Our Man on the Moon

On December 11, Harrison H. Schmitt will climb down the ladder of Apollo 17's lunar module—*Challenger*—step out onto the surface of the moon, and take a long look around him. He will be the first scientist in the history of space exploration to take that look.

Not that this difference will be particularly evident from Schmitt's performance on the spot; he will be doing all the tasks assigned him as a pilot-astronaut. But scientists all over the world will be waiting to hear his reports after he returns because, with his training and experience in geology, he will instinctively and continually make evaluations of what he is seeing—in a way that has been impossible for any other man who has yet been on the moon.

If he had chosen to stick to the conventional professional paths after he finished his doctorate, Schmitt might have become a distinguished geologist almost anywhere on earth. Instead, in 1965 he signed on as one of NASA's first scientist-astronauts. And through the tough and sometimes turbulent years since then, he has steadfastly stuck to his belief in the importance of that role.

It takes a special kind of man to abandon an ordered, successful career to work seven years and travel 235,000 miles through space just for the chance to spend a few hours on a "planet" more desolate and more rugged than any place on earth. It takes a special combination of motivation, hope, and sheer hardheadedness to accept the responsibility of being the first scientist and geologist to go to the moon—particularly when his trip is the last moon-landing mission the United States will make for many years to come.

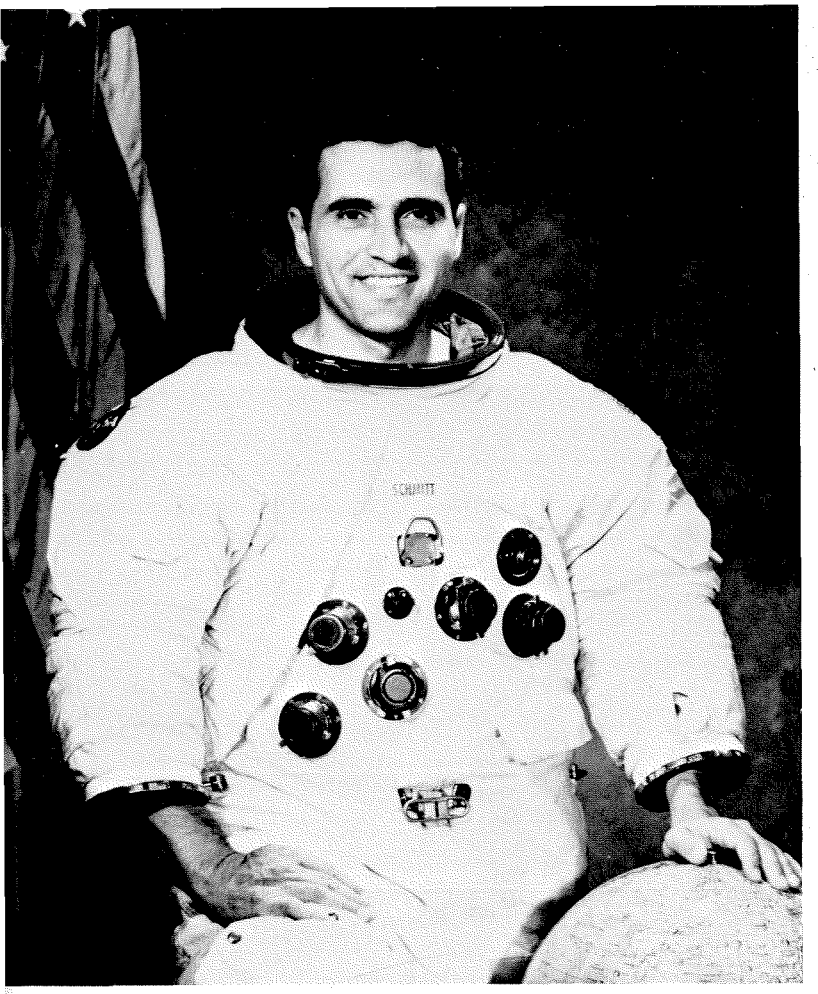
It is evident in even the most casual meeting that Harrison Schmitt is indeed a special kind of man. He seems taller than his 5 feet, 9 inches, and younger than his 37 years. He has short-cropped black hair, direct brown eyes, and his compact body moves with the fluid grace of an athlete. It is hard to visualize him in the cramped confines of a spacecraft, for even when he moves around a room, he seems uncomfortable within four walls.

