lander separating from the flyby spacecraft during the Mars voyage and changing course to intersect the planet. Titus calculated that MEM separation 60 days before Mars flyby would permit it to stay for 16 days at Mars, while separation 30 days out yielded a 9-day stay time. At Mars the MEM would fire its rocket engine to enter orbit, then land. As the flyby spacecraft passed Mars, the excursion module would blast off in pursuit. The amount of propellant required for FLEM was much less than for an MOR landing mission because only the MEM would enter and depart Mars orbit. Titus calculated that a FLEM mission boosted to Mars in 1971 using a nuclear-thermal rocket might weigh as little as 130 tons—light enough, perhaps, to permit a piloted Mars landing with a single Saturn V launch.

In the 1966 JAG piloted flyby plan, the automated MSSR would land on Mars about two hours before the flyby craft flew past the planet and would immediately set to work gathering rock and soil samples using scoop, brush, sticky tape, drill, and suction collection devices. Less than two hours after MSSR touchdown, its ascent vehicle first stage would ignite. If all went well, the ascent vehicle's small third stage would deliver the samples to a point in space a few miles ahead of the flyby craft about 17 minutes later, 5 minutes after the flyby craft's closest Mars approach. As their craft overtook the sample package, the astronauts would snatch it in passing using a boom-mounted docking ring. They would then deposit it inside the Experiment Module's biology lab.

The Planetary JAG pointed out that the MSSR/piloted flyby approach improved the chances for studying living Martian organisms because the Mars samples would reach a trained biologist within minutes of collection. Living organisms collected using a purely automated sample-return lander would likely perish during the months-long flight to a lab on Earth.

The trip back to Earth would last 537 days, during which the astronauts would study the Mars samples and repeat many of the same experiments performed during the Earth-Mars voyage. The flyby craft would penetrate the Asteroid Belt before falling back to Earth, making piloted asteroid flybys a possibility. When farthest from the Sun the flyby craft would be on the opposite side of the Sun from Earth, making possible simultaneous observations of both solar hemispheres.

A few days before reaching Earth, the crew would board the Earth Entry Module and abandon the flyby craft. On 18 July 1977, the Earth Entry Module would reenter Earth's atmosphere, deploy parachutes, and lower to a land touchdown, while the flyby craft would fly past Earth into solar orbit. Just before the landing, solid-propellant rocket motors would fire to cushion impact, ending the 667-day Martian odyssey.

The Fire

NASA's FY 1967 funding request was $5.6 billion. The White House Budget Bureau trimmed this to $5.01 billion out of a $112 billion Federal budget before sending the budget on to Capitol Hill. By the time President Johnson signed it into law, NASA's FY 1967 appropriation was $4.97 billion, more than $200 million less than FY 1966. Programs aimed at giving NASA a post-Apollo future were hardest hit. Of the $270 million NASA requested for AAP, for example, only $83 million was appropriated. Voyager funding start-up was bumped to FY 1968. Apollo Moon program funding, by contrast, barely suffered. In part this was because the agency was flying frequent Gemini missions—10 in 20 months—which kept the Moon goal in the public eye. Kennedy's goal seemed very close, with the first piloted lunar landing expected in just over a year.

In Gemini's last year, however, America's attention was increasingly drawn away from space. In March 1966, protesters marched against the Vietnam War in Boston, San Francisco, Chicago, Philadelphia, and Washington. The summer of 1966 saw race riots in Chicago and Atlanta and racist mob violence in Grenada, Mississippi. In June 1966, President Johnson ordered bombing raids against the North Vietnamese cities of Haiphong and Hanoi. By then, 285,000 Americans were serving in Vietnam. As Gemini 12, the last in the series, splashed down in November 1966, the number of American soldiers on the ground in Vietnam was well on its way to its 1 January 1967 total of 380,000.

Against this backdrop, in January 1967, the Planetary JAG resumed piloted flyby planning, this time with the purpose of developing "a clear statement of the activities required in FY 69 for budget discussions"[21] to place NASA "in a position to initiate a flyby project in FY 1969."[22] Planetary JAG participants had some reason to be hopeful. As they reconvened, President Johnson announced a $5.1-billion FY 1968 NASA budget that included $71.5 million for Voyager and $8 million for advanced planning. He also backed $455 million for a substantial AAP. In presenting his budget, the President explained that "we have no alternative unless we wish to abandon the manned space capability we have created."[23]

On 26 January the OMSF presented its ambitious AAP plans to Congress. Barely more than a day later, NASA's plans received a harsh blow as fire erupted inside the AS-204 Apollo spacecraft on the launch pad at KSC, killing Apollo 1 astronauts Gus Grissom, Ed White, and Roger Chaffee. They had been scheduled to test the Apollo CSM for 14 days in Earth orbit beginning in mid-February. NASA suspended piloted Apollo flights pending the outcome of an investigation. The AS-204 investigation report, issued in April, found shortcomings in Apollo management, design, construction, and quality control. Apollo redesign kept American astronauts grounded until September 1968.

