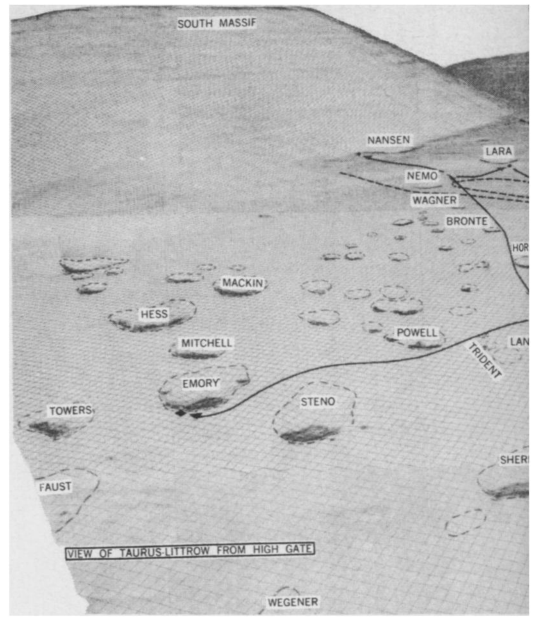
Journey to a lunar Camelot



Apollo 17's Challenger will land in a small valley in the Taurus mountains where ancient crust appears to surround very young volcanics

by Everly Driscoll

"We are on the verge of understanding the evolution of another planet. This is the significant news of Apollo—that we can stand here and talk about this evolution from hard facts and observations. . . . This is really unprecedented. . . ."
Harrison H. (Jack) Schmitt, Oct. 27, 1972

Nestled in a small lunar valley in the mountains that border the southeastern rim of the old Serenitatis basin is Camelot—the landing-approach target crater for Apollo 17. Surrounding Camelot are other craters with equally improbable names—Billy Mitchell, Horatio, Sherlock, San Luis Rey, Lewis and Clark, Snoopy, Shakespeare, Cochise, Wagner, Faust, Bronte and Victory.

Apollo 17 will begin its journey to Camelot on the evening of Dec. 6. If all goes well, Commander Eugene A. Cernan and geologist Harrison H. (Jack) Schmitt will land the lunar module "Challenger" at the Taurus-Littrow site near Camelot crater Dec. 11. Ronald E. Evans, pilot of the command module "America," will orbit the moon, operating instruments.

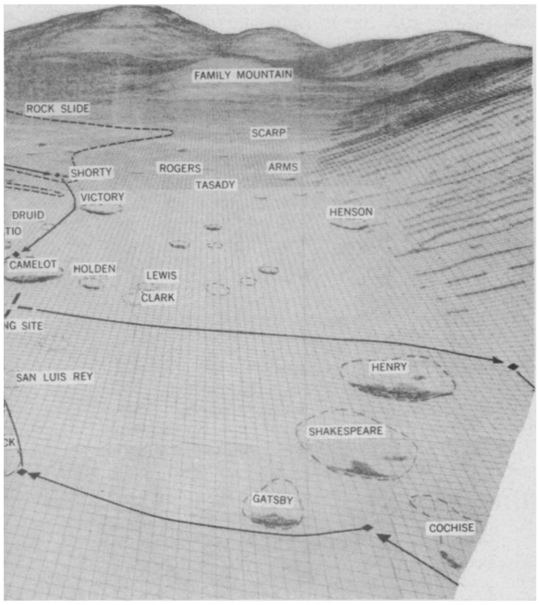
The names of the craters and spacecraft reveal a lot about the last Apollo moon men—two Navy aviators and a geologist. As Schmitt puts it, they are names of men whose mind and spirit reflect the same spirit of exploration that conquered the American West, opened up space, and now compels him to want to take and "preserve the seed of individual freedom in space." Such philosophic musings dominated the interviews granted the press this month before the three men went into prelaunch quarantine. They spoke at length about their hopes for this last Apollo mission (which they view as the end only of the beginning of man's exploration of the universe), their pride in their country, and the challenge of their trip.