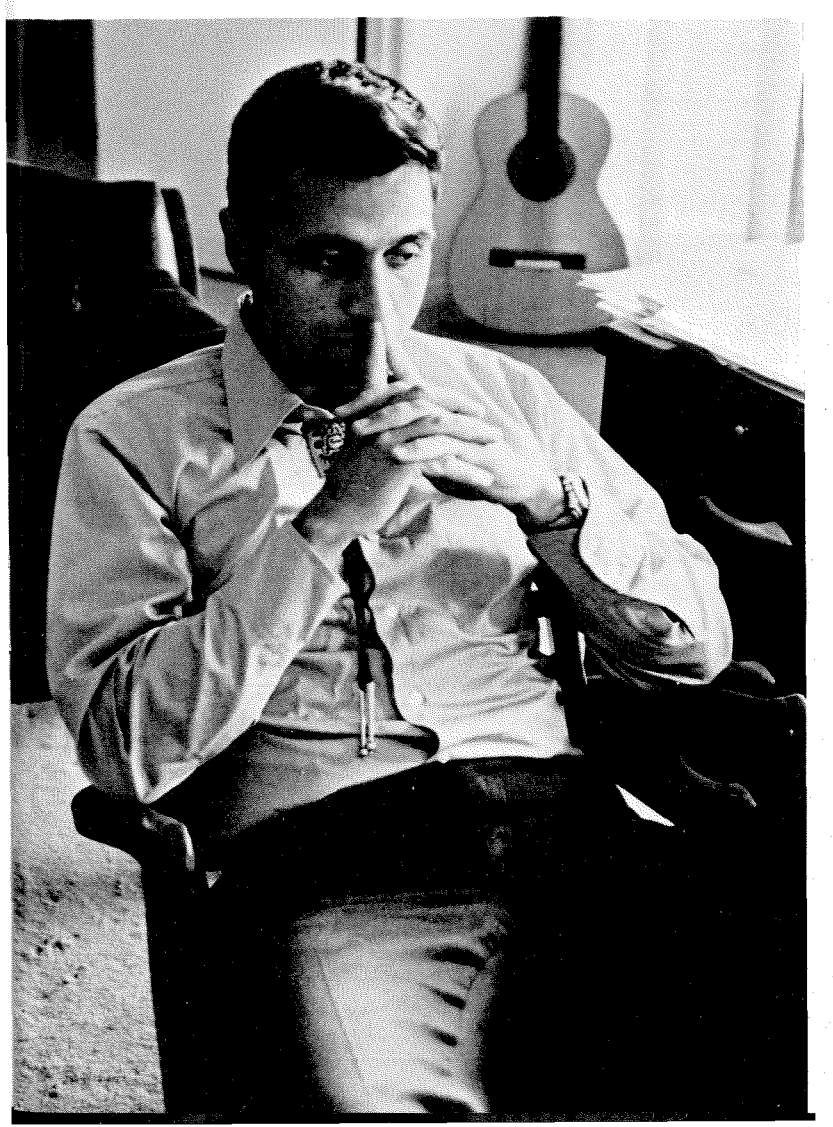
His conversational manner is easy. But occasionally he shows a reticence, a privateness, which—if he were a football player or the man facing you in a fight—would make it difficult to predict his next move. But he is openly emotional on subjects he feels strongly about. And when he talks about Apollo 17 and the reasons he became involved in the manned space program, he pounds his fist on whatever is available to make his points, and his voice gets low and husky.

"When I got involved in the space program, I was constantly asked: 'Why is it worth doing?' And my answer came from my feeling that if there is any clear message from history, it's that civilizations *need* frontiers and challenges, and that's what space offers us. The idea of exploring beyond the earth and to the outer reaches of space is new enough that everybody has trouble, myself included, in grasping it for what it is. When you start searching for ways to explain something you don't quite understand, you fall back on what is familiar and a part of your experience. And for me, America's western frontier is familiar. The parallels are close enough that we have to expect space exploration will influence us in the same way the frontier influenced us.

"The effect of the western frontier on us as a people has been basically and fundamentally good. It attracted special kinds of people, and in turn produced people with the kinds of special abilities and attitudes that helped us to face and overcome the many crises we went through. It has been good for mankind that a nation developed the characteristics we did. And what the western frontier did for us, the space frontier can do for the entire world.

"Space exploration gives us an infinite frontier within which we can further nurture values like respect for the rights of the individual, innovativeness, creativity, flexibility, and a balance between looking inward and moving outward. I think that alone justifies man's move into space. I think it particularly justifies this country's maintaining itself as the first and leading 'spacefaring' nation in history right now, because we are the only power





On Jack Schmitt may rest the hope of the scientific world for a fuller understanding of the moon.

on earth that can protect these values. That may be a very nationalistic point of view, but for me there's no other logical interpretation—at least not with my background and upbringing."

Schmitt's family was at the frontier as America headed west. Both his great-grandfathers were part of the American movement westward—to Tennessee on his mother's side and Minnesota on his father's. His father, Harrison A. Schmitt, was born into a lawyer's family only one generation removed from the frontier. Although the necessity to be a carpenter, a smith, or a hunter was rapidly disappearing when he was a young man around the turn of the century, the elder Schmitt nevertheless acquired these skills along with a jack-of-all-trades knack for improvisation.

