ORAL HISTORY 2 TRANSCRIPT

HARRISON H. "JACK" SCHMITT
INTERVIEWED BY CAROL BUTLER
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BUTLER: Today is March 16, 2000. This oral history with Harrison Schmitt, also known as Jack Schmitt, is being conducted at the Johnson Space Center in Houston, Texas, for the JSC Oral History Project. Carol Butler is the interviewer.

Thank you for joining us again today.

SCHMITT: Great to be back.

BUTLER: Wonderful to have you back. Previously we had talked about some of your early experiences at NASA and leading up to your mission, your Apollo 17 mission. We talked about your work on a backup crew for Apollo 15, and then the training that you had both for Apollo 15 and Apollo 17. So I thought today maybe we could pick up with leading up to your Apollo 17 mission, and if maybe you could tell us a little bit about what was going on at that time and what some of your impressions were, some of your thoughts, and the aura of NASA as a whole at that time as the Apollo Program was coming to a close, but yet you were still having your mission and the science, the important science, that was going to be done on that.

SCHMITT: There was really two facets, I think, broad atmospheric facets to Apollo 17. One was that everybody had maintained and was maintaining this high level of motivation and dedication to success for the Apollo mission, even though we all knew, and had known for some time, that this was the last of the Apollo missions to the Moon. But still you never saw, or at least I do not recall being aware of any relaxation in the working-level dedication to success. That attitude remained that this was the important thing they were doing with their lives, and they were going to make sure that anything that they could do to guarantee success would be done. We saw that all the way through the fifteen months of training.

It was reflected, I think, in the fact that when our mission actually flew, there were by far, probably an order of magnitude or two, fewer component failures, system failures. Everything just worked beautifully from a hardware and a software point of view, which wouldn't have happened had people been letting down anywhere along the line in the tests and checkout and working of the hardware. We replaced a lot of stuff during tests.

For example, our lunar module [LM], we used to jokingly refer to it as the LM 9 module, because LM 9 was a lunar module that had been configured for the Block I or H missions, such as Neil [A.] Armstrong flew. It was superseded by a J mission, or Block II lunar module, the first one of which flew on Apollo 15.

But we took the landing radar off of it and replaced it. It was being cannibalized to make sure that our spacecraft had everything working at the time of launch. But still there was general atmosphere on the one hand of continued clear Apollo dedication. There just was no diminution of that at all that I could ever detect.

On the other hand, it was clear NASA, as an agency, was looking to something else, that although we had the attention of the Flight Control Division, Gene [Eugene F.] Kranz's group, and we had the attention of the Flight Crew Support Division and the Apollo Spacecraft Program Office, Jim [James A.] McDivitt now running it, having replaced George [M.] Low, all of that, as far as I could see, everybody was doing exactly what we needed to have done and everybody needed to have done to make Apollo 17 a success.

On the other hand, NASA engineers and administration were focused on the space shuttle. They were already looking at that as the next major challenge, and so I suspect that at that level we certainly did not have the level of attention. It didn't seem to make any difference, other than the fact that Apollo 18, 19 and 20 had already been cancelled, in part, I think, due to a lack of interest by NASA, more so, though, due to a lack of media interest, which was translated into a lack of political interest in the country.

But, still, 17 never suffered, that I could tell, from any of that. The training cycle went well. The checkouts went well and, of course, the launch and mission were just superb.

BUTLER: Absolutely they were. As time for the launch came up, what were some of your thoughts at the time? Were you just focused on the mission, or did you ever stop to reflect what you were about to actually embark on?

SCHMITT: Training for an Apollo mission, and I suspect it's not too much different for current space shuttle missions, once you're in the queue and you're actually training, that is a highly focused task. In fact, one of the things that is, I think, symptomatic of that, at least from my perspective, is that my memory of day-to-day events and hour-to-hour events is very poor. I have a general recollection of the major flow and things that we did, but you ask me what did we do on a particular day or week or month, I can't recall it unless I see documents that, at least in outline form, give me that information and then I start to be able to retrieve it.

I found that the same when I was in the United States Senate, things were happening in such a compressed schedule that the short-term memory is good when you need it, but it doesn't get seated in the same parts of the brain as long-term memory, as other things do. It takes something else, the *Congressional Record* in that case, or our committee records, or our training schedules and things like that, to bring back some of the events of that time.

Now, in a general sense, we spent about three weeks out of every month in intense spacecraft-related training. In the first six months or so, we were here at JSC [Johnson Space Center, Houston, Texas] training in the simulators here, but we very quickly moved down to the Kennedy [Space] Center [Cape Canaveral, Florida] for simulations and flew back and forth every week for that, because their computers, one, were generally kept at a higher state of accuracy in terms of configuration. That was always the case. They were the first ones to be upgraded or to be fixed if something needed to be changed.

Secondly, again, there were other things happening here. There were other distractions. The space shuttle work, the meetings, the people were being distracted by that kind of effort. It may have been even that they were starting to break down the computers here, or to reconfigure the simulators so they could begin to work on space shuttle simulations. I'd have to go back and see whether it was a combination of events that took us down to the Kennedy Space Center for most of our spacecraft training. But we ran most of the simulations, I remember, were with mission control here and we were down at the center.

So all of that and hardware reviews and classroom training on particular components that we might want to have refreshers on, I kept cycling through some refresher courses on the lunar module systems and things like that, and the command module [CM] systems. That was basically my job, was to be a systems engineer in both spacecraft. So I spent a fair amount of time with the contractors who had built the hardware and the training people from those contractors.

Now, the other week, though, each month, was, for the most part, dedicated to science training, and that was pretty much true of the last three missions. Most people, I don't think, realized that we put that much time into the actual work on the flight plan for the lunar surface operations, the experiment training, the planning of exactly how each traverse would be conducted, where we would stop, things like that.

Early in our training cycle, as I recall, we did not have our site selected. It was selected after we were selected, so we were somewhat involved, at least I was, in that site selection process, at least in making sure that from a science point of view we were picking a site that could use the talents that we had on board, and that made sense in the broad spectrum of what we knew about the Moon at that point, or thought we knew about the Moon at that point.

Secondly, though, I also wanted to be sure that we weren't doing anything that was operationally off the wall. For a while it wasn't clear in the minds of the MPAD, Mission Planning and Analysis Division, that we could even land in the valley of Taurus-Littrow. So there were several months of back and forth, of iteration, of landing techniques and tracking techniques, and things like that to see if they could narrow what was called the three sigma error ellipse down to a point where it would fit in the valley. The first run-through by MPAD was it wouldn't fit, and we had some statistical chance of running into a mountain rather than actually landing.

But gradually, with a lot of help from some folks in the Bellcomm [Incorporated] group at [NASA] Headquarters in Washington, [DC], a lot of give and take between that group and MPAD, they finally figured out some tracking techniques that allowed us to bring that down. The primary thing was being able to insert into our computer new information about our position and speed in space, the state vector, into the lunar module computer after we came around the Moon, just prior to actually going into powered descent. So there was a little gap of time, and it was very tight, because we were landing farther east on the Moon than anybody had ever landed before.