After the fire, NASA could no longer count on a friendly reception on Capitol Hill. The fire, plus growing pressure on the federal budget, meant that all NASA programs were subjected to increased oversight. In March, Aviation Week & Space Technology reported a "growing antipathy from Congress" toward NASA's programs, adding that "[d]elays in the manned program, resulting from the Apollo 204 crew loss . . . will hamper the agency's arguments before Congress since public interest will dwindle without spectacular results."[24] The magazine predicted, however, that Project Gemini's conclusion would free up funds in FY 1968, permitting "a modest start on Apollo Applications and . . . Voyager." [25]

As NASA in general came under increased scrutiny, the piloted flyby concept suffered high-level criticism for the first time. The President's Science Advisory Committee (PSAC) report The Space Program in the Post-Apollo Period (February 1967) was generally positive, calling for continued Apollo missions to the Moon after the first piloted lunar landing, as well as planetary exploration using robots such as Voyager.[26] The PSAC reiterated Faget's 1962 criticism of the piloted flyby mission, however, stating that

> the manned Mars flyby proposal, among its other weaknesses, does not appear to utilize man in a unique role . . . it appears to us that NASA must address itself more fully to the question, "What is the optimum mix of manned and unmanned components for planetary exploration?"[27]

The PSAC also complained that Voyager and the Planetary JAG's piloted flyby plans were "distinct and apparently independent plans for planetary exploration," and criticized NASA for "absence of integrated planning in this area."[28] As has been seen, this criticism reached the Planetary JAG early enough for an integrated plan to be included in its report. NASA officials denied, however, that the PSAC's criticisms had prompted its effort to integrate Voyager and the piloted flyby.[29]

The PSAC's critique stung the Planetary JAG. One response was to distance itself from the term "flyby"—a word identified increasingly with automated explorers since Mariner 4's success—by dubbing its mission an "encounter."[30] Planetary JAG members also sought to reemphasize that the encounter mission astronauts would accomplish productive observations and experiments throughout their two-year voyage, not just during the hours of Mars encounter.

OMSF advanced planner Edward Gray and his deputy Franklin Dixon first publicly proposed the Planetary JAG's Apollo-based piloted Mars flyby as an FY 1969 new start the next month (March 1967) at the AAS Fifth Goddard Memorial Symposium, where they presented a paper called "Manned Expeditions to Mars and Venus."[31] That same month, NASA forecast a stable annual budget of about $5 billion per year through 1970, after which the budget would decline to $4.5 billion annually for the rest of the 1970s. New programs such as Voyager and the piloted flyby would be phased in as the share of NASA's budget allotted to Apollo lunar missions decreased.[32] In May, Aviation Week & Space Technology reported that the $71.5-million new-start funding approved for Voyager by the House Space Committee "does not face serious problems."[33]

A New Era for NASA

By the beginning of 1967, 25,000 United States servicemen had died in Vietnam. The summer of 1967 saw racial violence wrack Newark, New Jersey, and Detroit, Michigan. Large sections of Detroit burned to the ground. At least 5,000 people lost their homes, and more than 70 lost their lives. Violence also swept more than 100 other American cities. Detroit alone suffered up to $400 million in damage. Needless to say, most Americans focused more on Earth than on space.

The cost of the Vietnam War soared to $25 billion a year—the entire FY 1966 NASA budget every 10 weeks. This, plus the cost of President Johnson's Great Society social welfare programs, led to spiraling Federal budget deficits. Congress approached the Johnson Administration's 1968 Federal Budget with its scissors out, and NASA was an easy target.

In early July, Aviation Week & Space Technology reported that the House and Senate had "sustained the pace of spending in the Apollo program but seriously cut into NASA's plans for both manned and unmanned space programs of the future."[34] The Senate voted down all Voyager funding, while the House cut the program to $50 million. House and Senate conferees settled on $42 million for the automated Mars program. In response, NASA announced that a 1971 Voyager mission was out of the question. A 1973 landing was, however, still feasible if the program was funded adequately in FY 1969.[35]

In early July, the Senate report on its FY 1968 NASA authorization bill specifically advised against piloted planetary missions, stating that "all near-term [piloted] missions should be limited to earth orbital activity or further lunar exploration."[36] Later that month, in testimony to the Senate Appropriations Committee, James Webb refused to "give aid and comfort to those who would cut our program" when asked by Spessard Holland (Democrat-Florida) to choose between $45 million for AAP and $50 million for Voyager. Holland chided Webb for "failing to see that Congress is faced with dilemmas in applying all its economies."[37]