Inheriting all his forefathers' frontier instincts, he gave them a modern twist. He was one of the first of a generation of university-trained geologists who took the art of mining geology and turned it into a science, using the new techniques of geochemistry and geophysics. From his first work in the Parral distict of Chihuahua, Mexico, in the 1920's to his last field trip in 1966 to the Mono Crater area of California, just a week before his death at the age of 70, he had discovered and developed some of the major mining districts in the Southwest—Christmas, Esperanza, Mineral Park, and Battle Mountain. His son—called Jack from the time he was a small boy to simplify life in a household with two Harrisons—was born on July 3, 1935, in Santa Rita, New Mexico, a small town in the southwest corner of the state not far from the

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Harrison Schmitt (Caltech BS '57, Harvard PhD '64) has probably spent more time working in his spacesuit in the last 18 months than he has relaxing in the comfort of his Houston, Texas, apartment. As part of the training for the Apollo 17 mission, Schmitt and his fellow astronauts—mission commander Eugene Cernan and command module pilot Ronald Evans—spent several hours daily working out in their pressure suits.

Rio Grande and next to one of the largest copper mines in the world.

When Jack was eight years old, the family settled down on an 80-acre homestead just outside the mining and ranching town of Silver City. Schmitt still retreats there occasionally "Basically, I'm not city-bred," he says. "Even though I've lived in cities most of my life, there are times when I need to get away from the closeness of it all."

Schmitt's father was the center of his life, and by association young Jack picked up many of the skills his father had learned as a youth. "There were all sorts of things to build and repair—additions to the house, garages, furniture, boats; anything that had to be done around home and many things that didn't. There were electrical work and plumbing, and even blacksmithing. We had quite a workshop and did just about everything imaginable with our hands."

Against the backdrop of the rugged Pinos Altos mountain range of southwest New Mexico, Jack picked up a love of hunting, fishing, hiking and—not surprisingly—geology. "That part of New Mexico is beautiful," he says, "mountainous, semi-arid, but with small forested spots and streams here and there, and it is materially productive. It still takes my breath away every time I see it. I guess it was natural for me to learn something about what was around me."

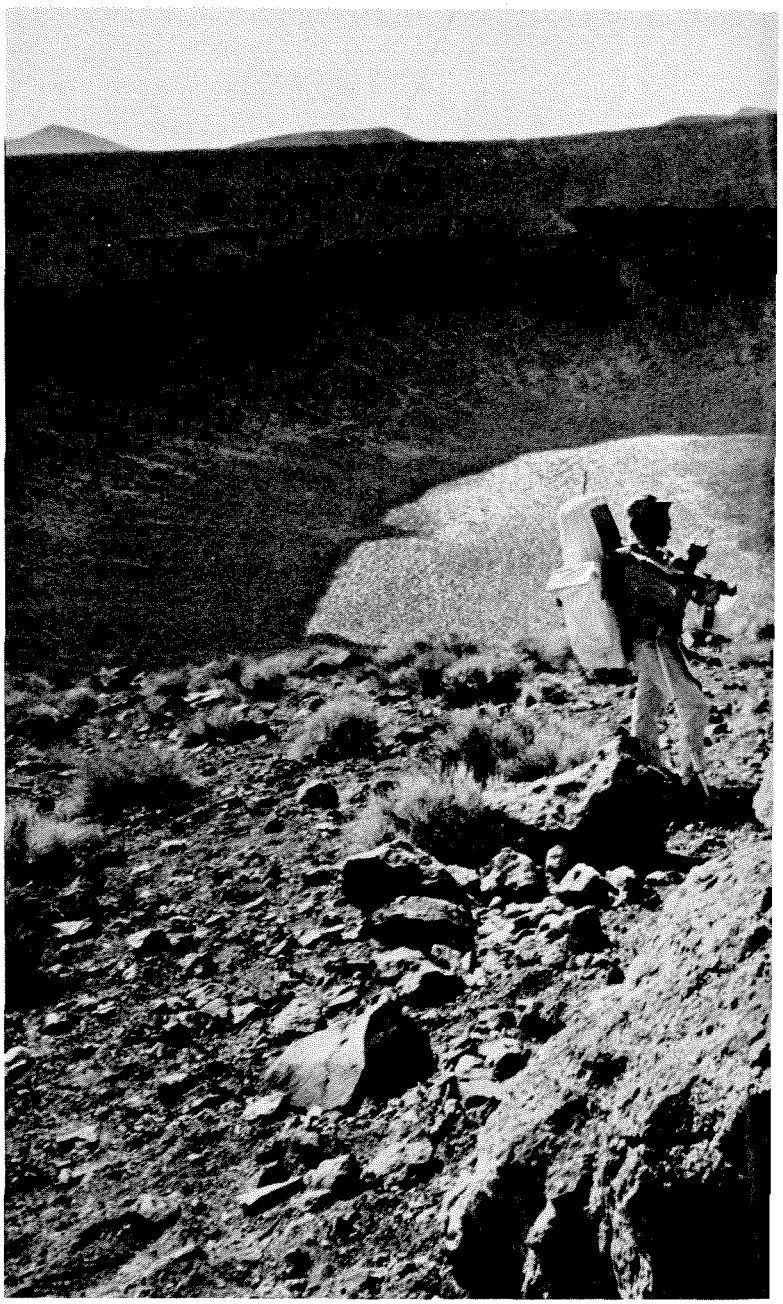
As far back as he can remember, Jack traveled with his father through the Southwest—the mining camps, prospectors' digs, surveys of potential ore deposits, occasionally into the mines. "It was like one long camping trip, with all sorts of extras thrown in: learning about the rocks and features around us, listening to stories about the country, people, and places, and just being in the open. It's something you come quickly to love and never want to give up."