So they had to work out how do we get that new information on your state vector into the lunar module's guidance system during that very short interval of time, and we worked out those procedures. We had to do certain things in the spacecraft, the ground had to be ready to do certain things. Ron [Ronald E.] Evans had to get his tracking data done on the orbit just prior to that, so that could be fed into this new calculation of a state vector. All of that then began to shrink that error ellipse until it actually started to fit in the valley. Just another tribute to the remarkable inventiveness of these young men and women of Apollo, and that they developed these extraordinary precise navigation techniques for deep space.

In reality, this error ellipse was a ludicrous construction, because in every mission except for the first one, Apollo 11, as soon as the spacecraft pitched over, then the information we had, the commander had on his window, when you take it out of the computer, told you exactly where we were going to land. It was always essentially where we had trained to land within a few tens of meters of that point on the Moon. And that is just absolutely remarkable that at those distances, with all of the unknowns that to be made into knowns, that that kind of navigation was possible. It still fascinates me, and it's hard to believe.

It happened to us, we pitched over, and I called out the numbers from the computer, and Gene [Eugene A. Cernan] said, "It's right where we planned to land," or words to that effect. And it worked on every mission except 11. As you remember, Apollo 12, one of the major objectives was land next to the *Surveyor* spacecraft. That's what developed these so-called pinpoint landing techniques, which served us very well until we got to Apollo 17, and then we had to make them even more refined in order to get that error ellipse, that artificial construct down to a size where the managers would approve the mission.

BUTLER: Good example of how all the experience and all the training all has to build one on the next to make each mission more successful than the last. As launch day came up, and now moving into your mission, how—

SCHMITT: Let me interrupt.

BUTLER: Yes, absolutely.

SCHMITT: There were certain other things that were involved in that fifteen-month period.

BUTLER: Certainly.

SCHMITT: One of the things that I had believed in from the very beginning, my first contact with Gene Kranz and the flight control people, as well as our own flight crew support groups, that the more contact that these groups could have with each other and with the astronauts, the crew and the backup crew, the better the whole atmosphere was for success. Gene agreed with that, and so we did a lot of socializing with our various types of support people.

We had softball games with them. We went out for barbecue and beer when we were at the Cape [Cape Canaveral, Florida]. When we were back here, we had evenings with the flight controllers. Sometimes when the flight controllers were having a gathering, I would always try to show up. I think I was probably the only astronaut that showed up regularly at these social events down at the old Hoffbrau House in Dickinson [Texas] and places like that, and the Singing Wheel when it was still around.

I don't know, you never know how important that was to keep everybody's enthusiasm and interest in a mission up. Well, it was fun, for one thing, and, secondly, I think it had a very good effect on the attitude that we all had when we worked together. Unlike some of the earlier missions that you may have read about, Apollo 7 in particular, there was never any tension between the astronaut crew, the flight controllers, and the flight crew support group, other than the natural tension of having a problem to solve, and people having initially different ideas on how to solve it, and then working out what is the best way to actually find that solution. So that was, I think, a very important part of our training during that time.

Of course, we had the physical, there was a sequence of flight physicals that we took as we got closer and closer to launch. There were not many physiological investigations that were going to be done on our mission.

I remember one was, the only one that occurs to me right now was that Ron Evans was going to wear an experimental pressure suit for entry when we came back to Earth to see if that in any way affected the performance during entry and things like that. That's probably looking forward to the space shuttle time to do that, because we all had learned how to go through entry just by tensing our muscles. Even though we held 4 Gs for a long time, or several minutes, it did not seem to affect performance in any significant way. Most of it was being done automatically, anyway, so we didn't have to worry about it.

So the training cycle was intense. It seemed long. The one thing at the end of it is that you certainly don't want to recycle for another month. That was the first thought we had on the launch pad when we did, in fact, have a delay, was that, well, let's hope that we don't have to go through this for another month. You're ready. It's geared, it was geared through experience and maybe through attitude to reach the peak, your peak performance level, just about the time you were ready to launch. To have to go then cycle back down and come back up for another month later would have been a different thing. You would have gotten into it and done it and then never noticed the difference, but still at the immediate point of being ready to launch, you're ready to launch, there's no question about that.

BUTLER: You had full confidence in yourselves, your training, the people that were to back you up, because you did have that relationship with them.

SCHMITT: I think that's probably the most important part of the training, was the development of mutual confidence.

BUTLER: Absolutely. It's one of the things we've found with this project, that a lot of people talk about is that need for that relationship and to have that comfort, have that confidence, that trust in each other. It makes it all easier in the long run.

SCHMITT: It wasn't always there in the early days, as reading Gene Kranz's book and just from things that I knew happened in all the programs up into the early Apollo, that level of confidence wasn't always there. There was maybe a lack of recognition about how important the interactions were, but that sort of came a little bit late to the program. But almost all of Apollo benefited from it. I think certainly with Apollo 8, when I first got deeply involved, the interaction between crew and flight controllers and flight crew support was growing very, very fast and, I think, producing very good results.

BUTLER: Hopefully that's something that will continue through modern programs.

SCHMITT: I have no idea. I don't know how it's done today. [Laughter]

BUTLER: It seems they have a pretty good relationship, but unfortunately I don't know very well either. We'll have to look into that.

You mentioned getting to the launch and that there were delays, a few things that were going wrong. Also this was the first night launch of the Apollo Program, so things were a little bit different in that aspect.

SCHMITT: The main thing that started first relative to a night launch was that we had to begin to adjust our sleep cycle and basically turn it by twelve hours. We did that over a period of about two weeks. We'd just go to bed an hour, I can't remember whether it was earlier, earlier, I guess, and get up an hour earlier every day for two weeks until we were on the flight plan schedule. Everybody had to do it. It wasn't just us, it was the simulators, everybody was operating on a different schedule to be prepared for what the flight plan was going to require, and that was a night launch. So we had breakfast, I guess, mid-afternoon of launch day, or something like that. It was those kind of things that happened.

I do remember that when we were suiting up and getting ready to go out to the launch pad, that Ron Evans had his last cigarette just before he put on his helmet. We kept after him all during the flight that he had to take advantage of this now, he's going to have two weeks' cold turkey and he shouldn't pick it up again. He resisted for about two more weeks after we got back, but, unfortunately, he started to smoke again after that time.

Once we got down to the—going out of the suit room and, of course, all the technicians and all the support people were in the hall wishing us well as we got on the elevator. When you see the movies of it, it looks like we were having a good time and that's what I remember that we were having. Of course, we couldn't talk to anybody. We had the helmets on, we were breathing, we were pre-breathing pure oxygen, and so that went all the way down in the elevator, out into the van. And Al [Alan B.] Shepard [Jr.] was waiting for us to escort us out to the van.

Charlie [Charles L.] Buckley was there, too, the former head of security at Kennedy Space Center. I pretended that I was trying to get back off the bus, I remember, and you'll see that in the film. Suddenly my head will appear back in the doorway and Charlie sort of pushes me back in. So it was a little joke that he and I had on each other.

But after that, it was pretty uneventful. You don't have a good view of the launch pad going out there. I had gone out the night before to see the rocket illuminated by the searchlights. That is sort of a tradition that I inherited from Bill [William A.] Anders. He took me out for Apollo 8 the night before launch, and it's really an amazing sight, that Saturn V illuminated. Of course, at that point we could get ourselves in very close just because of who we were, and so you had a view that very, very few people, other than the pad technicians, ever got of the Saturn V.

