APOLLO 10

A step to Mars

The dress rehearsal for July's moon landing has spacemen dreaming about the planets

After nine days of spectacular views, excited commentary and just enough glitches to keep a near-perfect mission from leading to overconfidence, the Apollo 10 astronauts brought their dress-rehearsal mission to a smashing finish last week with the shortest recovery time of any U.S. space flight.

Forty minutes after splashing into the South Pacific, the crew, Thomas Stafford, Eugene Cernan and John Young, was whisked by recovery helicopter to the deck of the carrier Princeton.

The astronauts had barely got their space suits off when Dr. Thomas O. Paine, head of the National Aeronautics and Space Administration, announced in Houston that the next step, the landing mission, was definite.

"We will go to the moon," he said.

Buoyed by the excitement of the successful mission, Dr. Paine waxed ecstatic about the possibilities of man in space. The true goal of the Apollo program "is far more than being the first to land men on the moon," he said.

"The real goal is to develop and demonstrate the capability for interplanetary travel. . . . Men working together with modern science and technology can extend the domain of terrestrial life through the solar system," including the planets.

Such heady talk, combined with the anticipation of the further excitement of the landing this summer, took some of the steam out of the elation over the successful rehearsal. But while it was going on, the Apollo 10 spacecraft held the world spellbound.

The outbound leg of the mission (SN: 5/31, p. 521) brought Stafford, Cernan and Young to the moon in talkative high spirits, climaxing when the spacecraft's main engine fired first to lock into an orbit around the moon, and then again to trim the orbit into a circle less than 70 miles above the lunar surface.

That much had been done before. Last December, Apollo 8 won headlines with its practically flawless first flight to the moon, but a key element was missing: the Apollo lunar module. The LM was proven to be ready to go by the earth-orbiting Apollo 9 flight in March, but as Apollo 10 revealed, the task of coordinating two spacecraft rather than one around the moon was well deserving of the pre-landing practice mission.

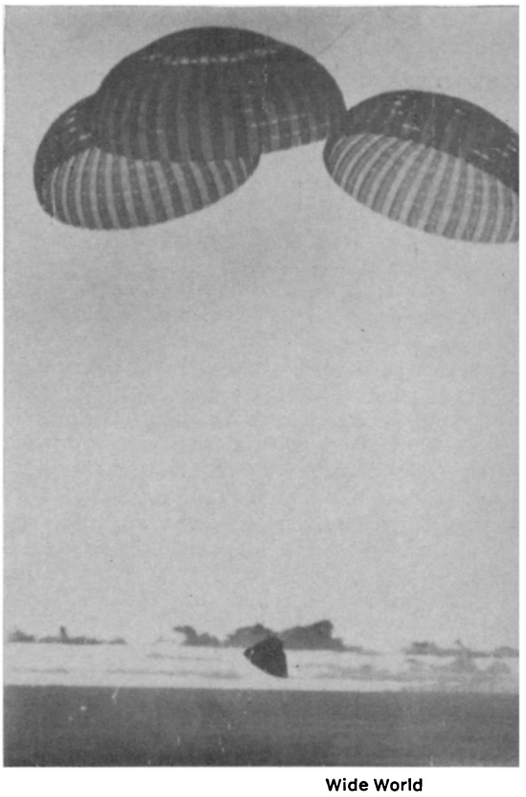
Before the LM began its workout, however, the astronauts spent several of their 31 orbits around the moon photographing and commenting on lunar craters and other landmarks, both as an aid to selenologists and in preparation for Apollo 11's tracking and site-hunting activities.

After a night's rest—the mission was designed, unlike Apollo 8, to let all three astronauts sleep at the same time—Stafford and Cernan made ready to uncouple the command module from the LM. And there, early in the eleventh trip around the moon, the flight's first substantial problem arose.

"We cannot get the tunnel to vent," radioed Young, who would be left alone in the command module while the other two astronauts flew the LM. The tunnel is the passageway, about eight feet long, formed between the docking hatches of the coupled command and lunar modules. Venting all the oxygen out of the tunnel was the planned way of making sure that both the CM and LM hatches were properly sealed: any leaks would show on instruments as differences between the zero pressure in the tunnel and the five pounds per square inch in each of the two spacecraft. The tunnel's vent valve, however, had become clogged with pieces of the Mylar thermal insulation that had come loose from around the command module's hatchway.

After some complicated fiddling with pressures in the CM, LM and hatch, the astronauts decided that the seals were tight, and uncoupled the modules. On the ground, officials said the insulation would be trimmed on Apollo 11.

Both before and after the LM uncoupled from the command module to begin its low-altitude workout, a number of communications difficulties appeared, ranging from a lack of LM-to-earth telemetry data to intermittent voice communication between the two spacecraft. Space agency officials, however, attributed the problems almost entirely to procedures in need of improvement rather than to faulty equipment.



Wide World

Apollo 10 splashes into the Pacific.

One disappointing malfunction that did take place was with an item that was not new at all on the Apollo 10 mission. The Hasselblad still cameras that have become almost standard equipment on U.S. manned space flights suffered with jammed film magazines and, later, dead batteries in their motor drives. This was particularly regretted in view of the LM's low swoops over the lunar surface.

The LM's initial descent, on a course identical, as far as it went, to that planned for the lunar landing, carried it down to within 8.04 nautical miles of the moon's surface.

"We is down among 'em," radioed Cernan, to which Stafford added, ". . . there are enough boulders around here to fill up Galveston Bay."