Leon Silver, who was one of Jack's professors at Caltech nine years later, remembers meeting him as an 11-year-old "aide" to his father.

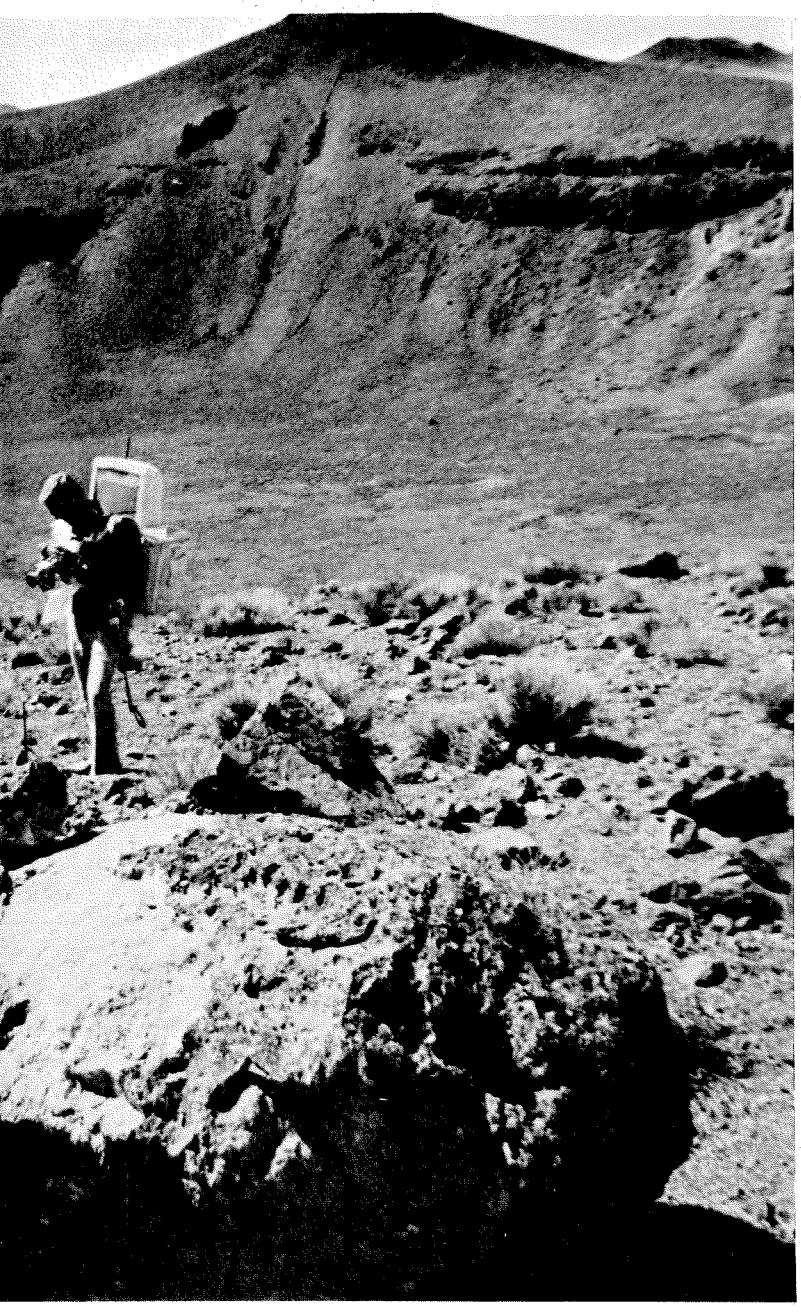
"I was a young graduate in geology from the University of New Mexico at the time," says Silver, "working that summer for a Caltech geology alumnus, Vincent Kelley, and I went with him to the Schmitt home. I sat there in the front room listening to those two distinguished geologists and tried to absorb as much as I could. And there, sitting quietly in a corner of the room, was this young boy doing the same thing."

By the time he was in high school, Jack was helping his father with surveying and other technical tasks. "My interest in geology wasn't something he cultivated deliberately," says Jack. "That was probably the furthest thing from his mind. I'm sure he was pleased that I was interested, but it wasn't any different than a farmer's son helping with the crops. Besides, it looked like he was enjoying what he was doing."