The Taurus-Littrow site (SN: 2/19/72, p. 120) has been and is a challenge. "The landing is near the limits of our performance capability," says Floyd V. Bennett manager of the Apollo mission planning and analysis division at Houston. Because of the site's location in the moon's northeastern quadrant, the trip to the moon will take about 13 hours longer than did Apollo 16's. This particular trajectory was necessary to avoid putting the spacecraft in a nine-hour total solar eclipse (the systems can take only four or five hours in the shadowy cold). Cernan and Schmitt will have only 15 minutes (the usual time is about 25 minutes) from the time the craft comes around from the moon's far side to prepare for the landing maneuver. Their descent path is over hills that rise about 750 meters above the plain, although many are as high as 1.5 kilometers. Challenger will have to make a pinpoint landing. "Unlike the other sites," says Bennett, "there is no smooth terrain downrange." Challenger can overshoot the landing point by only 7,000 meters before hitting the south massif. "In no way, however," stresses Bennett, "has the safety of the crew been compromised. We can do this kind of landing."

The same thing that makes the site difficult to get to is what makes it scientifically challenging. Taurus-Littrow appears to have at least three different rock types or geological formations and probably material of several different ages. The other landing sites have been largely grouped around the moon's equator near the center of the moon's near side and near the effects of the Imbrium impact event. The Apollo 17 site is 750 kilometers east of the Apollo 15 site in a region of relatively low radioactive material. To the north, south and southeast of the landing spot are large massifs more than 2,000 meters high. These large blocks—10 to 20 kilometers in diameter—are generally interpreted to be sections of crust uplifted by faulting action at the time of the event that created the Serenitatis basin. Measurements from orbit indicate they are probably similar in composition to the anorthositic gabbros found at Apollo 16 (SN: 7/1/72, p. 12). Their 25-degree slopes make sampling them difficult. But by luck it appears that a landslide has occurred from the south massif. "The crew will be able to sample the layers of the massif by sampling the slide," says Paul Gast of MSC. Cutting through the slide is a scarp about 80 meters high that appears to be a very young formation.

Adjacent to the massifs are dome-like features called sculptured hills. Their morphology is definitely different from the massifs, says James W. Head of Bell Laboratories, and their origin and composition could also be different. "We really have no good ideas about how to tackle these hills," says Schmitt. What to do at the stop near the hills has been left to crew discretion. "We'll decide how to sample the area when we get there," says Schmitt. "It's a real-time decision, but that's what you want men there for anyway."

The valley or trough itself is a smooth plain. The subfloor was probably filled with material after the trough was formed. Over this first fill is a dark mantle, presumably an unconsolidated blanket varying in depths from a few meters to tens of meters.



Bell Laboratories

It also covers floors of nearby craters. "If this isn't pyroclastic deposits (volcanic) it's beyond our earthly experience," says Gast. Schmitt thinks the material could be the youngest ever sampled—one billion to three billion years old. He believes it could be from very deep within the moon—more than 500 kilometers down. The possibility of finding very young material there adjacent to older crustal material was one of the primary reasons for choosing the site (SN: 11/4/72, p. 292). Scattered throughout the region are what look like dark halo craters. They could be vents for volcanic ash. Head and Thomas R. McGetchin of the Massachusetts Institute of Technology did a study of what cinder cones would look like in one-sixth gravity and little atmosphere, and halo craters appear to fit their model.

Robin Brett of MSC speculates that the crew might find fumaroles (deposits from the last stages of volcanism) and xenoliths (rocks formed at high temperatures and pressures) if the models for the region are correct. "You'll know if we do," says Schmitt. (His thesis concerned rocks in Norway formed at high temperatures and pressures.)