Everything went really just as one would have planned it, as we went out the elevator and out on the catwalk and met the white room crew. Guenter Wendt was waiting for us, as he waited for everybody. They strapped us in and closed it off, and we then went into the final countdown and got to thirty seconds, and everything had come alive beneath us. The gimbals were moving and the rocket, you could feel it. You're lying there on your back, you could feel the engines moving down a football field below you or more, as it prepared for ignition.

Then right at thirty seconds, Skip [Clarence] Chauvin, who was handling the launch director role on that mission, came over the line and said that we have a hold. I think Gene was more concerned than the rest of us, because he didn't know whether the—none of us knew, but he, I think, was most worried about whether everything in the spacecraft and in the rocket knew we were in a hold. But we went through that thirty-second period and it was quiet for a few minutes, and Chauvin came back on the line and said, "We have a problem with the launch computer. It's not a major problem. We're going to fix it and when we have it fixed, we'll recycle—" I think it was eight minutes for a planned hold and then go through it again.

That is exactly what happened. At that point I felt very comfortable. I'd worked with Skip in many chamber tests and things like that, so we knew him very well, and the sound of his voice, it didn't sound like anything that wasn't going to be fixed. So I fell asleep. Anytime you put fans humming or a little bit of vibration, things like that, I can go to sleep. There's no problem. So I got an hour or so dozing sleep while we were waiting for that problem to be fixed.

What it turned out to be was that somewhere in the deep dark past of computer programming, a programmer had told the final sequencing checks that the computer was going to do—to look to see if a signal to pressurize a booster oxygen tank had been set. Not whether it had been received and acted upon, but had the signal been sent. Well, when they went through that particular point where that signal was supposed to have been sent and the tank pressurized, the signal didn't get sent. There was some problem in the computer, didn't send the signal, but the person in the launch control center saw that that didn't happen and just pressed a button and pressurized the tank.

So everything was fine, but the computer didn't know it. So when they went through the final sequence, the computer saw that that signal hadn't been sent, and it said "Hold." So the computer just shut everything down. That's what you want them to do, it's just that it was programmed wrong. Garbage in, garbage out. So what they did, they actually went into the launch computers, tracked down that point and hard-wired around that particular sensor so that the next time the computer went through, it would believe that the signal had been sent. Sure enough, it believed it, and off we went. We were two hours and forty minutes late, but, nevertheless, we were on our way.

BUTLER: That must have been certainly exciting, your first mission on the Saturn V.

SCHMITT: Yes. I don't think it makes much difference whether it was first or second or third, but I think everybody felt, whoever rode a Saturn V was tremendously stimulated by the experience. It's a very heavy vibration. Very slow acceleration at first, but heavy, heavy vibration as the five F-1 engines in the first stage, the S-IC, are fighting each other to some degree. You build up, over two minutes and forty-five seconds, about 4 Gs' acceleration. At that point everything shuts down. You drop off the first stage and then you ignite the second stage, the S-II, and you're back on your way, but only at one and a half Gs. So there's a big change, it's from 4 Gs to a minus one and a half, as the whole stack unloads, to a plus one and a half, as you go on on the second stage. And that all happens in just slightly over a second. So that is probably the most dynamically exciting point in the mission, certainly in the launch part of it.

From then on it's pretty straightforward. You get into orbit, what, in about ten minutes using all three stages, the third stage being the restartable. After two orbits of the Earth and checking everything out, you restart that and accelerate to 25,000 miles an hour and you're on your way.

We didn't have an awful lot of time in Earth orbit to look out the window, but we got a few nice photographs at 90 nautical miles. That's pretty close compared to the space shuttle. But still I can remember not only taking pictures, but really being fascinated, as everybody is, by the rapidly changing views of the Earth. Our actual acceleration out of Earth orbit started in the dark and actually went through a sunrise, which we had a good chance to see as we went through that sunrise. That was spectacular, to be accelerating at those rates, about a G and a half, and then see this sunrise out the windows. It was really something to see.

BUTLER: It must have been quite fascinating. On your voyage out to the Moon, you took on a little bit of a role of a meteorologist and were calling back to the Earth talking about some of the different cloud formations and such that you were seeing. How did your particular interest in that come about and had you done a lot of preparation beforehand that you wanted to talk about that?

SCHMITT: My father was an amateur meteorologist and he excited my interest when I was a boy in Silver City, New Mexico, or near Silver City. We would try to develop various predicative techniques for whether we were going to have storms or not down in that area. In those days, there was not much meteorological information coming out of Mexico, and so the weather forecasters were not too good at figuring out when we were going to have storms. But we gradually figured out what wind directions and barometer changes and what part of the solar cycle you might be in that would enable us to predict.

So I had this significant interest in weather, which I still have today, and so as I approached the launch, I started talking with the Air Force meteorologist at the air base that supported the launches down in Florida. The name is obviously escaping me now.

BUTLER: Patrick [Air Force Base]?

SCHMITT: Patrick. At Patrick. They got interested in this, and so just as I suited up, one of my friends with that group brought in the latest satellite pictures that covered the Earth, that gave me the whole southern hemisphere of the Earth. So I had those in my pocket as we went out to the launch pad.

I had planned, and we had talked about it, that in my spare time on the three and a half days to the Moon I would try to build on those, what those satellites pictures showed, primitive as they were, and try to experiment with how well could I forecast the weather, because the Earth in what we called a lunar reference trajectory, we would see the Earth turn every twenty-four hours beneath us. So you could see what the weather pattern was, try to predict the trend for the next day, and then see how well you did the next day.

Of course, we were getting farther and farther away and the Earth was changing from full to about two-thirds. But we had a 10-power binocular on board, so you could look out the window and see it. So all of that several inches of transcript was me exercising that little experiment, because there really wasn't much else to do, except try to get a little exercise and eat and check out systems. But it certainly was not a full day's work any one day.

BUTLER: Gave you a little something interesting on the side.

SCHMITT: Interestingly enough, somebody just recently has contacted me and they want to put together a journal of that particular phase of the mission, which is not in the *Apollo Lunar*

Surface Journal [website] that Eric [M.] Jones put together. So I think we're going to see a Web-based version of that transcript. I can't believe it's going to be of any great interest to anybody, but we'll see. [Laughter]

BUTLER: I think it'll be interesting, certainly from a historical perspective and maybe for meteorologists that are studying and up and coming.

SCHMITT: I don't know. They've got so much better information now than they did in those days. But it was an experiment to see what human beings could see.

BUTLER: Certainly able to see a variety of things, it sounds like. When was your first view of the Moon, then?

SCHMITT: We didn't have much of a view of the Moon, because we were landing so far east, and we wanted to land at sunrise, it meant that the terminator was way east. So as we approached the Moon, about all we saw, and you had to go over and it was really something that you only saw out of Gene's window. I can't remember exactly why, but we had to get him out of his seat in order to see it. All you could see is just a little arc, just a real thin illuminated part of the Moon out that window. So effectively all we saw was a dark looming shape that was blocking the star field, and then, of course, at the LOS point, loss of signal point, it would cut across the Earth, but it would be a silhouette of the Moon that was crossing the Earth and not any illuminated Moon.

The first real illumination of the Moon we saw was from the far side, as we had our spacecraft sunrise actually flying over a lunar sunset. We were in what's called a retrograde orbit, that is, we'd come around the front of the Moon, ahead of it, and to go into orbit, so that we actually were going in a direction opposite of the slow rotation of the Moon itself on its axis. The Moon rotates once on its axis every twenty-eight days and we were going the opposite direction.