That Caltech can claim Jack is due to the combination of his father's gentle influence and his own disdain for



Familiarity breeds success as far as exploring the moon is concerned. At the half-mile-wide volcanic "Lunar Crater" in the Pancake Mountains near Tonopah, Nevada, astronauts Schmitt and Cernan practice some of the things they will be doing on the moon. This area, a mixture of mountain highlands and valley lowlands, resembles the Apollo 17 landing site—Littrow Crater in the Taurus Mountains.



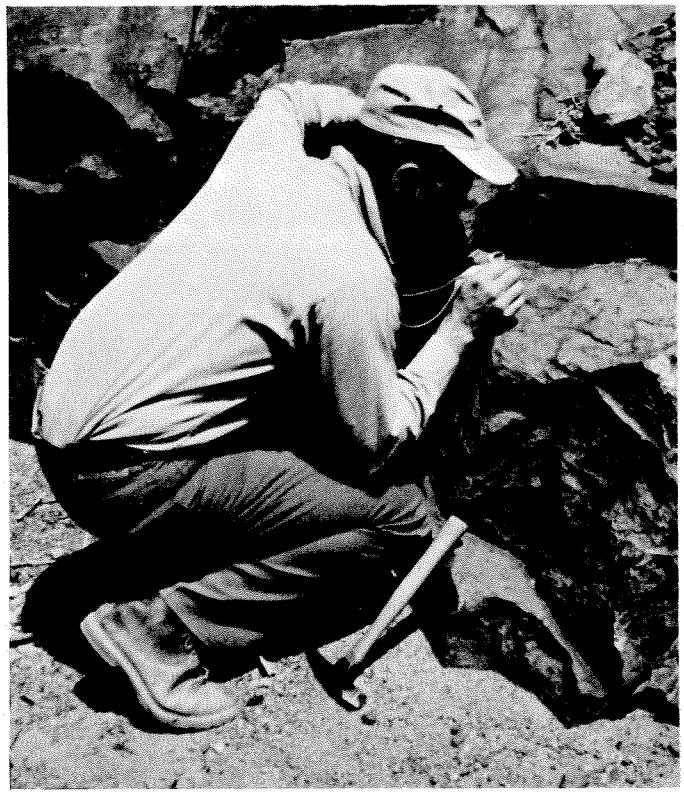
Caltech was the only school Jack Schmitt applied to. If he hadn't been accepted, he would probably have joined the Marines.

filling out forms. In his busy senior year at Silver City High School, Jack was president of the student council and a member of the school's football team, the Colts—which didn't win a single game that season. He also organized and played on a tennis team. Early in the fall his father suggested that it might be a good time to start applying to colleges. "I'd been thinking in a vague sort of way about Princeton, but hadn't done anything about it," Jack says. "My father suggested that I also apply to Caltech. He had heard it was a 'pretty good technical school.' That was the first time I had ever heard of it."

When the application forms arrived later that fall, Jack was busier than ever. Semester finals were coming up. He was studying for the national College Board examinations. He also had to study for the lead role in the senior play, Mark Twain's *A Connecticut Yankee in King Arthur's Court*. With all this on his schedule, Jack took one look at the "volumes" of forms Princeton had sent and immediately threw them out. He filled out the Caltech application quickly and sent it off without another thought. "It was foolish, I realize in retrospect, because I didn't learn until much later how difficult it was to get into Caltech," Schmitt says. "It was the only school I applied to. If I hadn't made it, I guess I'd have gone into the Marines like most of my high school buddies."

As a Caltech freshman in 1953, Schmitt was at first attracted to physics, which was a tremendously exciting field for scientists at that time. But he soon began turning his attention back to geology. His work in the field with his father gave him quite an edge over the other students in terms of practical knowledge. "Jack fitted into the geology department right away," says Silver. "But he seemed to have more in common with the graduate students and faculty than with his undergraduate classmates. He had a knowledge and sophistication in geology, even as a freshman, that was equal to, and sometimes far above, most of the graduate students in the department." As early as Jack's sophomore year his faculty adviser, Ian Campbell, suggested that Schmitt apply for a Fulbright scholarship to study abroad after his graduation. "First, he had to explain to me what a Fulbright was," says Schmitt. "When he did, I just looked at him and asked: 'Good heavens, ME?' "

By his senior year Schmitt had settled into a comfortable B average and had put the Fulbright out of his mind as unattainable. But two of his professors, Campbell and Richard Jahns, now dean of the School of Earth Sciences at Stanford, urged him to apply for the Fulbright as well as a National Science Foundation grant. To his surprise, he won both. He picked the Fulbright, and took off for a year at the University of Oslo, Norway—"an excellent school for studying the kind of geology that interested me." That interest focused during his last months at Caltech on the study of ecologites, rocks formed under high pressure and temperature from other basalt-like rocks. "The controversy was, and still is, over their origin," he says. It turned



A hand lens is a useful tool for taking a really close look at a rock on earth, but it would be excess baggage for a helmeted astronaut on the moon. Even so, Jack Schmitt took along a rock hammer and—even more important—his trained geologist's eye.

out that Norway was a classic locale for these kinds of rocks and the best place to collect information about them.