Besides calling out details on the terrain, the low-flying LM crew also gave the spacecraft's vital landing radar its first lunar test, which it appeared to pass with flying colors. On the landing

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mission, the radar will begin reporting the LM's altitude from about 32,000 feet on down, but for Apollo 10, it was modified so that it began picking up the surface from almost 70,000 feet.

Following the low point of the LM's descent, the astronauts then fired the spacecraft's descent engine for the second and last time, carrying the vehicle upward into an orbit even higher than the command module's. Giving the command module the inside track allowed the LM to fall behind the CM, then drop below it to be in position to simulate the Apollo 11 ascent from the lunar surface.

Here the LM descent stage was to be jettisoned, letting the remaining ascent stage carry the astronauts up to a rendezvous with the waiting command module. As the staging maneuver took place, a misread switch position gave the LM crewmen a frightening surprise when it caused the ascent stage abruptly to begin orienting itself for the return to the CM, instead of holding still for staging as expected. Stafford, however, coolly canceled out the unwanted guidance computer program, and no damage was done.

The ascent engine then received its first test around the waiting CM, this time from a low point of about 11 nautical miles. The remaining maneuvers leading toward rendezvous went like clockwork, until, during the 16th orbit of the moon, the command and lunar modules—Charlie Brown and Snoopy—were joined once again.

More than a day remained to be spent in lunar orbit, largely to provide more tracking data to help understand the errors caused by variations in the moon's gravity, along with its irregular shape.

The extra time seems to have paid off. By mission's end last week, officials claimed that they could predict the altitude of a moon-orbiting spacecraft to within 500 feet for each revolution in advance. This is 27 times as good as was possible during the Apollo 10. The tracking also helped to correct specific errors from previous measurements, notably that Apollo site 2, the one chosen for the first lunar landing, is 2,000 feet higher than indicated by maps made from lunar orbiter photographs.

The flight home was smooth; splashdown in the Pacific was within a few thousand yards of the prime recovery ship, Princeton.

Meanwhile, Apollo 11 is already in position on pad 39A at Cape Kennedy, aiming for a July 16 launch. The possibility exists that the launch could be postponed until August to allow additional crew training, but NASA officials last week seemed unanimous in favor of July. ◇

SOVIET SCIENCE

Getting out the cast iron

Central planning is an old story in Russia. The Czarist Government allowed private enterprise, but it never let it be very free. When the Bolsheviks took over, they nationalized what enterprises were not already owned by the state and amalgamated their administrative bureaucracy with the already cancerous state bureaucracy.

One organization the Bolsheviks inherited from the Czars was the Imperial Academy of Sciences, now known as the U.S.S.R. Academy of Sciences. According to a report on Soviet science policy by the European Organization for Economic Development, the eighth in a series of national reports and the first on a non-member, this old and prestigious group has successfully maintained its independence against pressures from party and ministerial officials. But it has become, as Communist planners wished, the central administrator for much of the country's research effort. Nearly all the pure research and much of the applied research is done in institutes managed by the academy or by the academies of the constituent republics, which are supervised by the U.S.S.R. Academy.

While it fights interference from outside, the U.S.S.R. Academy has established within its rank a control so rigid as to provoke loud complaints. If a Soviet scientist has enough prestige, he can fight back by refusing to send papers up and down stairs. Such a one is Dr. Gersh Istkovich Budker, director of Institute to Nuclear Physics at Novosibirsk, who builds large particle accelerators without asking permission and is very outspoken when interviewed. Referring to one such project, he says: "Our chiefs at the Academy of Sciences did not know about this accelerator until we had built the tunnel." He found the money by juggling other items in the budget he had been given.

There is open dissent as well. The report located a present center of outspoken discontent in the academies of the Soviet republics. Their complaint is the attempt by the U.S.S.R. Academy to make each of them concentrate its effort in a single scientific specialty. They want to build up general scientific communities in their several countries. Whether their protest will have any effect is yet to be seen.

Soviet universities are responsible for far less of the country's research effort than are their counterparts in Western countries. One reason for this, says the OECD, is that they are officially in a second-class position. In the scale established for payment of salaries and qualifications of personnel, the academy institutes occupy the highest level, the universities come second. The academy, therefore, takes the best personnel.

APN/Novosti

Academy President M. V. Keldysh.

Some hope of strengthening university research lies in a new policy by which industrial managers are being allowed to contract with university researchers for research programs they think they need. This method, which is traditional for both private and government agencies in Western countries, has done much to build up the research capabilities of the colleges and universities in the West.

The Russians seem to hope, the report indicates that it will also help to bring innovations into industry. Industrial laboratories themselves are on the bottom of the prestige list and have usually concentrated on the immediately practical. Yet any discovery that may be of industrial use has a hard time getting into production because of bureaucratic inertia.

In areas like armaments, nuclear technology and space science, the pressure of national defense and national prestige and the power of the military have combined to cut through the red tape and bring innovations to quick application. In the average washing machine factory this has not been so, and the over-all result is that the Soviet Union lags behind the West in most consumer industries.

The problem is that factory managers have production goals set for them by a general five-year plan. If they use familiar methods, they may fulfill the norm. Innovation entails the risk of missing the goal, and that can be fatal to careers.

Meanwhile money for science is getting tighter in the Soviet Union as elsewhere. The rate of increase in expenditures for science has steadily dropped, according to the OECD: from 18 percent per year in 1960 to 5 percent per year in 1966. As this has gone on, the government has been looking at