The reason for that, of course, was to have the sun at our backs as we landed at sunrise on the near side. Of course, most kids can figure that out. I'm not sure I can figure it out anymore. [Laughter]

BUTLER: As you were going along, coming to the Moon, approaching the landing point, again, here were you pretty much focused on the mission, on doing what needed to be done, or did you stop and think at this point at all that here you were a geologist, about to be the first geologist to land on another celestial body?

SCHMITT: Well, we had a little time during the first few orbits before we actually unhooked the lunar module and prepared to go down on the surface. A lot of it was checking out the spacecraft. Of course, for forty-five minutes out of every two-hour orbit you couldn't talk to the Earth. So we were a little bit more on our own then, unless the flight plan had some things that we had to get done prior to acquisition of signal, namely AOS, on the other side of the Moon. So I had some time to look out the window, take a few photographs.

Then on the near side, of course, most of the Moon was in Earth shine, not illuminated by the Sun. I can remember being very impressed by how much light the Earth cast on the Moon. You could see features very clearly in this blue light of Earth, and really quite spectacular.

At one point I was looking down at the surface, it would have been way west of Copernicus, and probably even getting close to the big basin called Orientale, and I saw a little tiny pinprick of light on the surface. It was almost certainly a meteor hitting the surface of the Moon and they will give off a little bit of visible light. So I had to chance to see what was effectively a shooting star hit the Moon.

The reason it still gets my attention is that when we were flying over Miami, [Florida]—I may have told you this last time. When we were flying over Miami, looking down on the lights of Miami from 90 nautical miles, Miami was about the only place in the United States that was clear of clouds. It was on our first orbit, I was looking down on Miami and a shooting star went underneath us. [Laughter] Sign of the times.

BUTLER: That kind of gives you goose bumps. We're going to go ahead and pause here. [Pause]

...the lunar module landed in Taurus-Littrow with no problems. In fact, most of your mission up to this point had really been relatively free of problems, other than the launch delay. As you landed on the Moon and came out and embarked on your first EVA [extravehicular activity], if you could tell us a little bit about that and what was going on and what you were thinking at the time, just basically what you were doing.

SCHMITT: Maybe it might be worth going into the actual landing, because that sort of leads up to everything else.

BUTLER: Absolutely.

SCHMITT: That process, of course, started as we came around on our last orbit and had AOS and the ground introduced the new updated state vector so that we would presumably land where we wanted to land exactly on the Moon. Once we initiated powered descent, the lunar module, as most people, I hope, know, was actually pointed backwards a bit. We were looking up into the sky; we weren't looking at the Moon. And that was to get the thrust vector of the descent engine directly along our trajectory and slow us down most efficiently.

But at about 8,000 feet above the surface, once we had landing radar locked in, and that was an important part of it, part of my job was to operate the landing radar and make sure that we indeed did have that information going into the computer, and then to take some of that information and put it into our abort guidance computer, so we had even better information in that, too. It was not as sophisticated, but still could do an awful lot of things.

At 8,000 feet we did pitch over, so Gene then could see where we were headed, the landing site, and things really start to happen pretty quickly there. About that time I start giving him information relative to his altitude and the rate of descent and any other velocities left to right that he might need in order to take over the vehicle if he had to do that. All of this is automatic at this point.

I had one look out the window right after we pitched over. I looked out and was looking right at the side of the valley. It was, of course, quite a spectacular glance, but my job was to be making sure that Gene had the information that he needed or we thought he might need, in order to safely land the vehicle, and so I didn't look out much. I took one more glance when he called "dust," and that meant that we were probably 100 feet above the surface, approximately, and saw that streaming dust away from the spacecraft. But for most of that time I was looking inside. You train to try to do your job and you're happy if you actually do it that way.

But I had other things that I had to monitor besides the computer, but the main task was to give him information off the main computer, because he was looking out the window and actually flying the spacecraft. As I recall, he took over at about 500 feet and we had one little brief period where he got his descent rate up a little bit higher than he should have, and if you ever listen to the tapes, you can sort of hear the emphasis in my voice change a bit to get him to slow that down. After the mission, some of the people from mission control told me privately, said, "We knew what you were doing." [Laughter]

BUTLER: I'm sure they had enough background and experience on their own to—

SCHMITT: Some people always kidded me about ever wanting to go to the Moon with a Navy pilot, because they tend to land hard.

BUTLER: All that practice on aircraft carriers, I guess they have to.

SCHMITT: That's right, they do. Statistically they wore out a lot more tires out at Ellington [Air Force Base, Houston, Texas] in the T-38 than the Air Force pilots did.

BUTLER: That's interesting.

SCHMITT: They never forgot how to land an airplane, that's for sure.

BUTLER: The landing did all go smoothly.

SCHMITT: Yes, everything went well, and we had planned—there had been some discussion, I think, in the flight planning period, about getting out of the suits, getting a rest period in and then going out on the surface. As we worked that through, we decided that we'd put that extra rest period at the end, after the third excursion, because you're just so keyed up, you want to go outside. There's no point in trying to sleep before an excursion or an EVA, the first EVA on the Moon. So once we were cleared to stay, had a go for a stay on the Moon, then we immediately got into the preparation for going out on our first excursion.

Those procedures and all of that is well documented on the *Apollo Lunar Surface Journal* page in the Web. I hope that you're downloading that in some way, or something like that for the archives.

BUTLER: Absolutely. Excellent resource.

SCHMITT: Yes. Because Eric debriefed most of us, and it's documented for every mission, not just one.

But, of course, the commander gets out first, that's the way the door's configured and positions are configured. I strongly suspect Neil Armstrong made sure that that designed back before my time. Once he's out for a while, then the lunar module pilot has to move over, shut the hatch, not totally, but move the hatch, and get over into the commander's place, and open the hatch again, and then slide out again. So I was the second to get out, a little while after Gene did, and head down the ladder.

The first thing I remember is that when I stepped down from the ladder my—I think it was my left foot first, it got on the side of a rock with these little beads of glass on it, and slipped. I can remember hanging onto the ladder while my foot was slipping off to the side. But those first steps on the Moon were in the shadow, because that's the way we had landed, the sun was behind us. Fact is, I would say the first half hour, forty-five minutes of all of that was, you were still in a very familiar place, even though you were walking and had the moon soil beneath you, you were working with the lunar module, something you had worked with before, and many, many times, and was like being in the same familiar scene. You didn't really have a chance to look around you very much. At least I didn't.

It wasn't until the flight plan called for me to go some seventy-five meters away from the lunar module in three different points around it and take a panorama at those three points to document the site before we had really screwed it up, that's the first time I had a chance to see this magnificent valley that we were in, a valley deeper than the Grand Canyon, 7,000 feet, six to 7,000-foot mountains on either side, 35 miles long, and about four miles wide where we had landed. The slopes of the valley walls were brilliantly illuminated by this little sun, by that time probably a 10-degree sun, something like that. The sun itself was brighter than any sun that I had ever seen, of course, in New Mexico or anywhere else, in a desert-like landscape.

But most hard, I think, to get used to was a black sky, an absolutely black sky. The biggest problem I think photographers have in printing pictures from space is actually finding a way to print black, absolute black. Certainly slides that you show will have a little bit of blue in that background, and you're just never going to get the contrast that we had visually on the Moon, because the sky was black.