Schmitt feels that the year in Norway gave him something that no formal education could—perspective. "My education at Caltech is irreplaceable in terms of the basic store of knowledge and patterns of problem-solving I acquired," he says. "But as to knowing how to apply my knowledge wisely, I don't think I could have gotten that at any school. It isn't something that can be taught. I needed that year to put things in perspective, to question the worth of everything I'd learned, to separate the good from the bad."

After he returned to the United States, Schmitt spent the next two years (1958-1960) at Harvard working on his doctorate, first under a Kennecott Fellowship and then a Harvard Fellowship. In the spring of 1960 he returned to Norway on a Harvard Traveling Fellowship to collect additional thesis material on ecologites. Then came a stint as a teaching fellow at Harvard and geological work for the U.S. Geological Survey in New Mexico and Montana. In the spring of 1962, as a Parker Traveling Fellow, Schmitt stopped by the USGS offices in Menlo Park, California, to visit a Caltech and Harvard classmate, Daniel Milton (MS '56). Milton was working with another alumnus, Gene Shoemaker, who is now professor of geology at Caltech. "They were mapping the moon," says Schmitt, "and people sort of thought this was a joke. I looked at the maps, and it seemed pretty intriguing to me, though I didn't think too much about it."

In fact, Schmitt forgot about moon-mapping until after he got his PhD at Harvard in 1964. "Then when I started trying to figure out what there was to do with this fantastic education I had, the only thing that seemed very exciting was what Shoemaker was doing. It matched my growing philosophical interest in the space program. By this time Shoemaker had established the USGS astrogeology branch in Flagstaff, Arizona, so I wrote and asked him for a job."

Fortunately, Shoemaker had received approval for several new studies and was looking for geologists to man them. Schmitt became a project leader of a program that "only Shoemaker could dream up," developing field geology techniques for the first men on the moon—at a time when it was not at all certain that men would ever get there. The audacity of the idea delighted Schmitt. It was like Christopher Columbus ordering his lieutenants to draw up the itinerary of the first landing party in the New World before he even had any ships.

In the spring of 1965, the National Aeronautics and Space Administration sent out a press release asking scientists to volunteer as astronauts and in the fall Schmitt applied for the program. "I talked to a lot of people first," Schmitt says. "It may have seemed as if I couldn't make up my mind, but really the decision was inevitable from the minute I decided to take an active part in the space program a year earlier. I think I determine

whether I do things or not by trying to project myself into the future and then asking myself: "Will I regret *not* doing this?' If the answer is yes, I go ahead."

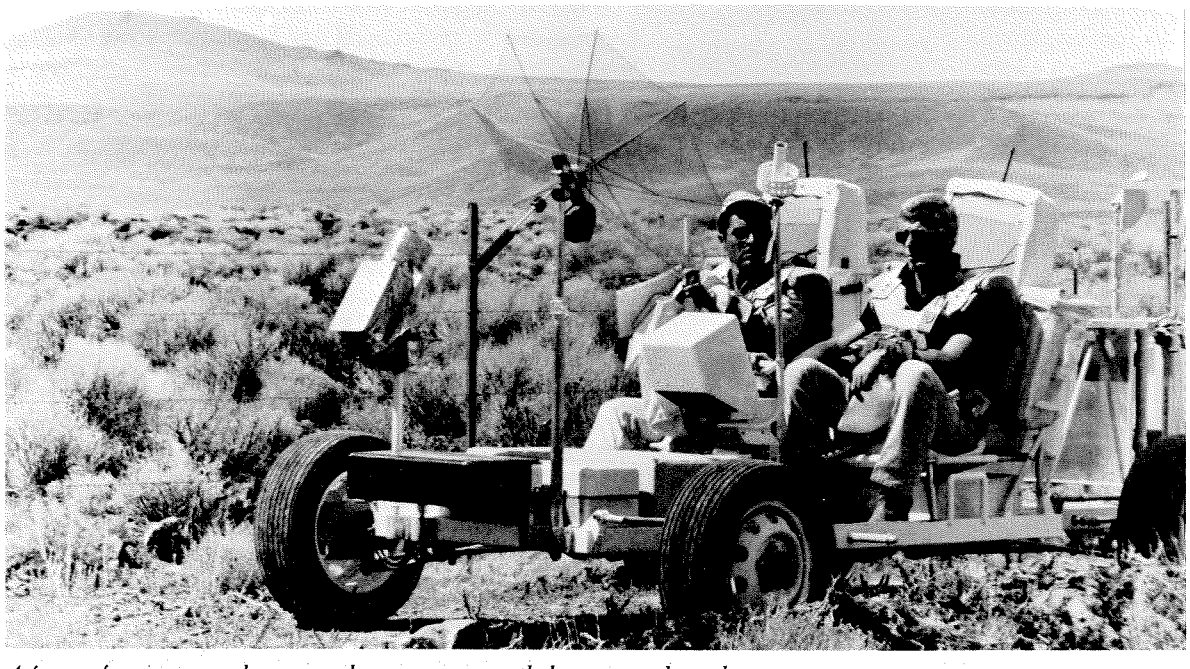
Schmitt was chosen as one of the first six scientist-astronauts, and he was the only geologist. This should have settled what he would be doing for quite a few years to come, but as soon as he completed Air Force pilot training in 1966, it was apparent that he had to make another crucial decision about his future. "As soon as I was assigned to NASA's Manned Spacecraft Center in Houston, it became clear to me that no one was sure that we were going to know how to land on the moon, and even if we did, my chances of actually flying there were very small. I had to decide whether I could make a contribution that would be worth staying for, or whether I should just forget the whole thing."

