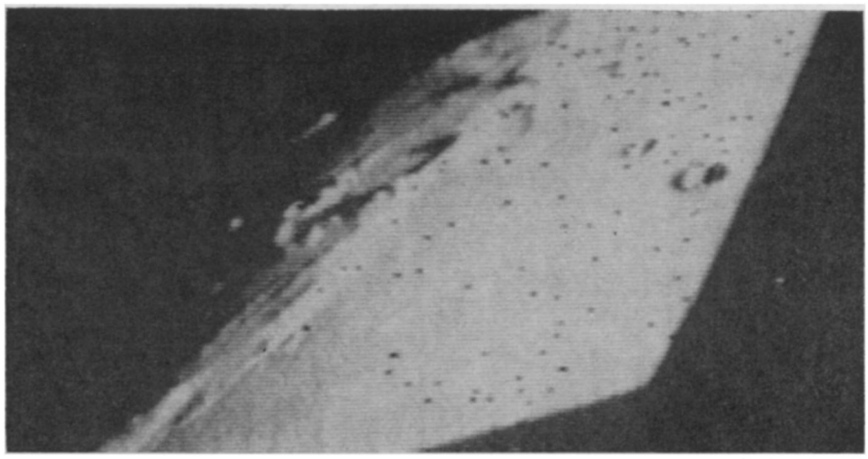
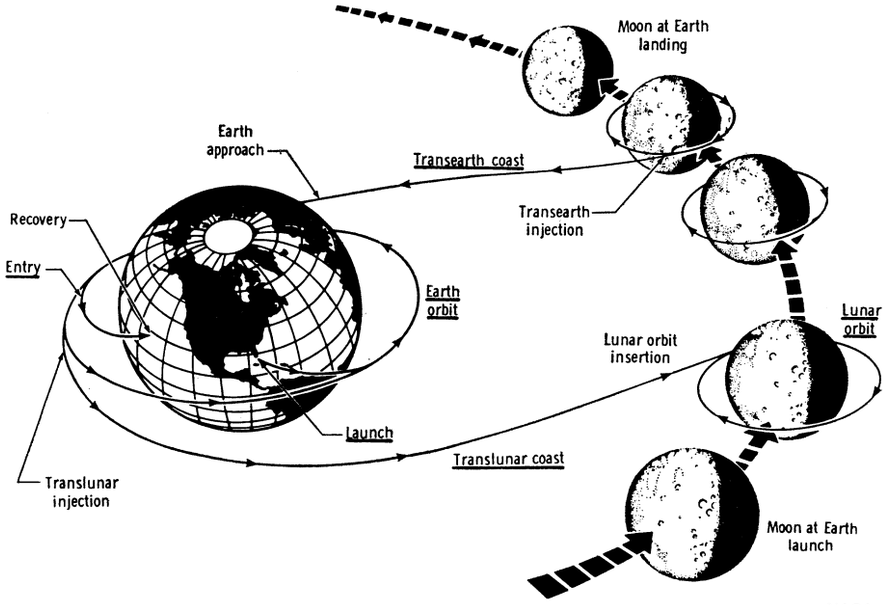
To the moon and back

The voyage of Apollo 8 blazed a trail for more critical flights



NASA via UPI

Window on the moon: Apollo 8 sent this view from 70 miles above surface.



NASA

Geometry of the longest journey ever made by man: the Apollo 8 mission.

"Roger. We look good here," acknowledged Frank Borman, in about the tone in which he might have said, "Please pass the potatoes." And so saying—and in the same matter-of-fact fashion—he and James Lovell and William Anders blasted their Apollo 8 spacecraft out of earth orbit and went to the moon. An age-old dream had taken its biggest step toward fulfillment; by Christmas Day, after 10 orbits around the moon, Apollo 8 had started home.

At Cape Kennedy before the launch, preparations were amazingly smooth. Minor problems such as a fuel leak in a first-stage engine and contamination in a fuel cell oxygen supply kept the chances of an on-time liftoff in the dark until only 17 hours before the scheduled moment of launch, but the schedule was kept.

Nothing in or out of the world could have raised hopes for the future of the space program as much as the voyage of Apollo 8, beginning at liftoff, only 0.665 seconds past the scheduled 7:51.00 EST on the morning of Dec. 21. Throughout the flight, times, distances, angles and speeds clicked off within fractions of a percent of their predicted values.