Then hanging over the southwestern wall of the valley was the Earth, at this point about a two-thirds Earth, in terms of its phase. The whole scene was really spectacular. It's one of those things that you—

SCHMITT: ...have a chance to go see yourself.

BUTLER: Hopefully some day most people will have a chance.

You called it a geologist's paradise when you were first looking around and embarking on this first EVA. What was it that struck you so much about it?

SCHMITT: I think being there was the first thing that was important, because I already knew in the general terms the kinds of different things that we could expect to work on. It was the most highly varied site of any of the Apollo sites. It was specifically picked to be that. We had three-dimensions to look at with the mountains, to sample. You had the Mare basalts in the floor and the highlands in the mountain walls. We also had this apparent young volcanic material that had been seen on the photographs and wasn't immediate obvious, but ultimately we found in the form of the orange soil at Shorty crater.

But as soon as you had a chance to look around, you could tell, everything we expected to find there, and more, was going to be available to us, and that's what geologists like. And they really like to have the unexpected. I mean, it's one thing, part of your jollies are gotten by trying to anticipate everything you could possibly anticipate, but then you get a new surge of adrenaline when you find there are things that you never could have anticipated. And that's discovery. That's when science really becomes exciting, those things that you didn't anticipate and they occur, and that's where scientific discoveries are made. That's the extension of your anticipation.

BUTLER: You certainly did have some of those discoveries on your mission, as well as some of the things that had been planned and that you expected to find. You mentioned the orange soil that had been a bit of a surprise.

SCHMITT: Yes. It would be hard to pick a different set of stations. You could, and it would have been probably equally as exciting, but the ones we picked were very, very good. We found the oldest rock that's been sampled on the Moon at the base of the South Massif. We found the orange soil, which is really stirring the things up this day and age, because it makes it very difficult to explain how the Moon might have formed by a giant impact of a Mars-sized asteroid on the Earth. The consensus of the scientists is still trying to make that giant impact work, but I frankly don't think it's going to work over the long haul. I think we're going to have to have a different theory than that. The orange soil is right in the middle of that debate.

Then the big boulder we worked at at Station 6 was at the base of the North Massif, was the first time that anybody had had a chance to see a large exposure of the kinds of materials that are produced by one of these huge basin-forming impacts on the Moon, impacts that happened about fifty times on the Moon and almost certainly happened three or four times that number on the Earth during the same period. It also was a period in which life was trying to get started on the Earth, but didn't get started, as far as we know, until that period of impact, big-basin forming, was over, about 3.8 billion years ago.

So we were looking at an awful lot of information, not only about the origin of the Moon, but that was relevant to a better understanding of the evolution of the Earth, the origin of the Earth and its evolution, particularly in that period of time when life was trying to get started here.

So Apollo had really two major benefits to humankind. One is, it demonstrated that free men and women, when faced with a challenge, can meet that challenge and succeed in a political and technological race that had a lot to do with the preservation of freedom on this planet. Secondly, something that was recognized by George Low and Bob [Robert R.] Gilruth and Gene Kranz and Chris [Christopher C.] Kraft and Sam [General Samuel C.] Phillips at Headquarters, even years, several years before Apollo 11, we had the capability and they allowed us to use that capability to understand the Moon to a first order scientifically. And that is contributing in many, many ways to a better understanding of the Earth, and one never knows all the things that are going to come from that.

One of the things we didn't know was going to come from that until fifteen years after we had collected the samples, was that on the Moon, particularly Apollo 17 and Apollo 11 sites, we have an energy resource that should be examined very, very carefully as a future alternative for fossil fuels. That is a potential return from the expenditure of the taxpayers' money that nobody could have anticipated, but it is in the same class of those unanticipated returns that came from Lewis and Clark exploring the Louisiana Purchase and really has always come from any type of human exploration that we've undertaken.

BUTLER: It shows the value of that exploration and the possibilities. There's so much out there that still remains to be discovered. I believe you had mentioned in a previous interview that there's so little of the Moon that actually was explored during these Apollo missions, that there's so much still that we can do there and learn.

SCHMITT: Well, it's interesting that since the Apollo missions we've had two major unmanned mapping missions, automated mapping missions. The Clementine Project run by the Department of Defense to test out some of their sensors, but which provided a tremendous amount of scientific data, and the Prospector, Lunar Prospector mission, which just flew in the last couple years, which is added to that immensely, as well. At this point as these data are massaged and analyzed, we're getting very close to having just about everything we need to do the kind of planning necessary if we decided we want to go back and tap these energy resources.

Now, I don't think the government's ever going to do that. I think it's going to be a private-sector initiative, but, nevertheless, whoever does it, there is now a tremendous database that we can use to do that kind of planning. Whether we need to fly additional automated missions before that happens is still an open question, partly going to be determined by investors and how much confidence they need to have before they put their money, all their money, into such a venture. But, still, beginning with Apollo and what we call the ground truth that it provides, and then these other mapping missions that have occurred, the combination of all three really has put us in an enviable position relative to understanding what potential the Moon may have for our future.

BUTLER: Looking at your missions, or your EVAs, as you mentioned in the *Apollo Lunar Surface Journal*, there's a lot of details and explanation about what you were doing specifically at the time, but comparing your lunar EVAs with field geology on the Earth, and obviously there's differences for the spacesuits and the tools and such, but were your procedures very different, or did you take a similar approach as you would on the Earth?

SCHMITT: Conceptually, the approach and exploration as field geology exploration doesn't change very much. You're trying to integrate your eyes and your hands and your mind, the database that exists in your mind, to rapidly as possible, and particularly on the Moon as rapidly as possible because you can't go back, get as much pertinent information about the origin and evolution of geologic features as you possibly can. That's a challenge here on Earth. It is particularly a challenge on the Moon because of this constraint of time.

Dick [Richard F.] Gordon [Jr.] was the first one to use the expression for me, and he said, "You know, Jack, when you get into space you'll find time is relentless," and it is. You never can run the clock back. There are field areas on Earth, including my major field area in Norway, that you generally would not go back to, or can't go back to, but clearly you cannot go back to the Moon to gather more information, so you have to do the best you can at the time.

Now, on the one hand, we were served by a much more intensive planning process for that field geology exploration of the valley of Taurus-Littrow and the other Apollo sites than we normally would ever have here on Earth. Field geologists, normally they sort of pick their area, they gather their aerial photographs, then they go out in the field, and then they start, they pick a place to start and they start to expand from there, and they sort of plan as they go along.

With Apollo, we planned the heck out of this thing right from the very beginning, the traverses and where's the most likely place to gather good information and things like that. So that was a net advantage. That really raised your efficiency of exploration to take advantage of the time available.

The primary disadvantage that almost overwhelmed everything else was the inefficiency of using the spacesuit. Even though the Apollo suit clearly was adequate for the Apollo Program, because we got an awful lot done using that suit, the efficiency by which you could operate, and particularly the efficiency by which you could manipulate things with your hands, couldn't have been much more than 10 percent of what you would do normally here on Earth.

The biggest challenge that we will have, whether public or private sector goes back to the Moon or goes to Mars, is to improve the efficiency of that suit. Unfortunately, to my knowledge to date, there hasn't been nearly the emphasis on that aspect of human activities in space that there should be. You take the human brain, the human eyes, and the human hands into space. That's the only justification you have for having human beings in space. It's a massive justification, but that's what you want to use, and all three have distinct benefits in productivity and in gathering new information and infusing data over any automated system.