Cernan and Schmitt will explore the region during three seven-hour field trips, traveling as far as 7.5 kilometers from the LM in the rover. They will set up a group of geophysical instruments, all but one of which are new to Apollo (SN: 10/21/72, p. 269). The Apollo 15 crew monitored high rates of heat flow, so the Apollo 17 heat flow experiment has top priority. "We must establish if that high reading at Apollo 15 was local or is moon-wide," says David Strangway of MSC." The answer is crucial to unraveling the moon's evolution. □

A geologist goes to the moon

NASA

Schmitt (left) and Cernan: "A team."

What does Harrison (Jack) Schmitt, scientist-astronaut, Harvard Ph.D., former U.S. Geological Survey astrogeologist and the son of a New Mexico mining geologist, expect from himself and expect to find at Taurus-Littrow? Equally important, what do his fellow astronauts and geologists expect from him?

The answer may be one reason Schmitt became "one of the hardest workers in the office." He is described by various scientists and astronauts as unbelievably self-disciplined and almost Spartan. ("He set a high professional and personal code for himself and lived by it.") Some think he is hard to get to know personally. No one need doubt what he thinks. But although he is outspoken and aggressive about his ideas at NASA, he has assumed a low public profile. "He has probably contributed as much or more than anyone to the science of Apollo," says a California Institute of Technology geologist. "He has been the astronauts' in-house resident geologist," says William R. Muehlberger of the University of Texas and head of field geology for Apollo 17. Ten years ago, for example, Schmitt was working at the USGS astrogeology center at Flagstaff and his main concern even then was, "What were the feasible things for man to do on the moon?" During his seven years at NASA, he has managed to allay the initial skepticism of the pilot-astronauts and also remain the darling of the "guys in the back room." These are the scientists (many of whom Schmitt worked with at Flagstaff) who work closest with the astronauts before and during a moon mission.

"My selection to fly on Apollo was based solely on my training as a geologist," says Schmitt of the difficult decision made to send him on this final Apollo mission in place of Joe Engle (SN: 9/4/71, p. 137). But will he see and discover things on the moon that a pilot with training in geology misses? Schmitt thinks he will since he has been thinking geology for most of his life (he is 37).

But he admits it will be hard. "The lunar surface is a great equalizer," he notes. Unlike doing geological research on earth, he will be able to study the site only once—and then only for three days, not three weeks. The sun's glare, and the bulky spacesuits are obvious problems. And the surface often lacks contrast: A thin layer of dust covers everything, and geological contrasts—both structural and color—are hard to see. "A lot of what an astronaut can see at a site is a function of the site itself," says John Young, commander of Apollo 16. The Apollo 17 site does have some contrasting terrain. "Jack is a real thinker; he will be able to piece it [the geology of the site] together," says Young. However, to do that, says Muehlberger, the crew needs more time at each station to determine which rocks came from what crater and to ascertain the subtle relationships of the one station to the whole site.

"I try not to form opinions ahead of time," says Schmitt of what he might see. "Some of the most important things to come out of any exploration is the unexpected, and I want to remain open." He hopes to be able to take a few minutes at each stop to get away from the mechanical duties of filling sample bags and taking pictures "just to think. That's the problem with a hectic timeline—there's no time to think." Schmitt and Cernan both worked closely with the scientists planning their traverse, and Schmitt helped prepare the maps of the site.

How will he and his partner work together on the moon? "I am really proud of the way it has turned out," says Cernan. "Because of our different backgrounds we complement each other. He sees things one way, and I see them another way. We argue. I am not afraid to disagree with Jack. Sometimes I see things he has missed and vice versa. I am just as good a geologist on the moon as he is. If he didn't feel he were just as good an aviator as I am, I would be disappointed."

"Cernan and Schmitt are a real team," says Muehlberger. While Schmitt might not solve all the lunar problems in three days on the moon, he will have a major role in figuring things out when he gets back to earth. "He will look at the site and unconsciously store impressions and relationships that will aid us later."

—Everly Driscoll