If he committed himself to continue, he was risking five or ten years on the slimmest of chances that he would actually get to the moon. "But it looked to me as if, even so, there were important things to do in the space program," he says. "So I stayed and took on not only my official assignment—helping develop the Apollo Lunar Scientific Experiment Package (ALSEP)—but also a number of other tasks on a more informal basis."

One of these informal projects was continuing as a co-investigator with Shoemaker in setting up a lunar field geology program under the USGS, and he also became active in the evolution of a joint NASA and USGS program to train the astronauts in geology. Just how active he became is hard to imagine, if you don't know Jack Schmitt—and completely logical if you do. What he believes in he pushes for, using whatever part of the firepower in his impressive personal arsenal the situation requires—intelligence, teamwork, bluntness and/or diplomacy, courage, hard work, and thorough-going competence, for example. And one thing he most certainly believes in is the absolute necessity of scientific training for astronauts.

"It was largely through his interest and intercession—directly and indirectly—that some very good non-scientist astronauts were persuaded that science was important," says Silver, "and a real field geology training program came into being."

"The program began on a trial-and-error basis," says Schmitt, "but we soon decided that its success would depend on three factors—the quality and professionalism



A far cry from a covered wagon, a lunar rover nevertheless serves about the same purpose—enabling men to travel further and in greater safety across unknown territory. Using a terrestrial version, Schmitt and Cernan explore the wilds of south central Nevada.

of the instructors, the teaching approach, and the material to be taught." His first step was to recruit many of the professors who taught him geology at Caltech and Harvard.

"Our early attempts were not as successful as we would have liked, probably because we were running things like an elementary geology course, and we simply didn't have the time to turn the astronauts into geologists. So we had to figure out a way to turn them into reliable geological observers, people who could report accurately back to the geologists on earth what they were seeing on the moon."

Schmitt and Silver together worked out an approach they thought would be effective. "We decided we had to be very selective in the kinds of problems we exposed the astronauts to, so they weren't saturated," Schmitt says. "We evolved the mission-oriented exercise, setting up specific problems in areas on earth that we suspected were geologically similar to the moon."

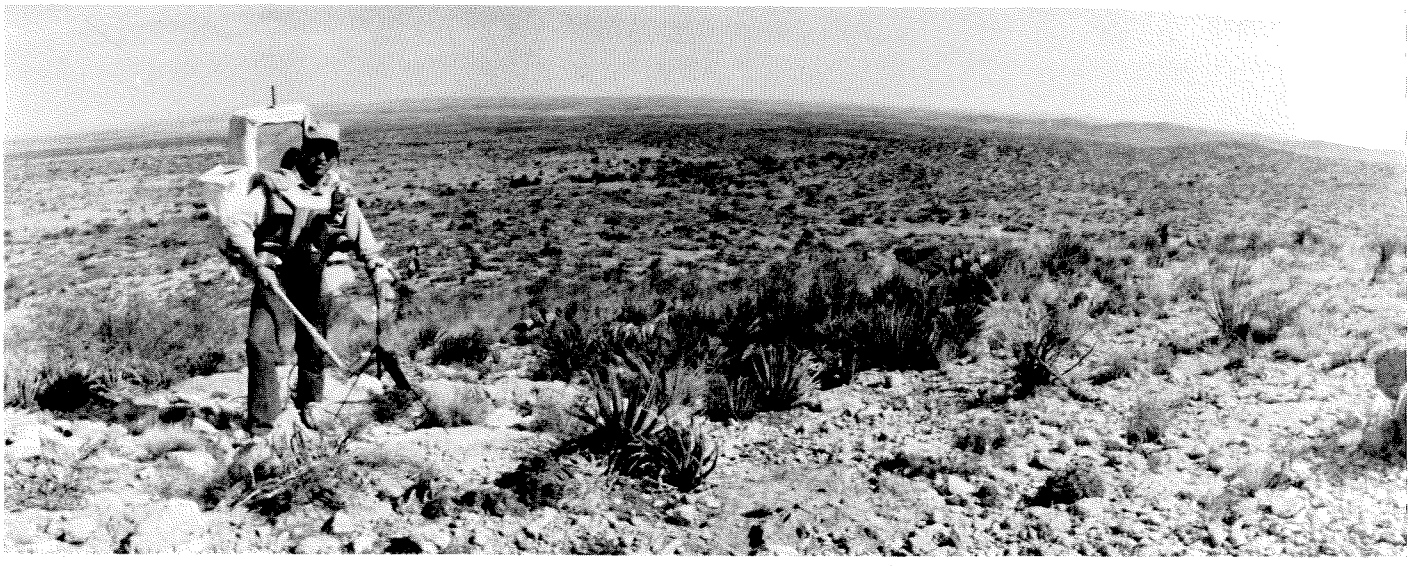
In 1969 Schmitt and Silver got the chance to put their theories to a systematic test when they took the Apollo 13 crew on a Caltech-funded expedition into the desert area near the Salton Sea in California. "That was the breakthrough," says Silver. "The enthusiasm of that crew, even though they never landed on the moon, persuaded NASA to permit, and eventually to encourage, similar intensive training in geology for the rest of the Apollo lunar crews."