Unfortunately, we have discarded one of those, and that is the hands. The Space Station suit, the Space Shuttle suit, is not much better than Apollo. If you were operating at 3.5 psi [pounds per square inch] or 3.7 psi, it might be a little bit better, but you're not, you're operating at 8 psi and so you've lost most of that advantage. I'm sure there have been some improvements, but still we have not reached the point we have to reach in order to work indefinitely an EVA in space. So that engineering challenge is still out there.

But the biggest problem is that the gloves are balloons and they're made to fit. We had them custom-made to fit our own hands. Today, I guess, the space shuttle suits, there's one size fits several. Whatever it is, to pick something up, you have to squeeze against that pressure, 3.7 psi, in our case 8 psi and in the case of the shuttle. That squeezing against that pressure causes these forearm muscles to fatigue very rapidly. Just imagine squeezing a tennis ball continuously for eight hours or ten hours, and that's what you're talking about. Well, boys will be boys and they work too fast when they start out, they get too much adrenalin, and they wear themselves out early. So you get down to a very low rate of efficiency so you can keep doing things.

The other part of the glove that was a problem is that no matter how closely you cut your fingernails, every time you reach for something or moved in that glove, you would tend to scrape your nail against the bladder of the suit, the rubber bladder. I even wore liners, nylon liners, to reduce that, but still you would do that, and you'd gradually lift the nail off the quick. That is painful to some degree while you're working, but particularly gets painful later after you've gotten out of the suit and you then prepare for the next day.

Now, both of those things are things that are there, yes, that's discomfort, it's sore, you wish it wasn't there, but it sort of fades into the background because of the stimulus of everything else that's going on. But, still, from an efficiency of a hard engineering efficiency point of view, we've got to do better with the gloves. We've got to have mechanical assists. We've got to do something using new chip technology and micro mechanical systems to get those gloves so that when you start to move, they move, and that you use some energy from some other source besides your muscles.

Now, the nice thing, though, about working very hard in space is that the next day you have no sore muscles. The efficiency of the cardiovascular system in cleaning out the toxins, the lactic acid and other things that are produced, metabolic products that are produced in the muscles, is so great that there's no muscle damage. There's fatigue, but not damage. The next day it's as if you never did anything. You just start all over, and hopefully you've learned a lesson and you don't move quite as fast.

BUTLER: Interesting. Well, hopefully like you said, well, for a return to the Moon it'll be probably be longer duration.

SCHMITT: Well, we're going to have a very different approach, I think, at least the private sector will. We will not only concentrate on improving the efficiency of the hands and the gloves and the arms, but we'll want to reduce the weight probably by half, and anything we can do to decrease the energy expenditure and the fatigue that people have working, because efficiency is the name of the game when you're trying to do these kinds of things. The same would apply to Mars.

So I'd have that go about four times the mobility, at least four times the mobility, and half the weight. Now, one way you can improve that, the weight, reduce the weight, is carry less consumables and learn to use consumables that you have in some other vehicle, like a lunar rover. Anytime you're on the rover, you hook into those consumables and live off of those, and then when you get off, you live off of what's in your backpack. We, of course, just had the consumables in our backpack.

BUTLER: That's certainly a critical step that needs to be developed for the next—

SCHMITT: One of many. One of many.

BUTLER: One of many. One thing, talking about suits, it seems that you and Gene Cernan were possibly more confident in your suits, maybe having seen the earlier missions. It seems like you might have been a little more energetic than some of the other astronauts and maybe even a little more physical. Was that based on a confidence in the suit and knowing that—

SCHMITT: Clearly the confidence was there, but I don't think it had too much to do with the other missions. It had to do with just a long experience in using the suits, dealing with them, of knowing the people that made them, how they were made. Again, the motivation level that people had who made anything for Apollo, I felt certainly that I could do almost anything I could physically do and everything would be all right. I mean, I never even thought about it.

It was one of those things that I think both of us just went about our business assuming that the suits were as good as we had experienced before and that there was no reason to think otherwise. Indeed, we went through pressure checks before each excursion and after each excursion to make sure there were no leaks or anything like that. The suits were almost as tight at the end as they were at the beginning, so we never had any evidence that we should be worried.

We were both reasonably active and athletic people at that time, and we had a lot of training in the suits, and we got our experience very fast while we were on the Moon, and we just took advantage of that and were able to do a lot of different things. I think anybody could have done them, it's just that we did have the indirect experience of, one, seeing what other people had done; two, having a very full and exciting mission; and three, knowing we were the last mission, so let's get as much done as we can. [Laughter]

BUTLER: Throughout your whole mission, particularly the time on the surface and your EVAs, was there any one moment that stood out the most for you, or stands out after all these years?

SCHMITT: I don't think so. There's the mission as a whole which stands out. Every day had its high point. I won't deny that. But to make a relative judgment on those is really very, very, very difficult to do, and I really don't try to do that. Probably the least interesting part of the mission were the two days headed back, the first two days headed back to Earth, although Ron Evans did an EVA, which certainly was a highlight of the first day. The second day was a drag. The Earth was, all you could see was a crescent Earth. There really wasn't much to look at. There was a bit of a letdown after having had such exciting days preceding it on the Moon. We had one or two experiments to do. There just really wasn't—that next to last day was not much to write home about.

BUTLER: Understandable.

SCHMITT: But then the last day, of course, you're preparing for entry and the adrenalin is starting to come back, and that's sort of the *pièce de résistance*, actually getting back into the atmosphere and coming home. By then you knew there was no choice, you were coming home one way or the other, and so let's do it right.

BUTLER: It did all go right and go well, then you were able to have the opportunity then to study more in-depth the samples that you had brought back.

SCHMITT: With only one or two exceptions, I think our crew was, if you go back, if somebody went back and looked at the record and really wanted to do an analysis, I think our crew was more wedded to following checklists than other crews. I don't know what that was. Maybe it was because I'd spent so much time mission after mission helping to develop them. We trained to them, and most of the problems that other crews had, not most, but some of the problems other crews had was when they sort of deviated from checklists.

Gene, of course, had had a bad experience related to that on Apollo 10. It's not quite clear that the crew still will—what actually happened, but it does appear like it might have been a checklist problem.

After us, the ASTP, Apollo-Soyuz [Test Project], yes, ASTP mission had a problem with checklists on reentry. But our mission, other than one time, Gene, I think it was on that next to last day when they just—Gene just started playing with the computer, I think absent-mindedly and started firing thrusters, which got everybody all excited. He just accidentally hit, I guess, got a command in that started the thrusters firing, and that's the only one I remember where we didn't really—somebody didn't really follow the checklist.

BUTLER: Maybe that was to keep things from getting too boring. [Laughter]

SCHMITT: I don't think so. He seemed as startled as anybody else. [Laughter]

BUTLER: Oops. [Laughter] After you had left the lunar surface, but before you came back to Earth, President [Richard M.] Nixon had a message broadcast up to you that was a bit of a letdown, I think, for many people, of saying that this was probably going to be the last mission to the Moon in the century. I know that must have, at the time, that must have been very frustrating, and, of course, knowing, you did know that you were the last one for a while. But now that we are coming up on the end of it, did you ever really expect that it would be this long before we would go back to the Moon?