It was almost 10:42 a.m., however, before Apollo 8 became more than just another spacecraft, tied, like all its predecessors, to the relentless gravity of earth. At tnat moment, Command Pilot Lovell fired the powerful engine of the still-attached third-booster stage, letting it burn for more than five minutes to strike outward for the moon.

A few minutes later the booster stage was jettisoned, and then fired away to orbit the sun. Because the astronauts chose, as a precaution, to move their spacecraft farther away than originally planned while the booster blasted off, they had to make a larger-than-intended correction in their moonbound trajectory. For the larger correction, they had to use their spacecraft's powerful service propulsion engine, thus providing a welcome advance test of the engine that would later have the job of getting Apollo 8 into and out of its orbit around the moon.

As in the Apollo 7 mission, a television camera brought to earthbound audiences a view of what it is like in space. Although NASA admits that the function of the TV shows is largely public relations, there seems no doubt they will be part of future Apollo missions also.

Communications were crystal clear. Even from the lunar distance of more than 230,000 miles, the astronauts sounded more like they were talking on the telephone than radioing back from the depths of space. Then, 68 hours, 58 minutes and 5 seconds after the flight began, the spacecraft's signal abruptly cut off. This was the beginning of its first pass around the moon, during which ground controllers waited nervously for it to emerge some 33 minutes later so that they could see whether the SPS engine had locked Apollo into its lunar orbit—as it had.

In their 20 hours around the moon, 70 miles high, the astronauts took hundreds of pictures of the lunar surface, particularly of areas planned as potential Apollo landing sites. A surprise to lunar scientists waiting on earth was that the astronauts who called off the names of craters and other features like experienced travel guides (including some named for themselves and other astronauts shortly before the flight for purposes of ready identification) could pick out known surface features even when the sun was shining down from almost directly overhead, leaving little or no shadow. A major constraint on Apollo launch planning has been to time flights so that the sun would shine obliquely over planned landing sites, making landmarks stand out.

Although this suggests the possibility that there might be some relaxation of the restraints on when they could launch flights to particular landing spots, mission planners are likely to play it safe and stick with their tight scheduling, which Apollo 8 has shown they are able to meet.

As for the moon itself, the main impression given by the astronauts was that they wanted to come home. ". . . it's a vast, lonely, forbidding type existence," said Borman, "a great expanse of nothing . . . not . . . a very inviting place to live or work." Lovell spoke of its "vast loneliness," and Anders echoed his impressions of the "stark nature of the terrain." The photographs, miles above the lunar surface, and the first close-up motion pictures of the moon, will enable greatly improved analysis of feature heights and depths.

No traces were noted by the astronauts of unusual features such as the bright red spots which some earth-based observers have noted in the crater Aristarchus. Anders had said before the flight that he particularly intended to look for the mysterious red spots, which some scientists feel may indicate that the moon is still volcanically active.

Selenologists at the Manned Spacecraft Center in Houston were able to conclude little from the television pictures. They preferred to wait for the photographs. The astronauts did, however, point out such features as large dark areas, probably denoting ancient lava flows.

The recent discovery of mass concentrations beneath the lunar surface (SN: 8/31/68, p. 205) was confirmed in an unexpected way. During its 10 revolutions around the moon, Apollo 8's path stretched, increasing its ellipticity about five miles, an effect attributed to the so-called mascons. They produced perturbations in the orbit which caused the change, it was concluded.

The greatest tension of the flight came near the end of Apollo 8's tenth and last lunar orbit, as ground controllers waited to see whether the SPS engine had freed the astronauts to head home or left them stranded to die from lack of oxygen. At 19 minutes 56 seconds after one a.m. on Christmas morning, a rousing cheer went up from the control room—the spacecraft's signal had appeared—but it was five nerve-racking minutes before troubles with an Australian tracking station straightened out and Borman's voice was heard: "Apollo 8, Roger."

All that remained was the Friday morning splashdown in the Pacific.