That some in the aerospace world were sympathetic to Holland's plight is telling. In an editorial titled "New Era for NASA," for example, Aviation Week & Space Technology editor Robert Hotz wrote,

> We have no quarrel with reductions imposed so far by Congress . . . . They reflect a judicious and necessary pruning of NASA's budget . . . . [Space exploration] cannot hope to occupy such a large share of the national spotlight in the future as it did during the pioneering days of Mercury and Gemini when the war in Vietnam was only a tiny cloud on a distant horizon; when no American city cores had yet glowed red at night, and when a tax cut was the order of the day instead of the tidal wave of tax rises that now threatens to engulf the nation.[38]

Though none of this augured well for piloted planetary missions, the Planetary JAG continued planning its piloted encounter mission with the aim of seeing it included as an FY 1969 new start. The revised Planetary JAG plan called for just two MS-IVBs.[39] This meant that only two Saturn V rockets would need to be launched in rapid succession, so the costly new Pad 39C was no longer required.

The encounter spacecraft would again include an Experiment Module with an automated probe suite based on Voyager technology. This time, however, the probes, including at least one large MSSR lander, would be sealed in the Experiment Module before launch from Earth and sterilized to avoid biological contamination of Mars. Previous piloted flyby studies had justified the presence of astronauts in part by their ability to service the probes during flight. This would now be impossible because servicing would introduce contamination.

The Planetary JAG realized that the MSSR was the most challenging element of its encounter mission plan—the one demanding the earliest development start if the first piloted encounter mission was to be ready for flight in 1975. On 3 August 1967, therefore, MSC issued a Request for Proposals for a "9-month engineering study . . . to perform a detailed analysis and preliminary design study of unmanned probes that would be launched from a manned spacecraft on a Mars encounter or a Mars capture mission, [and] would retrieve samples of the Mars surface and atmosphere and rendezvous with the manned spacecraft." MSC added, "The results of this study" would "aid in selecting experiment payload combinations of these and other probes and in configuring the Experiment Module section of the manned spacecraft used in the Mars . . . Reconnaissance/Retrieval missions in the 1975-1982 time period." Cost and technical proposals were to be submitted to MSC by 4 September.[40] At the same time, MSC released an RFP calling for a piloted flyby spacecraft design study.

The Planetary JAG knew of the de facto congressional "no new starts" injunction but apparently assumed that it did not apply to studies with implications beyond the next fiscal year.[41] Congressman Joseph Karth (Democrat-Minnesota), chair of the House Subcommittee on Space Science and Applications, saw it differently. Normally a strong NASA supporter, he lashed out at the "ostrich-like, head-in-the-sand approach of some NASA planning," and added, "Very bluntly, a manned mission to Mars or Venus by 1975 or 1977 is now and always has been out of the question—and anyone who persists in this kind of misallocation of resources is going to be stopped."[42]

By August, the expected 1967 Federal budget deficit was $30 billion. Goaded by MSC's Request for Proposals, on 16 August 1967 the House zeroed out funding for both Voyager and advanced piloted mission planning. AAP funding fell to $122 million. On 22 August, the House approved a $4.59 billion FY 1968 NASA budget—a cut of more than $500 million from the January 1967 White House request.

Faced by a spiraling budget deficit, war and anti-war dissent, and urban riots, President Johnson reduced his support for NASA, saying, "Under other circumstances I would have opposed such a cut. However, conditions have greatly changed since I submitted my January budget request."[43] He added, "Some hard choices must be made between the necessary and the desirable . . . . We . . . dare not eliminate the necessary. Our task is to pare the desirable."[44]

Denouement

The Voyager program died in part because NASA cast it as a lead-in to piloted flybys. The scientific community viewed Voyager's loss as a slap in the face. In September, in an unusual move, NASA officials went before the Senate Appropriations Committee to negotiate a Mariner mission in 1971 and a Mars landing mission in 1973, both designed "to conform to sharply reduced funding in FY 1969."[45] The 1971 Mariner mission became Mariner 9. In March 1968, NASA unveiled Project Viking—a cut-price version of the Voyager program. Viking, managed by NASA's Langley Research Center, emerged as one of the few FY 1969 NASA new starts.

MSC received and reviewed MSSR study proposals from industry, although, of course, no contract for such a study was ever issued. The piloted flyby mission, the object of so much study from mid-1962 to late 1967, was defunct. Despite the obvious congressional hostility toward advanced planning, however, NASA's piloted Mars mission studies were not. As will be seen in the next chapter, the focus shifted to the other area of Planetary JAG emphasis—piloted Mars landing missions using nuclear rockets.