SCHMITT: I don't think very many people who were really active in the program, even with the cancellation of Apollos 18, 19 and 20, thought it would be over twenty-five years before we go to the Moon again or go into deep space again. That was naivete, I think. None of us were deeply enough embroiled in the politics of the media and other things in Washington [DC] to have, I think, a really educated opinion on it. But that was our feeling. I mean, it'd be ridiculous to have done all of this and then not do something else. It just seemed illogical, I think, to those of us who were involved. It still does today, as a matter of fact, but, nevertheless, that was the feeling.

I think what bothered me most, and I think, as far as I know, that Nixon statement bothered me more than it did anyone else, it was an unnecessary statement to make, whether true or not, whether his insights were greater than anybody else's, or whoever wrote that speech, insights were greater, or that message greater than anybody else's, I think is beside the point. It was an unnecessary thing to say to the young people of the country. That's what bothered me instantaneously at the time. I thought it was a stupid thing to say. There were plenty of other things he could have said. He also could have read it himself instead of having Jim [James C.] Fletcher [NASA Headquarters Administrator] read it. I just really did not think that was appropriate.

I have mixed feelings, like I think a lot of people do, historians and otherwise, about Richard Nixon, but that's just one little thing that I think disappointed me. He did some other things that I think were quite remarkable, and some other things that were quite disappointing. But you can say that about a lot of Presidents.

BUTLER: A lot of Presidents, a lot of people in general. You mentioned, for the young people, that this statement was not very inspiring for them. What would you say for them today, having been so long since we've been to the Moon, and not a lot of hope in the immediate future for a return, what would you say to get them inspired, to get involved in science and engineering, and exploring and stretching those boundaries?

SCHMITT: I don't think you can reach the young people unless you reach the teachers. The teachers have to realize that the teaching of history, and not just the history of the Apollo Program, but history in general is a very, very critical part of young people knowing what kind of opportunities have faced their ancestors and their parents, and how their ancestors and parents reacted to those opportunities. It gives a background and experience that they can't get any other way, the student cannot get any other way.

Now, I find that a lot of science and math teachers feel that way, and when I go to meetings of the International Science Teachers Association and things like that, they understand that space is not only an important part of history and of science, but it is a great teaching tool. But they are really a very small minority in the teaching profession, and they don't have access to all students, because we don't really give our young people from grade school on up a very liberal arts, in the classic sense, or eclectic education. We leave an awful lot of stuff out for an awful lot of students.

The worst, I think, is probably they're not advised how important a working knowledge of mathematics will be to the options that they may want to have in the future. If you don't have a working knowledge of mathematics, there's an extraordinarily large number of career options that you can never even consider, and this is not brought home to students, male or female, at a very young age. Math should be considered a language and taught like a language so that it's part of the vocabulary of every young person who's at all capable of having some knowledge of that language. If it were taught that way, well, then it could become part of their career options. But today the vast majority of young people do not have a chance to go to work in the most exciting and rapidly advancing fields in our society, because mathematics is so critical to it, and they don't have that skill.

BUTLER: That is very unfortunate, because it is something we use every day.

SCHMITT: I think if parents had more of a choice in where their kids got their education, then we would see more emphasis on that, because I think parents may understand that better than teachers at what those career options are and what they missed in their life because they did not have a good fundamental education in math, science, history, language, and so forth. So I think that's very important is to find out ways in which parents can exercise more of a choice. Some won't, but many more will, that if they have that opportunity than do today, where most public school systems the parents do not have a choice of what kind of education their children are receiving.

Somewhere in this whole mess we have to make teaching as a career as respected and as valuable from a salary point of view, as any other career in our society, because it is. It is the most valuable career in our society and should be paid accordingly. But when you're not attracting the best and the brightest to the teaching profession, and the teachers themselves at times do not inspire confidence that they should be paid at those kind of levels, well, then it's a very difficult political nut to crack.

So it's a number of chickens and a number of eggs that have to come together here, and it's not going to be easy. But I have great confidence there are paths into the future that not only vastly improve our education system, but vastly improve teaching as a profession. We just have to be willing to start to search for those and reach out and get them.

Space can play a very important part in this whole part, because kids are excited about it. They like it. They are interested in it. I've seen English taught with a space theme, and there's no reason why you can't teach almost anything with a space theme.

BUTLER: Applies to pretty much every subject.

We'll go ahead and pause again. [Pause]

After your mission, did you spend a lot of time reviewing your samples that had come back, a lot of time studying those, or did you begin to move into other areas right away?

SCHMITT: After the return to Earth, and after we did about six months of public relations work, I spent part of the next two years, in addition to everything else I was doing, about a week a month at Caltech [California Institute of Technology, Pasadena, California] as what was called a Fairchild Scholar. I was one of the first of the Fairchild Scholars, an endowment given by the Fairchild family that provided for Caltech to bring in visiting scholars. And I used that time to try to bring together the science of the Apollo 17 mission. I published a couple of papers and things like that, so that was sort of the base that I established.

But then I had already begun during that time to move towards a career that I had thought about many, many years before, and that was politics. I started that by going to

NASA Headquarters at the request of George Low and Jim Fletcher to set up and run NASA's energy research and development programs, which I ran for about almost two years before I then decided the time was right to go into politics and run for the Senate in New Mexico.

Once I got into the Senate and got into politics, there's about a seven-year hiatus in doing anything of any significance relative to Apollo science. Since 1983, though, when I left the Senate, I've gotten increasingly back into that. Again, I'm in the business of publishing papers related to Apollo science and Apollo 17, writing articles and chapters to books and things like that.

BUTLER: You mentioned going to NASA Headquarters and working with the Office of Energy there. Can you tell us a little bit about what that involved and how that progressed over the couple of years you were with it?

SCHMITT: In 1973, all the government agencies were beginning to try to scramble to look like they were doing something in energy, because, as you recall, we had the Arab oil embargo in that year and it was the time of gasoline lines and high prices that people forget they've already seen. During that year, one of the other things I did was give a couple talks at some of my geological associations about the pending energy crisis before it arrived. I wasn't alone; there were others in my profession who could see the handwriting on the wall that our dependency on foreign resources was growing at such a rate that ultimately we would be held hostage to that.

With those talks, and I'm sure some private conversations with George Low, NASA decided that they would try to put something together to apply the research and development background that had been developed for Apollo and Skylab to the energy crisis, particularly to conservation and efficiency and production of energy. George asked if I would come up and work through how an office like that might be organized and what we might work on, what resources might be available to do it, and I said, "Sure, I'll do that."

So in early 1974, I went up to Headquarters and started putting that together, and once they agreed, yes, let's do this, then they asked me to run it, which I did for about a year and a half before I then decided it was time to go into politics. In that year and a half, we had learned, though, that NASA was not going to be major player, primarily because OMB [Office of Management and Budget] would not let NASA, one, staff to spend resources that we might gather for this. We had to use the existing manpower within NASA to do it. We couldn't add an increment of manpower. They wouldn't give us slots for energy work, new slots.

Secondly, it was very difficult to get other agencies to give up any of their power in their areas and ask NASA to undertake developing technology for them. It's just interagency rivalries and things like that made it a very difficult job. We had a five-million-dollar appropriation for NASA's own energy work, which is the basic appropriation, but we had tens of millions of dollars that we were able to get in from other agencies. At one time, at the peak of my activity there, we had, I think, something like 700 people in the agency working on energy projects. For an agency of 30 or 40,000, 30,000, maybe at that time, that's not very many, but it was quite a bit of work going on.