Historically significant as Apollo 8's mission was, however, it was not nearly so indispensable to U.S. moon landing plans as will be the far less spectacular earth-orbiting flight next month of Apollo 9. With Gemini 8 veteran David Scott manning the command module throughout the 10-day mission, Astronauts James McDivitt and Russell Schweickart will be the first men ever to fly the troubled Lunar Module, the spacecraft that must carry two astronauts to and from the lunar surface. Apollo 8 did not carry a version of the module.

Troubles with electronics and excess weight prevented the LM from being included on Apollo 8, and there have been other difficulties that make Apollo 9's checkout mission particularly vital. The lunar landing training vehicles, spidery craft intended to give astronauts practice in landing and maneuvering the LM, have been grounded ever since one of them crashed on Dec. 8 (the NASA test pilot ejected safely), without a single astronaut ever having flown them.

"This certainly does put a crimp in our plans," admits Apollo program director Lt. Gen. Samuel Phillips. Eight months before that, one of the two research vehicles being used to design the LLTV also crashed, with Astronaut Neil Armstrong ejecting safely when a sudden loss of fuel pressure caused the attitude control system to shut down abruptly in mid-flight.

The LM will receive its first manned test, according to the first draft flight plan, beginning about two hours and 43 minutes after the scheduled 11:00 a.m. launch. First, the combined command and service modules will separate from the third stage of the launch vehicle, to which the LM is attached. (The first and second stages will already have been jettisoned and fallen into the sea.) Pilot Scott will fly to a distance of about 50 feet from the LM, then turn and come back to within mere inches of its circular docking collar, pause for about 15 minutes of practice in precise position-holding, and finally nose into the collar and couple the spacecraft together. This is the position in which the future moon-bound missions will make most of the journey.

Then the two LM crewmen will crawl through the tunnel-like hatchway connecting the command and lunar modules. With Schweickart piloting and McDivitt navigating, they will then fly the LM for the first time, including a rendezvous in which the command module remains completely passive, forcing the lander to do all the maneuvering with its own engines.

In addition, plans call for Schweickart to climb out of the LM and crawl outside through space to the command module and back, the only extra-vehicular activity in the Apollo program before astronauts actually set foot on the moon. During his spacewalk, besides taking pictures of earth and the spacecraft, he will check the brightness of a floodlight mounted outside the service module to provide illumination for docking. Other Apollo 9 events include changing the shape and size of the earth orbit 16 times, and testing the module's ascent engine—the one that must work to get the astronauts off the moon—by detaching the ascent stage from the rest of the module and letting it blast upward into space, unmanned, until its fuel runs out.

The space agency's plans list the earliest possible date for the mission as Feb. 20. But according to Gen. Phillips, "It will probably center down to Feb. 28."

Then will come Apollo 10, in which Astronauts Thomas Stafford, John Young and Eugene Cernan will take the lunar module to the moon. The chances are at least 99 percent that on that flight the LM will orbit the moon, swinging down to less than 10 miles above the surface and providing vital additional flying time in the tricky vehicle, but without actually touching down on the surface.

Space agency and industry officials all but swear that the second LM checkout flight is needed before the landing attempt, and in fact the lunar module now earmarked for Apollo 10 is physically several hundred pounds too heavy for the ascent engine to be sure of lifting it off the lunar surface once it has touched down. For the moon-orbiting mission, the likeliest launch date is May 17.

There is just a miniscule chance, however, that Apollo 10 could land on the moon. This would require commandeering the lighter LM from Apollo 11, as well as postponing the launch at least a month, since the decision would probably not be made until after Apollo 9 had shown the LM to behave flawlessly. The space agency could lose a great deal of its newly revived image if something should go wrong as a result of such a shortcut. But weeks of questioning cannot completely rule out the possibility.

Apollo 11, nevertheless, remains the likeliest candidate for a lunar landing. The crew has not yet been chosen, but a good bet would be the Apollo 8 backup crew, since the Apollo 7 backup trio is the prime crew for Apollo 10, in keeping with a cyclic progression such as was followed during part of the Gemini program. In addition, two of the Apollo 8 backup crewmen, Neil Armstrong and Edwin Aldrin, are among the three astronauts who have flown the lunar landing research vehicle. If Apollo 9 and 10 are both successful, the first U.S. astronauts could be walking on the moon on the morning of the 18th of July.