As co-investigator for the Lunar Field Geology Experiment, Silver continued geological training with the crews of Apollo 14 and 15 (*E&S*, November 1971). Jack Schmitt was a member of the backup crew for Apollo 15, and Silver says: "He was the real geology teacher, because he was there all of the time, and he used every opportunity to make geological points. He was far more the prime instructor of those astronauts than I ever was."

After his work with the Apollo 15 crew was completed, Silver's commitments at Caltech made it necessary for him to step down from the prime responsibility for the astronauts' training. Another Caltech alumnus stepped in—William Muehlberger, who was chairman of the department of geological sciences at the University of Texas and is now the principal investigator for the Lunar Surface Geology Experiment for the Apollo 16 and 17 missions. Muehlberger and his co-investigators have made the Apollo 17 crew the best trained yet, at least in terms of time spent on the project—18 months of monthly field trips, plus many science lectures at the Manned Spacecraft Center in Houston. A lot of the effort of this training program has been focused on equalizing as nearly as possible the team skills of Schmitt and Eugene Cernan, the mission commander and Schmitt's companion on the lunar surface.

"Even though Jack started with the advantage of scientific training and vocabulary," says Muehlberger, "Gene Cernan has done a remarkable job of closing the gap. The two of them have developed an exceptional working relationship, and to an amazing extent they supplement each other's special abilities. It's in the post-mission interpretive sessions that we hope Jack's long scientific experience will pay dividends."

Silver, Shoemaker, and Muehlberger agree that Schmitt's unique role in the Apollo field geology effort for the past seven years has given him a kind of perception that will be vitally important to the success of this last moon-landing mission. It has given him a detailed knowledge that will make the rough terrain around the lunar landing site in the shadow of the Taurus Mountains as familiar to him as the New Mexico mountains of his childhood. "Because of this familiarity and because of his training as a geologist, we will be able for the first time to see, through his eyes, what is *different* about the moon, rather than the ways in which it is similar to the earth," says Shoemaker. "As good as they were, the other astronauts could only look for what we told them to, and for what they recognized from their training. With that information it has taken years to piece together coherent pictures of just the immediate areas around each



Loaded down by just about everything but his spacesuit, Schmitt tests equipment he will use on the moon in the bare expanse of West Texas. While his lunar field studies will help answer questions about the early crust of the moon, large meteor impacts, and young volcanic rock, much of Schmitt's time there will be spent in setting up remote experiments for earthbound scientists. These include investigations of heat flow, surface electrical properties, moon seismology, the response of the moon to the earth's tidal pull, gravity waves, the make-up of the lunar atmosphere, and the magnetic field at the moon's surface.

landing site. But we hope that Jack, on the spot with his unique knowledge and long experience, can do the same thing in minutes or seconds."

When Challenger lifts off the lunar surface on December 14, the Apollo series of moon landings will come to an end. Important as they have been, as far as Jack Schmitt is concerned they represent only the preface to man's future in space. "I have ultimate faith that this is just the beginning," he says. "We've taken a psychological and mechanical first step in evolving from an earthbound environment to the completely new one of space. It may be years, while we slowly realize the significance of what we've done, before we take our second step, but it is a step we will surely take."

Each astronaut has contributed in his own way, and in his turn, to the achievement. The other astronauts who have been to the moon have been as well trained scientifically as it was possible to train non-scientists in a relatively short time. But a field geologist like Jack Schmitt will be able to do the kind of on-the-spot observing, analyzing, and integrating that can make sense of the whole configuration and history of an area. On him may rest the hope of the scientific world for a fuller understanding of the moon—and ultimately, perhaps, for further exploration and understanding of the farther reaches of space.

—Bernard C. Cole,
Jacquelyn Hershey