But eventually that all died off. It just became very, very difficult to sustain with budget cutbacks in general, personnel cutbacks and things like that, when OMB would not let you actually dedicate slots to energy work.

BUTLER: You had mentioned that one of the reasons you moved into this position was an interest in becoming involved in politics. How did you become interested in that area, having come from a scientific background?

SCHMITT: When I was at Harvard [University, Cambridge, Massachusetts] working on my Ph.D. in geology, I became acquainted with a number of students in other fields, government and the liberal arts in general, and we just had a little group that met together a lot. I began to, at that time, get concerned about the kind of philosophy that those young men and women seemed to be leaving Harvard with, relative to the role of government in our lives. There's a tendency of Harvard to teach that more government is better. My legacy from my parents and upbringing, I'm sure, as well as hopefully some intellect, was that it wasn't necessarily a good thing. Some things government should do and some things it shouldn't do.

So I got an interest in politics at that time and actually had begun to think that if once I had had some kind of a successful career in the earth sciences, teaching or working for the government or for industry, that I felt like I should seriously consider going into politics. That consideration never really had a chance to be undertaken until after Apollo 17, and then I began to think a lot more about it.

BUTLER: How did your experiences at NASA benefit you in the Senate?

SCHMITT: I think it benefited me mostly in the campaigning. Any experience broadens your outlook, I hope, and adds to your overall base from which you can then do other things. But for the campaign I had already spent a lot of time with the public as an astronaut, so that was helpful. I could get invitations to speak about space, where I could not get them to speak about politics in my campaign in New Mexico, and so that made me competitive with the incumbent, who could get invitations to talk about politics, since he was already a senator. So it helped there.

Also, the planning of the campaign, I think, was assisted by the kind of planning that we had to do to put together the space missions and things like that. I'd learned a lot about how do you integrate different components of a plan into an overall strategic plan. All of that, I think, helped a great deal.

In the Senate, Barry [M.] Goldwater made it possible for me to be chairman, ranking Republican and then chairman of the Science, Technology and Space Subcommittee of the Commerce Committee. After the Republicans took control, a series of circumstances made it possible for me to chair the Human Resources and Labor and Education Subcommittee of Appropriations [Committee]. Particularly in the science and technology committee, my background fit pretty well with what we were trying to do. I had also, in the appropriations subcommittee, I had responsibility for the Senate's appropriations for the National Institutes of Health [NIH]. So there was a lot of scientific activity there.

I happened to be in that role when the first hints of something that later was called AIDS [Acquired Immune Deficiency Syndrome] started to appear in Los Angeles [California]. Just as an example, was able to recognize that, that that was something unusual, and then to go to the Centers for Disease Control part of the NIH and start to force them to think about what they were going to do in reaction to this unusual set of diseases in young men.

So those kind of things, I think a scientific background can really help you in those things. Unfortunately, no scientist really wants to run for political office, and so very few ever go into politics. I tried for six years to get more to, but it just didn't happen.

BUTLER: You mentioned one of the reasons that you had become interested in politics was from Harvard and from working with different colleagues there, different students in other areas. Were you able, as you were in the Senate, to put into place some of the things that you had been thinking about those years leading up to it?

SCHMITT: I was not very productive in the Senate, and I don't think the Senate's a very productive place. All I can claim to have done that might be of interest would be to be clairvoyant about some issues, about a lot of issues, that later on became critical, and even today have become more important than they seemed to be to people in the past. I tried to stimulate other people's thinking while I was there, and whether I did or not is something that only somebody else can write about.

BUTLER: You're certainly well documented of your career in the Senate. A lot of the government archives and archives at the University of New Mexico that will show us a lot of what you were involved with there.

After you left the Senate, after you were out of the Senate, you then began to get back into geology, and as you mentioned, doing more work with the Apollo 17, and have continued doing that to this day. Throughout that process, has there been anything that's come across as a new discovery to you or surprising? We talked a little bit about the helium-3, both today and in the previous interview, or any other areas that you see now as areas to expand into and explore?

SCHMITT: The question of developing energy resources on the Moon for use here on Earth is the one that stands out, and the one which I work on still, and seeing if we can find a way to do that. In the pure science side of things, the continued examination of the orange soil and other samples from other missions has, I think, called into serious question, whether anybody else believes me or not, but I think it calls into serious question the prevailing theory about the origin of the Moon and the giant impact theory, so called.

There are other things that are beginning to develop as a result of that continuing study, that I think, I hope, are started to shake the tree a little bit in the lunar science community. It'd gotten a little bit complacent, and there seemed to be a bandwagon effect for various consensus to develop. Consensus, consensi? I'm not sure what the plural is.

I'm just trying to be a little bit of a maverick these days and force people to reexamine the basic principles that underpin some of these ideas and see if they're really valid. So I've had a lot of fun with that. It's not a full-time job, it's more of a hobby, but I spend maybe a quarter of my time working on those kind of things, a quarter of my time dealing with corporate boards of directors, a quarter of my time trying to put together business plans for energy and related matters, and another quarter teaching, I guess, at the University of Wisconsin [Madison, Wisconsin]. And I'm sure there's several other quarters of my time that I'm doing something else.

BUTLER: Keeps your time plenty full and plenty interesting, I'm sure.

SCHMITT: It really does.

BUTLER: Looking back over your career, primarily with NASA and the space program, although possibly some of it pertains to today, what would you consider as your biggest challenge?

SCHMITT: The biggest challenge is being prepared to take part, take advantage of your opportunities. That's what education is all about, it's making decisions inadvertently or advertently that will expand your educational base and your experience base to where you can then have the maximum number of opportunities in the future.

One of those will usually stand out as one that you really would like to do, whether it's going into geology, as I did initially, or volunteering for the space program, or going into the Senate, or getting involved in business. All of these depend on having enough background and experience to be able to present yourself as a credible candidate for being involved in those various things. So education is the key, and you never can stop. You must keep trying to broaden that base of experience so the next opportunity is one that you can take advantage of.

It's a little bit an extension of what Deke [Donald K.] Slayton used to talk about relative to flying airplanes, T-38s, or helicopters. His principal reason was that he wanted people to have to get out of trouble themselves, if they got into trouble, and not be able to reset a simulator. But he said that many times, but also, the more different aircraft that you fly, the quicker and better you're going to fly the next one. I think that applies to life in general. The more things that you try to do, the better you can do the next thing that you try to do. That's what experience is all about, judgment and wisdom, hopefully.

BUTLER: Absolutely. With that in mind, is there anything you consider your most significant accomplishment?

SCHMITT: No, I hope it hasn't come yet. [Laughter] I've still got some things that I hope will happen and we'll see whether they happen or not. I would like to think that any really significant accomplishments that I might make are ahead of me.

BUTLER: Well, it certainly sounds like you're involved in many areas where there's a lot of room for significant accomplishments to be happening.

SCHMITT: Probably too many.

BUTLER: Too many is better than too few. I'd like to thank you. We're about at the end of our time today. I thank you very much for your participation in this project and for sharing your experiences with us.

SCHMITT: Happy to do it, and if we need to do some more to clean that up, we'll work out next time I'm in town.

BUTLER: Great. Thank you.

[End of Interview]